Thesis No.: 513 Virtual Reality-Based Advanced Life Support Serious Game

Name: Arun Ekin Özkan, Year: 2023

Advisor(s): Cengizhan Öztürk/Mehmet Emin Aksoy

Abstract: This thesis investigates the development and learning outcome of an immersive virtual reality (VR) serious game designed to improve the training of medical professionals in Advanced Life Support (ALS) procedures. More than a million healthcare professionals partake in ALS training each year. This high demand for highly skilled healthcare providers proficient in time-sensitive emergency interventions necessitates innovative approaches to training. The software developed for this thesis aims to facilitate this training process while paying proper attention to non-technical aspects of ALS that are generally overlooked by similar training serious games. This serious game is developed in Unity game engine using C# for Unity scripts and plug-ins. The scores of users are sent to a database using Experience Application Programming Interface (xAPI) calls and stored using a Learning Management System (LMS) and a Learning Record Store (LRS). There are two training modes and a final test mode that scores the user. An initial study was conducted on 29 participants to compare the efficiency of VR training and conventional training. One group trained in VR and the other trained in a classroom setting, before all participants took the same test. Another follow-up study was conducted on 12 participants to check the correlation of the scores form the VR test mode and a more conventional hands-on manikin simulation where all participants took both tests to see if their results were statistically similar. The findings show that VR training is non-inferior to conventional training for the most part and that VR test scores correlate with conventional test scores. These findings combined with the advantages of being a self-service training software indicate that this serious game can be utilized effectively as an additional training resource, and even shows potential to replace classroom training in the near future.

Keywords: Advanced Life Support, Virtual Reality, Serious Game, Training Simulation.

Thesis No.: 512 A Novel Hybrid Scaffold For Managing Critical Size Mandibular Defect

Name: Sait Emre Doğan, Year: 2023

Advisor(s): Cengizhan Öztürk/Bahattin Koç

Abstract: This study provides a comprehensive approach to managing segmental mandibular defects. The patient's computed tomography images were used to design a patient-specific reconstruction plate. The mandible was reconstructed using virtual surgery, and new reference parameters were developed using craniometric and anatomical structures. Topology optimization and light-weighting were performed using the Voronoi and hollow patterns based on the areas with the most and least forces. The Voronoi pattern was used for the first time in topology optimization of a reconstruction plate. Structural analyses were conducted on the final designs. The Voronoi pattern is advantageous for clinical use, providing stability while using less material. The hollow design is effective, offering strength, screening for cancer recurrence, and easy removal after healing. A bioprinted bone scaffold was designed to improve function, healing, and aesthetics. An 0/90 hybrid scaffold (TCP-PCL enhanced with HA) was designed and manufactured using additive manufacturing methods. The printed scaffold was observed under a 40x microscope to assess the printing accuracy. Using a hybrid scaffold that mimics the original defect for a segmental defect is one of the novelties of this study.

Thesis No.: 511 Improving the quantification accuracy of Tc-99m mibi dual-phase parathyroid SPECT/CT: Amonte carlo simulation study

Name: Bahadır Aytaç, Year: 2023

Advisor(s): Albert Güveniş

Abstract: Quantitative parathyroid SPECT imaging is a technique used to assess primary hyperparathyroidism that may have potential in the identification and differentiation of parathyroid lesions as well as the estimation of disease severity. Studying the effect of data acquisition parameters on the quantification error is important for maximizing the accuracy of this diagnostic technique. In this study, we examine the effects of different data acquisition parameters, namely the type of collimator, scatter correction status, and reconstruction iteration number on the quantification accuracy using computer simulation. Methods: The SIMIND Monte Carlo Simulation and CASToR iterative reconstruction program was used to simulate a commercially available SPECT camera (Siemens Symbia Intevo Gamma Camera) with a crystal size of 29.55cm and 128x128 matrix size. A digital cylindrical phantom filled with water was constructed. A 0.36 cm radius spherical adenoma filled with a uniform 1MBq/cc Tc99m-Sestamibi was placed within the phantom. Low-Energy High Resolution (LEHR) and Low Energy Ultra High Resolution (LEUHR) collimator models are tested. Along with the presence of Scatter correction and differing iteration numbers (x16, x32). An image FOV-based calibration method was used to gather quantitative information and check against the input radioactivity. Results: The presence of scatter correction caused a 15-20 percent relative improvement in quantification accuracy. The optimal number of iterations produced a 10 percent relative improvement. Overall, accuracies as good as 7 percent in estimated activity concentration could be observed. Conclusion: The optimization of parameters can provide a significant improvement in quantification accuracy.

Thesis No.: 510 Intertion of Magnetic Nanoparticles With Polymersomes For Use As Multimodal Nanocarriers

Name: Gizem Uysal, Year: 2023

Advisor(s): Banu İyisan

Abstract: Magnetic nanoparticles (MNPs) are extensively used targets for drugs to help with early detection and the treatment of disease. However, drug targeting with MNPs in a specific site within the body is quite challenging to achieve. In these situations, pH-responsive polymersomes can provide an effective dual targeting opportunity by hosting both MNPs on their membrane and drugs in the core. Therefore, the overarching objective of this research is to develop pH-sensitive polymersome that interacts with Super Paramagnetic Iron Oxide Nanoparticles (SPIONs), intended for potential applications. SPIONs were chosen as magnetic nanoparticles since they have good biocompatibility. We hypothesize that, in an acidic environment, increased permeability of pH-sensitive polymersomes induces controlled release from the core; meanwhile guiding with MNPs makes these structures a multimodal tool. In our first aim, we will synthesize SPIONs with average sizes of 10-15 nm using the co-precipitation method. These SPIONs will be stabilized with β-Cyclodextrin. Following that, Poly (ethylene glycol) (PEG), 2-(diethylamino)ethyl methacrylate (DEAEMA) and Ferrocene units will form the multimodal polymeric nanocarrier system. After polymersome formation, SPIONs will be introduced to the system, aiming for interaction with the exterior of the polymersome membrane facilitated by the complexation of ferrocene and β Cyclodextrin. Our second aim involves conducting a morphological analysis of these multimodal nanocarriers to ensure their integrity and assess the success of the interaction. The ultimate prospective of this study is to utilize these multimodal nanocarriers for image-guided applications, potentially extending their use to drug loading in future studies.

Thesis No.: 509 An Unsupervised And Refractoriness-Supported Algorithm Design For Real-Time Spike Sorting

Name: Alparslan Önder, Year: 2023

Advisor(s): Ahmet Ademoğlu/Burak Güçlü

Abstract: Neural spike sorting algorithms have been used to group the action potentials in electrophysiological signals according to their characteristics to use them in neuroscience studies. In this study, we developed an unsupervised and online spike sorting algorithm that performs better than existing online and unsupervised sorting algorithms, calculates thresholds variably, and can be used for real-time studies when applied on FPGA boards. A template matching algorithm OSort, based on Euclidean distance, functioned as the base for this algorithm. We used the NEO method to detect the spikes and the Windowed Sinc Interpolation method to upsample the detected spikes four times. We developed a refractoriness control mechanism that works according to the peak points of the spikes to prevent assigning a spike to the wrong cluster. We designed a second block that considers the probability of a spike belonging to the second closest cluster to itself. It controls this issue to prevent assigning a spike to the wrong cluster if the spike waveforms of the different neurons are similar. We avoided using more complex mathematical operations like calculating standard deviation with the aim of future real-time studies on cheaper FPGA boards. When we compared the performance of our algorithm with the well-known algorithms in the literature, we saw that ours performed significantly better than the online ones and insignificantly worse than offline ones. The presented thesis shows that more accurate online and unsupervised spike sorting is possible without complex algorithms. It is expected that this kind of algorithms will support the increment in the number of neuroscience studies that use spike sorting.

Thesis No.: 508 Effects Of Prior Stimulation On Tactile Evoked Epidural Field Potentials In Rat S1 Cortex

Name: Aslı Akdeniz Karatay, Year: 2023

Advisor(s): Burak Güçlü

Abstract: Understanding how tactile sensation is processed in the somatosensory cortex is crucial for the development of neuroprostheses that can provide a realistic sense of touch. Exploring the electrophysiological basis of vibrotactile forward masking offers valuable insights into how the brain integrates and responds to sequential sensory inputs. This understanding can help drive progress in the development of haptic interfaces and the enhancement of neuroprosthetic technologies designed to improve tactile perception. Epidural field potentials were recorded from the hind paw representation of the rat S1 cortex by using various experimental parameters. The effects of the prior stimulus on the test stimulus window measured as dB difference and latency difference were evaluated. The results indicated that all main factors had a significant impact on the dB difference. An increase in the amplitude of the prior stimulus was found to enhance suppression effects. The suppression decreased as the temporal gap increased. By demonstrating the impact of the prior stimulus, the study underscores the fundamental influence of preceding sensory inputs in shaping subsequent sensory processing.

Thesis No.: 507 Mid-Air Haptic Sensations Produced By Ultrasound Actuators In Patients With Carpal Tunnel Syndrome

Name: Mehmet Akif Akdağ, Year: 2023

Advisor(s): Burak Güçlü

Abstract: This thesis utilizes psychophysical experiments with mid-air haptic ultrasound actuators to assess carpal tunnel syndrome (CTS) patients' tactile sensation. 19 female and one male patients (age: 33-61) with unilateral CTS took part in the experiments. We used a two-alternative forced choice task experiments to measure detection thresholds around 250 Hz modulation frequency at the thenar eminence (TE) and at the index finger in affected and healthy hands. In addition, 15 female CTS patients participated in a virtual reality-assisted hand exercise game with haptic feedback. The system usability scale (SUS) and exercise performance scores were evaluated. There was no significant difference in the threshold values from the TE between the CTS hand (M=0.85 au, SD=0.15) and the healthy hand (M=0.87 au, SD=0.16). The thresholds measured from the index fingers of CTS affected hands were all higher than the maximum stimulus level that could be produced by the ultrasonic actuators. For the healthy hands of 17 patients, the detection thresholds were (M=0.90 au, SD=0.09), and the remaining 3 had threshold values above the maximum output of the device. For the exercise game results, there was a significant correlation ($\rho = 0.89$, $p < 0.001$) between the SUS (M=80.17%, SD=18.33) and performance scores (M=83.31%, SD=14.80). Since the CTS was at an early stage and there may be a branching (palmar cutaneous branch) of the nerve before entering the carpal tunnel, thresholds were found similar in both hands at the TE. Unfortunately, the limitations of the haptic device did not allow a comparison between index fingers. Moreover, this device and novel technology may be used for the follow-up of the rehabilitation and the treatment of the CTS. As such, the usability of the system is above the criterion value, and in the future it can be improved not to be affected from the performance in the exercise games.

Thesis No.: 506 Polyethylenimine-Capped Gold Nanoparticles In Nucleic Acid Delivery

Name: Aykut Hınık, Year: 2023

Advisor(s): Cengizhan Öztürk/Ömer Aydın

Abstract: RNA interference is a gene editing tool applicable in cancer therapy. Nucleic acid delivery into the cells is challenging due to nucleic acid instability, insufficient cellular uptake, and endosomal entrapment. Polyethylenimine (PEI) is a positively charged polymer molecule widely used in nucleic acid delivery. PEI ensures increased endosomal escape thanks to the proton sponge effect. However, PEI is known to be highly toxic because of molecular size and electrical charge. Gold nanoparticles (AuNPs) are attractive inorganic carriers with biocompatibility, easy synthesis, and adaptability of surface chemistry. In this study, it was aimed to synthesize polyethylenimine-capped gold nanoparticles (AuPEI-NPs) to investigate their cytotoxicity and nucleic acid delivery in breast cancer cells compared to free PEI. Resazurin assay demonstrated that AuPEI-NPs induced less cytotoxicity than free PEI until the 20 μg/ml concentration in breast cancer cells. Flow cytometry demonstrated that AuPEI-NPs yielded significantly higher cellular uptake of fluorescently tagged siRNA than PEI. In conclusion, this study demonstrated that AuPEI-NPs are promising nucleic acid carriers in gene therapy with a less cytotoxicity and better cellular uptake than free PEI in breast cancer cells.

Thesis No.: 505 Generating Noin-normal Distributions for Interval Schedules: Effects on Instrumental Behavior

Name: Emirhan Buğra Albayrak, Year: 2023

Advisor(s): Daniela Schulz

Abstract: VI schedules are used in instrumental conditioning to obtain a relatively constant response rate. In VI schedules, a reward is delivered following an operant response, that is emitted after a variable time interval has passed. A peculiarity of VI schedules is that responding increases as time spent in an interval increases, producing output which is less uniform. To reduce this effect, positively skewed distributions have been implemented. However, non-normal distributions cannot be generated with current number generators. Here, we have established a procedure in Microsoft Excel that generates non-normal distributions. We further ran instrumental conditioning protocols utilizing the distributions we generated to see the effects on instrumental behavior. We hypothesized that our distributions will lead to a time independent behavior after discrimination training, in which animals learned to discriminate between existence of the stimulus and a no-stimulus context. First, we analyzed discrimination training by comparing lever press rates and lever press latencies across days of training and time within session. Then, to see how our distributions affected the time-dependency, we analyzed the relationship between time after stimulus onset and lever press rates during discrimination training performing correlation analyses. We found that the animals pressed the lever less in the 21 st day of discrimination training in EXT state compared to the 1 st day. We also found that, although there was a significant moderate correlation between time after stimulus and the lever press rate in the 1 st day of discrimination training, the correlation was not significant for the 21 st day. However, a curvilinear function explained over 70% of the variance in the data. Here we showed an easy-to-use method to generate non-normal distributions with Microsoft Excel. Our findings suggest that distributions generated by the given formula led to learning in rats in 21 days, but the lever press responses were not time independent contrary to our expectations.

Thesis No.: 504 Effect Of Ir780-Loaded Silica-Coated Gold Nanorods For Photodynamic Therapy of Cancer

Name: Merve Yünlü Doğruyol, Year: 2023

Advisor(s): Murat Gülsoy

Abstract: Photodynamic therapy (PDT) is a new approach to cancer treatment that activates a photosensitizer (PS), a light-sensitive chemical, with a specific wavelength of light. PDT is a promising new method, however, the efficacy of PDT is still limited because of a low accumulation of PS in the target cell and limited penetration of light to the deeper tissue which prevents the killing of all cancer cells. As a result, cancer recurrence is inevitable. Gold nanostructures are good biocompatible carriers of PS. Increasing PS accumulation on the target site leads to the effective destruction of cancer cells, but different cancer cells require different approaches. One of the resistant colon cancer types is HCT116 and it needs a better approach to treatment. Gold nanorods (GNRs) have a high absorption spectrum at near-infrared (NIR) as compared with other types of Gold nanoparticles (GNPs). However, GNRs are limited for the loading amount of PS and they tend to aggregate within cells. To overcome these limitations, we will develop mesoporous silica-coated GNRs (GNRs@SiO2) for effective PS loading in this study. To test this hypothesis, we aim to test the PDT efficacy of IR780, as a PS, loaded GNRs@SiO2, (GNRs@SiO2@IR780) and GNRs@SiO2@PEG (GNRs@SiO2@IR780@PEG). This investigation of PDT with GNRs@SiO2@IR780 and GNRs@SiO2@IR780@PEG will cause a dramatic decrease in colon cancer volume as compared with GNRs@SiO2 alone and GNRs@SiO2@PEG alone. Keywords: Photodynamic Therapy, Colon Cancer Cells, Gold Nanorods, Silica Coating, IR780.

Thesis No.: 503 Deep Learning-Based Virtual Special Staining Of H&E Stained Tissue Sections

Name: Fatmanur Kınalı, Year: 2023

Advisor(s): Mehmet Turan

Abstract: Hematoxylin and eosin (H&E) staining, which is standardly applied to tissues in histopathological diagnosis, is an incredible tissue staining method that reveals the morphological features of tissues and cells and gives an idea about their biomolecular structures. However, a more accurate determination of tissue and cell structure and biomolecular components is essential for the diagnosis of diseases under the light microscope. For this reason, histochemical, immunohistochemical, immunofluorescent and genetic techniques have been applied to tissues and cells and it has been aimed to reach the closest diagnosis to the truth. However, the number of these methods is quite high and depending on the method, they can be very complex and time-consuming in terms of procurement, cost, time requirement and application. Manual preparation of each is an expensive and labor-intensive process that requires complex and difficult methods of using many chemicals, and ready-to-use kits are often costly. Here, we propose a novel virtual staining tool that transforms H&E-stained tissue images into specially stained versions in just a few minutes. Virtual staining of some of the frequently use methods in daily pathology practice with a transformation that is derived through a learning process, using H&E slide as a basis, will make the use of these methods in the histopathological diagnosis process incredibly practical, inexpensive, simple and easy to apply in a short time. As well as, we propose a novel StainKid dataset of stomach and kidney tissue samples stained with a wide collection of histological stains. The StainKid dataset can make a significant contribution to the development of computer aided diagnosis in histopathology by paving the way for new artificial intelligence-based virtual staining techniques.

Thesis No.: 502 Investigating The Bacterial Adhesion Behaviour on Bone Surface Mimicked Chitosan Membranes

Name: Meltem Uçak, Year: 2023

Advisor(s): Bora Garipcan/ Banu İyisan

Abstract: An extremely serious post-op consequence of orthopedic replacement surgery is infection, which is currently challenging to treat with antibiotics. According to data, prosthesis infections correlate with biofilm formation that is highly resilient to host immune defenses and antibiotics. The main goal of this thesis is to examine the relationship between topography and surface-cell and surface-bacteria interactions. The secondary objective is to determine whether it is possible to chemically alter implant surfaces and their topographical features to maximize cell-implant interactions while minimizing bacterial-implant interactions. Physicochemical characterization for Graphene Oxide (GO) coated bone surface mimicked Chitosan (BSM-CH-GOc) loaded ampicillin sodium salt (Amp) or Tetracycline hydrochloride (Tetra) membranes were done via degradation test, Scanning Electron Microscopy (SEM) and drug release study. For cell study, mouse fibroblast (L929) was selected as a model mammalian cell line. Bacterial behavior on these membranes was investigated using the biofilm growth test. The rate of biofilm production was assessed and utilized as an indication in which Escherichia coli (ATCC 8739) and Staphylococcus aureus (ATCC 6538) were utilized as model organisms. It was found that while GO coated bone surface mimicked chitosan membranes had a noticeable effect on preventing bacterial biofilm formation, the presence of ampicillin sodium salt and tetracycline hydrochloride remarkably reduced the biofilm formation compared to the control groups. Keywords: Surface-cell interactions, Surface-bacteria interactions, Chitosan, Ampicillin, Tetracycline

Thesis No.: 501 Proof-Of-Principle Of Ed-DBS (Experience-Driven Deep Brain Stimulation) In The Hemiparkinson Rat Model

Name: Betül Tamer, Year: 2023

Advisor(s): Daniela Schulz

Abstract: Parkinson's Disease (PD) is a neurodegenerative disease characterized by the progressive loss of dopamine (DA) neurons in the substantia nigra (SN). The loss of DA leads to debilitating motor symptoms, such as tremors, rigidity, and bradykinesia. Deep brain stimulation (DBS) is considered state-of-the-art in the treatment of motor symptoms in advanced PD. The standard practice is to stimulate the subthalamic nucleus (STN) or internal globus pallidus (GPi) continuously via surgically implanted electrodes. However, continuous administration of DBS conflicts with the firing patterns of nigrostriatal DA neurons because these neurons generate rapid phasic DAergic signals in response to specific experiences, such as the presentation of a reward-predicting stimulus (S) or an unexpected reward (S*). This conflict may be one of the reasons for only moderate treatment efficacy of DBS. In our Boğaziçi University Scientific Research Projects (BAP) project, we hypothesize that treatment outcomes are enhanced if DBS is given acutely, in an experience dependent (ed) fashion that is tailored to specific experiences of the subject, involving S-S* contingencies (Experience-driven (ed)-DBS to improve motor symptoms in the hemiparkinson rat model under grant number 15981). Towards a test of this hypothesis, we will a) integrate DBS with operant conditioning in which experiences can be completely controlled, and b) determine the value of ed-DBS for the brain. In this thesis, we took initial steps towards achieving these aims. Specifically, we integrated the operant setup with DBS and tested the viability of our methods with two rats, one hemiparkinson rat and one control. In this thesis work, we report data which show support for the success of our behavioral training procedures, surgical approach, and integration of a conditioned inhibition procedure with ed-DBS. Keywords: Variable Interval Schedule, Discrimination Learning, Hemiparkinson Rat, 6-Hydroxydopamine, Apomorphine-Induced Rotation

Thesis No.: 500 Synthesis And Characterization Of Bovine Serum Albumin Based Nanocontainers For Drug Delivery Applications

Name: Elif Özlem Topal, Year: 2023

Advisor(s): Banu İyisan

Abstract: Polymeric nanocontainers which consist of both a core and a polymeric membrane have an important role for drug delivery applications. They can carry active compounds like drugs, proteins in their core and their polymeric membrane prevent the living environment from the side effects of these carried compounds. There are various types of polymeric materials that can be natural or synthetic according to their source for the production of the polymeric nanocontainers. Also, the combinations of different polymers are used to produce highly stable nanocontainers. The main goal of this thesis study is fabrication of totally biocompatible, biodegradable, durable, nanocontainers that consist of polymeric shell and lipid core. For these reasons, conjugates made of the Bovine Serum Albumin (BSA) which is a protein and Pectin which is a polysaccharide, were synthesized through the Maillard reaction based on reducing sugar and proteins without using external chemicals or enzyme. The effects of protein- polysaccharide weight ratio, pH adjustment were investigated to optimize the conjugate formulation. The produced conjugates were characterized via Protein Assay, SDS-PAGE and FT-IR Analysis. The polymeric nanocontainers were produced through oil-in-water miniemulsion method by using the obtained BSA and Pectin conjugates. Addition of biocompatible stabilizers had a drastic influence on the resulting features on the nanocontainers which are extensively characterized by dynamic light scattering analysis, zeta potential measurements and STEM imaging.

Thesis No.: 499 Spatiotemporal Graph Convolutional Neural Networks For Motor Imagery EEG Classification

Name: Ahmet Alramly, Year: 2023

Advisor(s): Ahmet Ademoğlu

Abstract: Electroencephalography (EEG) has various applications in medicine, neuroscience, and neural engineering. It records the electrical activity of the brain tissues caused by the interaction among different neuronal communities. Numerous algorithms for the automatic classification of EEG signals have been developed. These algorithms work via extracting unique and non-redundant features from EEG signals. However, the majority of the proposed algorithms employ temporal components of EEG signals while disregarding the rich spatial network structure that underlies in the EEG. In this study, we propose a classification pipeline that uses the network structure of EEG data for a simultaneous representation of spatial and temporal features in the EEG signals. First, graph theory is utilized to model the EEG networks in two spatial domains; i) the sensor space and ii) the cortical source space. Second, a spatiotemporal graph convolutional neural network (STGCNN) classification model is employed combining both temporal and spatial features of EEG data for its classification under motor imagery conditions. Additionally, the model is tested using the cortical source space data in each of the seven resting state brain networks individually to estimate their performance on classification accuracy. The results show that STGCNN model performs slightly better than the temporal convolutional neural network (CNN) models by 1.25%.

Thesis No.: 498 Investigation Of Protein Corona Formation On Biodegradable Nanocarriers

Name: Damla Kelle, Year: 2023

Advisor(s): Banu İyisan

Abstract: Biodegradable nanocarrier systems are significant tools for drug delivery systems since they enable prolonging the therapeutic effect of the chemotherapeutic drug by extending the release over a longer period of time. However, the most significant challenge of these systems is the protein corona (PC), the layer formed around the surface of nanocarriers by the adhesion of plasma proteins when nanocarriers are injected into the body intravenously. Since the PC structure identifies the nanocarriers' destiny in the body, it is required to be analyzed the proteins that form the PC structure comprehensively. In this study, proteins found in the hard protein corona (HPC) structure of two different biodegradable nanospheres (NSs), poly(lactide-co-glycolide) (PLGA) and polycaprolactone (PCL) NSs, were identified. For this purpose, distinct PLGA and PCL nanoparticles (NPs) were fabricated by miniemulsion/solvent evaporation method, followed by the characterization by electron microscopy, dynamic light scattering (DLS) and electrophoretic light scattering (ELS). Subsequently, PLGA and PCL NSs were treated with human plasma or FBS to form PC structure. Proteins in PC structures were analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis. Furthermore, each protein in the HPC structure were identified by liquid chromatography-mass spectrometry (LC-MS) and grouped according to their functions. Moreover, doxorubicin hydrochloride, a significant chemotherapeutic drug, was encapsulated into PLGA NSs. Drug encapsulated NSs were characterized by DLS and ELS. Afterward, the PC structure around the surface of drug encapsulated NSs was formed by treating with human plasma or FBS. The impact of the PC on the drug release behavior of PLGA NSs was investigated at pH 7.4, a critical pH value to mimic the physiological environment.

Thesis No.: 497 Assessment of Effectiveness of Muscle Lengthening Surgery in Cerebral Palsy Using Musculoskeletal Modelling

Name: Eda Biricik, Year: 2022

Advisor(s): Can Yücesoy

Abstract: Cerebral Palsy is a permanent movement disorder that manifests itself at early childhood, as poor coordination, and gait difficulty due to muscle spasticity and/or con tracture. Excessive knee flexion during gait e.g., crouch gait is a common impairment and often corrected by hamstring lengthening surgery. Such crouch gait is presumed to originate from shortness (i.e., contracture) and/or slowness in lengthening (i.e., spastic ity) of affected muscles and remedial surgery is considered to improve gait by increasing muscle length or its velocity. However, a third group of patients who neither has short nor slow hamstrings pre-operatively can still undergo surgery. The aim of the thesis is to investigate whether the gait of those patients improved after the surgery by testing the hypotheses: post-operatively, (i) the knee joint movement is improved (ii), the hip joint movement is deteriorated (iii), the gait deviation index (GDI) is increased (iv), muscle unit length do not change, and (v) pre-operative psoas muscle lengths were shorter. Findings showed that mean knee angle decreased significantly at the initial contact (0-3%), terminal stance (28-43%), and the terminal swing phases (95-100%) ($p<0.05$). No significant effects were detected in the hip angle or the GDI. Additionally, no significant changes in the hamstring muscle lengths were found. Only half of the patients had shorter psoas muscle lengths pre-operatively. In conclusion, the excessive knee flexion of the patients was decreased without negatively affecting hip movement or gait overall. The improvement in the knee angle was achieved without any change in the muscle length of the hamstrings, suggesting that an isometric position shift of the target muscle occurs, which may be ascribed to post-surgical alterations in the epimuscular connections.

Thesis No.: 496 Effects of Hamstring Lengthening Surgery on Muscle- Tendon Velocities of Patinets with Cerebral Palsy

Name: Fatma Turan, Year: 2022

Advisor(s): Can Yücesoy

Abstract: Cerebral Palsy (CP) is a permanent movement disorder seen in early childhood, consisting of muscle spasticity and/or contracture, and difficulty in walking due to poor selective control. In CP patients, crouch gait with excessive knee flexion is usually corrected by hamstring lengthening surgery, which is believed to improve gait, by increasing the length or velocity of the spastic muscle. However, hamstring muscles that may not be not short and slow before the surgery can also be operated on. The thesis aims to assess whether the gait of CP patients improved after the surgery by testing the following hypotheses: (i) knee joint movement does not improve postsurgery, (ii) the hip joint movement was impaired pre-surgery, (iii) the gait deviation index (GDI) increases post-surgery, (iv) the muscle lenghtening velocity remains unchanged in postsurgery, and (v) the pre-surgery psoas lenghtening velocity is slower than post-surgery. 8 limbs of 4 CP patients who had undergone hamstring lengthening surgery were included in the study. Pre-and post-surgery muscle lengthening velocity changes of patients were compared with reference to age-matched TD children (14 limbs of 7 participants) based on gait analysis data and using musculoskeletal modeling (OpenSim). Our results showed that post-surgery, mean knee angular velocity did not change significantly. No significant effect of surgery was shown in hip angular velocity or GDI. Moreover, no significant changes were shown in hamstring muscle lenghtening velocities. Only two of the preoperative patients had slow psoas muscle lenghtening velocity. As a result, post-surgery improvement in knee movement was achieved without a significant change in hamstring muscle lenghtening velocity. Keywords: Muscle Shortness, Cerebral Palsy, Contracture, OpenSim, Hamstring Lengthening Surgery, Spasticity, Psoas, Lengthening Velocity

Thesis No.: 495 Development of a recurrent neural newtwork system for estimation of ankle power by using surface electromyography

Name: Alper Atal, Year: 2022

Advisor(s): Can Yücesoy

Abstract: Estimation of ankle power can be used in identification of gait abnormalities and establishing timings of net power generation in powered prosthetic devices. Current inverse dynamics calculations of ankle power rely on gait analysis data collected in specialized, expensive laboratories, which limits its applicability and accessibility for prosthetic device users. The aim of this study is to develop a Recurrent Neural Network system to estimate ankle power during level walking by using only surface electromyography (sEMG) as algorithm inputs. For this purpose, an open access data set which includes 50 participants with 25 males and 25 females aged between 6 to 72. In the dataset there are sEMG data from upper leg muscles: Biceps Femoris (BF), Gastrocnemius Medialis (GM), Gluteus Maximum (GMax), Rectus Femoris (RF), Vastus Medialis (VM) and lower body muscles; Peroneus Longus (PL), Soleus (SO), Tibialis Anterior (TA). Algorithms for combinations of all these muscles have been developed. A correlation coefficient of 0.90 between the actual (result of gait analysis) and predicted ankle power is considered to perform successfully. 25 muscle combinations yielded successful correlations with 1 set of 1 muscle, 3 sets of 2 muscles, 5 sets of 3 muscles, 9 sets of 4 muscles, 5 sets of 5 muscles, 1 set of 6 muscles, 1 set of 7 muscles. Note that, all successful muscle groups include either PL or GM muscle. Our findings suggest that our system can be used in powered prosthetics control and detection of gait abnormalities.

Thesis No.: 494 Predicting Epileptic Seizures of Pediatric Patients Using Phase-Amplitude Coupling and Deep Learning On EEG Signals

Name: Lina Alqam, Year: 2022

Advisor(s): Ahmet Ademoğlu

Abstract: Epilepsy is one of the most prevalent neurological disorders in the world. It is estimated that between four and six children out of every thousand suffer from epilepsy. Visually diagnosing seizure activity can be challenging for medical professionals because doing so correctly requires a great deal of observation and practice. Recent developments in deep learning technology have made it so that erroneous diagnoses of seizure activity are occurring much less frequently and that significantly less time is needed to forecast when a seizure will occur. This study improves upon existing metrics by utilizing cross-frequency coupling gleaned from scalp electroencephalogram (EEG) and transfer learning inside deep neural network architectures. We conducted our study using data from the CHB-MIT dataset, which included 23 children as participants. In the first experiment, we culled all 18 channels from the dataset; in the second, we narrowed it down to just one. Fine-tuning boosted the accuracy of the first experiment to 87.21%, and the accuracy of the second experiment to 96.82%. Images of the phase-amplitude coupling help predict the next seizure when fed into the VGG-19 architecture. Several tests are used to assess the models' efficacy. In-depth analyses are performed and reported on.

Thesis No.: 493 Optimization of a microfluidic chip design for neuroblastoma cells and their microenvironment studies / Nöroblastom hücreleri ve mikroçevre çalışmaları için mikroakışkan çip tasarımının optimizasyonu

Name: Kübra Gökmen, Year: 2022

Advisor(s): Özgür Kocatürk

Abstract: Investigating each structural part of a neuron is crucial for clarifying the com plex working mechanism of the nervous system. Isolation of axons from their cell bodies plays an important role in understanding synapse formation, axonal injury and regeneration mechanisms, and the interaction between the neurons and their microenvi ronments. Multi-compartment microfluidic chips are one of the most developed systems used for axon isolation. In this thesis, the optimization of microfluidic chip produc tion has been carried out by changing photoresist types and UV exposure doses, and the effects of these variables on the microgroove width have been observed. For this purpose, two-step photolithography processes have been performed using SU-8 3005, SU-8 3050 SU-8 2005, and SU-8 2050 negative photoresists. Optimum microgroove width (7.3 µm) to isolate axons has been obtained by using SU-8 3005 and applying UV exposure for 3 seconds with a power of 21 mW/cm2 . A similar microgroove width (7.7 µm) has also been achieved by using a different mask alignment system operating outside the cleanroom conditions, and it has been evaluated as promising in terms of reducing microfluidic chip manufacturing costs. SH-SY5Y neuroblastoma cells have been seeded into the microfluidic chips with different microgroove geometries (4.4×10.2 µm, 4.4×7.3 µm, and 4×7.7 µm) through filtered micropipette tips and 8 mm wide reservoirs. The second seeding method has been found more efficient in terms of ap plicability and sustainability. It has also been observed that 4.4×10.2 µm geometry allowed cell migration in both cell culture methods while the other two geometries provided axon isolation. In conclusion, obtained microfluidic chips and improved cell culture method has been considered suitable to investigate the neurite elongation and differentiation of SH-SY5Y cells, and their interaction with their microenvironment. Keywords: Axon isolation, microfluidic neuron chip optimization, photolithography

Thesis No.: 492 Design of a Vibrotactile Balance Support System With A Virtual Reality Training Program

Name: Enes Tarık Aras, Year: 2022

Advisor(s): Burak Güçlü

Abstract: This thesis aims to design a vibrotactile feedback(VTF) system to help balance rehabilitation with virtual reality (VR) training. First, the training program was built in a virtual reality platform by using Unity3D and Blender software. Data for visual and vibrotactile psychophysical limits were obtained in several experiments performed by one participant. The VR platform simulated anterior/posterior sways which were conveyed to the participant visually and/or by VTF. Visual experiments consisted of motion detection, angle discrimination, and angular velocity discrimination of an avatar in the VR screen. All motion detection thresholds were found to be lower than 0.04 deg/s. Angle and velocity discrimination limens were in the range of 0.26-0.46 deg and 0.19-0.34 deg/s in the visual avatar. Arduino UNO was used to control six vibration motors placed around the upper arm . Motors were recruited incrementally as the avatar's sway angle increased. Angular velocity was mapped either by mixed (Pulse-width/pulse-number) or pulse-number modulation to the VTF. Motor distances were adjusted to ensure maximum (\%81.2) localization. Next, the participant matched VTF to the postural sway of the avatar while the computer screen was off. Combined identification accuracy of sway angle and angular velocity was 91\% by only VTF. Finally, the avatar was simulated to cross a road in the VR platform with three conditions (visual on tactile off, visual off tactile on, visual on tactile on) participant. In all conditions, the participant could control the avatar successfully without any falls. Quickest response was obtained when both feedbacks were on (98.7\%), and the worst response was obtained when only VTF was on (92.1\%). VTF seems promising in the proof of concept balance support system presented in this thesis.

Thesis No.: 491 Development of Polymer-Lipid Hybrid Nanoparticles for Anticancer Drug Delivery

Name: Sedef Salel, Year: 2022

Advisor(s): Banu İyisan

Abstract: The challenge of conventional cancer treatment is the side effects caused by the chemotherapeutic drugs. To prevent these side effects, nanocarrier systems can be designed to have functions of controlled and selective drug release. Among these systems, core-shell structured hybrid nanoparticles have been drawing attention in the last decades because of their multifunctional structures. The major limitations of these nanocarrier systems are the toxicity related to synthetic surfactants as well as undesired leakage of highly toxic drugs. In this study, a unique nanocarrier sys tem was designed using natural materials for controlled delivery of an anticancer drug. This system contains a biopolymeric shell and a lipid core which could be used to encapsulate lipophilic anticancer drugs. Bovine Serum Albumin (BSA) and Dextran in different molecular weights were covalently conjugated via Maillard reaction to pro duce shell and used to stabilize lipid core by miniemulsion/solvent evaporation method. The shell of the nanoparticle could prevent undesired drug leakage from the core and provide enzyme-sensitive drug release thanks to its protein structure. Shell properties such as concentration of the Maillard conjugate, protein-polysaccharide molar ratio, and polysaccharide molecular weight were systematically investigated to reach opti mum nanoparticle features that are size which can enable passive targeting through enhanced permeability and retention (EPR) effect, narrow size distribution, and high stability. Furthermore, zeta potential analysis was performed to evaluate surface charge of the nanoparticles in physiological (pH 7.4) and early endosomal (pH 6.5) mimicking environment. This study can bring new perspectives to the hybrid nanoparticles and has a potential to be a new delivery platform for lipophilic anticancer drugs.

Thesis No.: 490 Predicting kidney tumor subtype from CT images using radiomics and clinical features / Radyomik ve klinik özellikler kullanılarak BT görüntülerinden böbrek tümörü tipinin belirlenmesi

Name: Duygu Şirin, Year: 2022

Advisor(s): Albert Güveniş

Abstract: This study aims to evaluate the performance of machine learning methods in predicting the subtype (clear-cell vs. non-clear-cell) of kidney tumors using clinical patient and radiomics data from CT images. CT images of 192 malignant kidney tumor cases (142 clear-cell, 50 other) from TCIA's KiTS-19 Challenge were used in the study. There were several different tumor subtypes in the other group, most of them being chromophobe or papillary RCC. Patient clinical data were combined with the radiomic features extracted from CT images. Features were extracted from 3D images and all of the slices were included in the feature extraction process. Initial dataset consisted of 1157 features of which 1130 were radiomics and 27 were clinical. Features were selected using Kruskal Wallis - ANOVA test followed by Lasso Regression. After feature selection, 8 radiomic features remained. None of the clinical features were considered important for our model as a result. Training set classes were balanced using SMOTE. Training data with the selected features were used to train the Coarse Gaussian SVM and Subspace Discriminant classifiers. Coarse Gaussian SVM was faster compared to Subspace Discriminant with a training time of 0.47 sec and 11000 obs/sec prediction speed. Training duration of Subspace Discriminant was 4.1 sec with 960 obs/sec prediction speed. For Coarse Gaussian SVM was found as 0.86 while for Subspace Discriminant AUC was 0.85. Both models produced promising results on classifying malignant tumors as ccRCC or non-ccRCC.

Thesis No.: 489 Correction of Artifacts in Formalin-Fixed Paraffin- Embedded Tissue Section Images with Contrastive Unpaired Image to Image Translation

Name: Mohammad Kassab, Year: 2022

Advisor(s): Esin Öztürk

Abstract: Formalin-fixation and paraffin-embedding (FFPE) is a specimen preparation and preservation technique that has been used in histology and pathology since the late 19th century. Because the preparation of FFPE specimens is a complex, lengthy, and difficult to standardize process, and due to the complex histological and cytological characteristics of tissue, FFPE slides often contain defects. Defects arise during tissue fixation, processing, embedding, microtomy, staining, and coverslipping. These defects are referred to in images as artifacts, a term which encompasses staining inconsistencies, tissue folds, chattering, pen marks, blurring, air bubbles, and contamination, in addition to some other defects. We propose an unpaired image-to-image translation approach,

FFPE++, which corrects artifacts in FFPE slides for digital pathology. Our method is a deep-learning-based approach which uses contrastive learning with spatial attention block and self regularization loss, leading to higher quality in terms of both the visibility of textural details and cellular features. 10 board certified pathologists have performed comparative tests between our FFPE++ method and the standard FFPE sections of the ovary, thyroid, and lung, showing that our approach results in a visually coherent images for histopathological diagnosis.

Thesis No.: 488 Development of Primary Keratinoxcyte Cel Culture Method on Fibrin Matrix

Name: Bilal Enes Okatar, Year: 2022

Advisor(s): Cengizhan Öztürk/ Ethem Güneren

Abstract: The use of cultured epithelial grafts in major burn cases is a promising alter- native. Keratinocyte cells have the ability to proliferate and form an epithelial layer when suitable conditions are provided and simulate as a dermal substitute. However, this layer, which is produced by the cell culture method, creates difficulties in surgical application due to its fragile structure. In this thesis, a biopolymer fibrin matrix was used as a carrier layer due to the advantages it offers in terms of biocompatibility, non-toxicity, biodegradability, and benefit for cell culture. In order to produce fibrin, fresh frozen plasma (FFP) was obtained from volunteers and with only CaCl2 solution, coagulation of the FFP has been achieved. In the second stage, to create an autologous cell culture method, a primary keratinocyte source is acquired directly from the human skin. Instead of a cell line, skin samples were taken from volunteers who had undergone abdominal panniculectomy surgery, and keratinocyte isolation was performed. After the formation of fibrin and the isolation of keratinocyte cells, keratinocyte cells are seeded on the fibrin matrix surface. The formation of the fibrin matrix scaffold and the feasibility of primary cell culture on this scaffold was examined and a sustainable and accessible method was established. FT-IR analysis was made to observe chemical bonds of polymerized fibrin structure. The success of cell isolation, cell culture, and the effect of fibrin scaffold on cell proliferation was demonstrated in optical microscopy, scanning electron microscopy (SEM), and pan-cytokeratin staining. The interaction of the keratinocyte cells and the feeder layer cells were visualized by SEM. In this thesis, methods of fibrin matrix formation from FFP, keratinocyte cell isolation and culture from a primary source, and keratinocyte culture on fibrin matrix were developed.

Thesis No.: 487 Investigation of Ablation Efficiency and Temperature Distribution Profile of 1940 nm Thulium Fiber Laser on Ex Vivo Ovine Liver Tissue

Name: Ayça Ertan, Year: 2022

Advisor(s): Murat Gülsoy/ Burcu Tunç Çamlıbel

Abstract: In liver surgeries, lasers with different wavelengths are used to make incisions and excisions with minimal bleeding and pain. The purpose of this study is to examine the efficiency of a 1940 nm Thulium fiber laser in the incisional operation of liver tissue. Thus, the tissue ablation efficiency of this laser was calculated as a ratio of the ablated site to the total affected site at various laser scanning speed values and output powers. Additionally, the thermal damage at the surrounding tissue was evaluated with a thermal camera. To create an incision, laser light should be absorbed by the tissue. In this study, lamb liver tissue was irradiated by 1940 nm Thulium fiber laser through 600 μm bareended optical fiber in continuous mode. The reason of using this specific laser was that, according to the literature, light in 1940 nm wavelength is highly absorbed by water molecules, which are abundant in soft tissues such as kidney. Initially, a predosimetry study was conducted to decide on the laser output power to be studied. Output powers including 0.6 W, 0.8 W, 1.0 W, 1.5 W, and 2.0 W were studied. According to the predosimetry study results, only 0.6 W and 0.8 W output powers were not able to be successful for ablation in most cases. Coagulation was observed in all of the incisions, independently of the output power. Base d on these findings, 1.0, 1.5, and 2.0 W output powers were decided to be used in the following experiments. In the actual experiments, the lesions were regularly created at a length of 2 cm. Laser output power and lesion lengths were kept constant in each application, while different scanning speeds were tested by changing the irradiation time. All the applications were performed with a single-pass. For example, 0.6 W output power was applied to a 2 cm length incision for 5, 10, and 15 seconds. Since the incision length was kept constant, the total light energy delivered to the samples was increased as the application time increased, which improved the ablation efficacy. During experiments, the temperature on and surrounding the incisions was monitored using a thermal camera. The results of this study showed that incision properties, such as deeper ablated and larger coagulated areas, were achieved when higher laser powers were used at slower laser scanning speeds compared to the other application parameters that were used in this study. However, carbonization, which is not desirable in laser incision applications, was also observed at 1.5 W and 2.0 W laser powers. Therefore, this study revealed that laser scanning speed and output power have a significant impact on ablation efficiency of 1940 nm Thulium fiber laser in liver tissue. Keywords: Laser Surgery, Thulium Fiber Laser, Liver Surgery, 1940 nm

Thesis No.: 486 Similarity-Based Analysis of FDG-PET Images of Alzheimer’s Disease Patients: A method for automated diagnosis and severity prediction with the aim of therapy response monitoring

Name: Ceren Yüksel, Year: 2022

Advisor(s): Albert Güveniş

Abstract: This study aimed to evaluate 18-Fluorodeoxyglucose positron emission tomography (18F-FDG-PET) images of the brain for the computer-aided characterization detection of Alzheimer's disease (AD) intuitive image similarity-measure-based ap- proach. The first objective was to diagnose AD automatically. The second objective was to determine the association between the similarity measure and neuropsycholog- ical assessments. Therefore, we aimed to develop a new AD evaluation algorithm that can give an early diagnosis of the disease and define an objective severity index that correlates with well-known neuropsychological tests. 125 patients with AD, 132 Cog- nitively Normal (CN), and a total of 257, FDG-PET data were obtained from ADNI. We then found a distance value indicative of the similarity between any 3D image to available CN and AD patient images in the database using the mutual information method. The diagnosis was based on a threshold value for the distance value. Then, the Mini Mental State Examination (MMSE) and Clinical Dementia Rating (CDR) results of all patients and the distance values obtained from FDG-PET were analyzed using an analysis of variance. The algorithm achieved an AUC ROC of 0,969 using a leave-one-out method for the original dataset (n=197) and 0,873 using the independent testing dataset (n=60). The correlation was 0,642 between MMSE scores and imaging scores, and for CDR global test correlation between imaging and testing was 0,677. A simple and intuitive similarity-based algorithm can be used for the early detection of AD using molecular imaging as well as determining an objective severity index. No ROI and feature computations should be performed.

Thesis No.: 485 Time_Frequency Analysis of Somatosensory Potentials Evoked by vibrotactile Stimulation of the Fingertip

Name: Kutluhan Mahmat, Year: 2022

Advisor(s): Burak Güçlü/ Mustafa Zahid Yıldız

Abstract: Tactile sensory feedback has become an essential topic for neural engineering to model advanced neuroprostheses providing artificial sensations. For this purpose, it is required to understand human brain activity related to some parameters (e.g., sensation level, frequency, time window, etc.) of tactile somatosensory inputs. There have been numerous studies related to tactile psychophysical channels and their properties. However, so far, a link could not be established between psychophysical data and somatosensory evoked potentials (SEPs) generated by vibrotactile stimulation in humans. Therefore, the fundamental goal of this study is to analyze SEPs, which were generated by 40 Hz vibrotactile stimulus applied to human fingertip, over the S1 cortex. EEG data were collected and analyzed in a previous study by Yildiz (2013), but it was reanalyzed by different methods in this thesis. In particular, seven healthy adult subjects participated in psychophysical experiments. EEG recordings were obtained for several (NS, 10dB, 20dB, and 30dB) sensation levels (SLs) at and above threshold. They were collected at the forehead and Cpi-Cpc as mechanically evoked SEPs by gold surface EEG electrodes on the human scalp over the S1 cortex. The data were analyzed by Continuous Wavelet Transform (CWT) by means of Morse Wavelet at different time windows of stimulation. Consequently, no significant differences were found in frequency band energies for different sensation levels except some combinations in the low gamma band at the stimulus onset. Given the small sample size, these results imply that non-invasive EEG recording methods may not be adequate to measure fine psychophysical parameters in this study for flutter sensation at 40 Hz.

Thesis No.: 484 The effect of titanium surface topography on biocompatibility, hemocompatibility, and bacterial behavior

Name: Tuğba Ecem Sakallı, Year: 2022

Advisor(s): Bora Garipcan

Abstract: Titanium and Ti alloys are widely used in several biomedical applications including cardiovascular stents, shoulder, hip replacement and dentistry. Ti and its alloys are preferred biomaterials, due to their mechanical, physical and biological characteristics. Ti is a biocompatible material with high corrosion resistance and several methods are used to process the material in addition to various alloying options. Although, Ti is biocompatible by its nature, cell- material interactions can be improved by surface modification. It is known from the literature that the interactions between material surface and cells, bacteria and proteins are affected by the surface topography. The characteristics of the surface; topography, roughness, surface free energy and wettability alter the cellular response. In this thesis, four different Ti surfaces; polished, sandblasted, line and mesh structured surfaces which were processed with laser, were examined from the aspects of material surface characterization, biocompatibility, hemacompatibility, and biofilm formation. Polished, sandblasted, line and mesh structured surfaces showed hydrophilic characteristics. However, sandblasted and line structured surfaces as they represent higher roughness on the surface, are more hydrophilic than polished and mesh structured surfaces. From the aspect of hemacompatibility, it is shown that all 4 groups are blood compatible in accordance with ISO10993-4. Nonetheless, the platelet activation is shown to be higher on the polished surfaces. When the adhesion and viability of fibroblasts were examined on the surfaces, no significant difference was observed. Abundant number of cells were observed on each of the surfaces. Therefore, the difference of biocompatibility on the polished, sandblasted, line and mesh structured surfaces are shown to be insignificant. For the bacterial adhesion, gram positive S. aureus bacteria showed higher tendency for polished surface and gram negative E. coli bacteria show higher tendency for the rough surfaces line structured, sandblasted and mesh structured specimens in descending order. In this thesis, it is shown that by changing surface topography physically, cellular response to the material can be altered.

Thesis No.: 483 3D-printing technique for fabrication of biodegradable PDLLA tympanostomy tube and examination of biofilm formation

Name: Dine Güner, Year: 2022

Advisor(s): Burak Güçlü/ Duygu Ege

Abstract: In this study, it is presented that the new fabrication method for biodegradable PDLLA tympanostomy tube by examining its degradation and swelling behavior, bacterial attachment, and biofilm formation with a comparison of Fluoroplastic one. The novelty of the study lies in the 3D printing fabrication technique. No research work studied the fabrication of samples in these dimensions (2 mm in length) and design. The samples are printed at 190 ◦C temperature under 7.9 bar pressure with 0.1 mm/min speed. The fabrication of one sample took 9 minutes with a 0.3 mm nozzle, and structural collapsing was able to be prevented. After the fabrication of 3D-printed PDLLA samples, they are examined for the degradation and swelling characteristics at 37 ◦C in PBS for 5 weeks. The degradation rate of 3D-printed PDLLA samples is 5%, and the swelling ratio is 40 % for 5 weeks. Scanning Electron Microscopy (SEM) was used for the surface examination, and results showed that PDLLA samples have fewer surface faults than control group of Fluoroplastic tubes in microscale level. For examining bacterial attachment on the layer-by-layer surface of the PDLLA sample, a biofilm assessment was done for 4 days. According to colony counting and CFU/mL results, 3D-printed samples had less biofilm formation despite the layered surface structure coming from the fabrication process. Overall, biodegradable tympanostomy tube fabrication by using the 3D-printing technique needs to be improved. However, according to experimental results, if the fabrication method can be improved to produce more precise structures in that dimension, it is possible to further this study to produce more perfectly tympanostomy tubes.
Keywords: 3D-printing, Poly-lactic acid, biodegradable implant, bacterial attachment, tympanostomy tube, otitis media

Thesis No.: 482 Emotion recognition of EEG data using tensor logistic regression

Name: İbrahim Cansu, Year: 2022

Advisor(s): Ahmet Ademoğlu

Abstract: Emotion recognition is a research area gaining momentum in the last three decades with a strong impact on our daily life. One of the most widely used methods to study emotion recognition is using physiological signals such as EEG data. However, using physiological signals requires using feature extraction and selection methods. Moreover, there is no gold standard for choosing the best methods. Therefore, this study aims to compare the sensor space and source space EEG data for emotion recognition using tensor based methods. In order to achieve that, different frequency bands were used as features of EEG data. In addition, support vector machine (SVM) as a conventional method, and logistic tensor regression (LTR), which was a tensor-based method, were used as two different classification methods. The results showed that the gamma was the most discriminating frequency band. Also, source space data improved the accuracy rates when compared with sensor space data. Moreover, TLR was superior in the source space than SVM. In the sensor space, both methods performed similarly.

Thesis No.: 481 Radiomics analysis of 3D computed tomography images for predicting the ISUP grade of clear cell renal cell carcinoma tumors

Name: Ahmet Karagöz, Year: 2022

Advisor(s): Albert Güveniş

Abstract: Renal cell carcinoma (RCC) constitutes %85 to %90 of all kidney malignancies. In 2020, 430,000 new cases were diagnosed and 179,000 of them lost their lives. Clear cell renal cell carcinoma (ccRCC) is the most common sub-type of RCC with approximately %80 occurrence rate. Accurate, non-invasive and preoperative determination of the International Society of Urological Pathology (ISUP) based tumor grade is important for the effective management of patients with ccRCC. Recent studies showed that CT radiomics can offer the means to predict this grade but there are some problems about data such as scarcity, unbalancing and standardization. In this study, we aimed to improve discrimination power between grades via using 3D and 2D radiomics features and ensemble machine learning methods. Radiomics features were extracted from 143 CT images obtained from the publicly available data set from The Cancer Imaging Archive. Over sampling methods and series of feature selection methods were applied to reduce the number of features. Besides the actual tumor volume, 5 additional VOIs were created to consider peritumor regions and test the robustness of the model against variations in segmentation for three ensemble machine learning algorithms. The best result was found when SMOTE was used in combination with Light Gradient Boosting Method (LightGBM) AUC of 0.89 ± 0.02. As a result, ccRCC tumor grade can be predicted from 3D CT images with a high reliability despite the inadequacy of a dataset. The algorithm is moderately robust against deviations in segmentation by observers.

Thesis No.: 480 Effects of ultrasound exposure to cells cultured on nitinol in a PDMS substrate

Name: Cansu Şen, Year: 2021

Advisor(s): Özgür Kocatürk

Abstract: Cardiovascular diseases are one of the most serious health problems in the world. Especially arterial closure, atherosclerosis, as a common, and vital disease has a great influence on a heart attack. As a remedy, vascular stents are frequently used to prevent restenosis. It is very crucial to prohibit the smooth muscle cells growth not to generate any thrombus formation which can lead to coagulation and in-stent restenosis, and to achieve endothelization on the stent surface. To get faster these processes, some of the innovative, user-friendly, and non-invasive treatment methods such as ultrasound can be applied to the target tissue during and after the implantation surgery. In this thesis, as a preliminary study, L929 mouse fibroblast cells and MCF-7 (Michigan Cancer Foundation-7) human breast cancer cells have been chosen to evaluate the ultrasound effect. Ultrasound has different impacts on both fibroblast and breast cancer cells. While ultrasound exposure has been utilized to observe the cellular viability of fibroblast cells, it has been applied to breast cancer cells to bring cell proliferation and viability under control and/or see cell necrosis. Since ultrasound has provided both the endothelization and preventing the smooth muscle cell generation leading to vessel occlusion, this in-vitro experimental study can be the representative solution for in-stent restenosis regarding the impact of ultrasound for both cells generation and/or cell necrosis. Also, these cell lines have been cultured on NiTi surfaces placed into the PDMS substrates to represent the NiTi-based stent in the vessel structure. Based on our results, the highest viability of L929 mouse fibroblast cells was detected at low intensities; 0.2 W/cm2, 1 MHz, and 0.2 W/cm2, 3 MHz. Moreover, for MCF-7 cancer cells, there has been no statistically significant difference in cell proliferation following ultrasound exposure. Therefore, it can be claimed that ultrasound treatment can aid to control cancer cell generation. As a result of this study, it was demonstrated that ultrasound can influence cell viability and growth since it was exposed to different cell lines to detect the cellular activity on NiTi surfaces. While ultrasound can stimulate fibroblast cell proliferation, it can also assist to regulate and prevent MCF-7 cancer cell proliferation. Consequently, it might be a prospective and promising study to explore the influence of ultrasound on both endothelization and to prohibit any obstruction in the vessel, which causes atherosclerosis.

Thesis No.: 479 Epileptic seizure prediction using machine learning and deep learning methods

Name: Burak Gözütok, Year: 2021

Advisor(s): Ahmet Ademoğlu

Abstract: Epilepsy is one of the most common neurological diseases in the world which negatively affects the daily life of a patient. Predicting epileptic seizures is of great importance for healthcare professionals and patients. The electroencephalography (EEG), which allows for registering brain activity with the help of electrodes placed on the scalp, is generally used to diagnose and monitor epilepsy. In this study, automatic seizure prediction was performed using CHB-MIT dataset which contains EEG data recorded at Boston Children's Hospital. Support Vector Machines (SVM), a common machine learning algorithm chosen as the primary method within this thesis's scope, and three different deep learning methods were compared. The first of these methods was long short term memory (LSTM) classifier with convolutional autoencoder which did not need any feature extraction. The second method used the spectrograms obtained by preprocessing the EEG data which were fed into a convolutional neural network (CNN) based classifier. The last method was based on converting the EEG data into three-dimensional images by applying source localization and performing classification with CNN. Among the methods used, the best result was obtained using source localization based CNN classification with 89.06% specificity, 92.58% sensitivity and 90.41% accuracy. Computational cost of three methods in terms of runtime efficiency were also compared, and it was observed that the SVM, which yielded the lowest classification performance with 74.07% accuracy, worked significantly faster than other methods.

Thesis No.: 478 Developmnet Of Semg And Artıfıcıal Neural Networks Based Powered Ankle Prosthesis Control Algorıthms For Staır Ascendıng and Descendıng Motıons

Name: Ramazan Tarık Türksoy, Year: 2021

Advisor(s): Can Yücesoy

Abstract: Amputation is the surgical removal of a limb due to various reasons, e.g trauma. Prosthesis is a device which is a replacement for the missing part of the limb. Ankle joint can have loads of 10-13 times of the body weight during power demanding activities. Since energetically-passive prostheses cannot generate net power output, powered ones become essential for demanding tasks. Surface electromyography (sEMG) is a non-invasive method which measures neuromuscular activity. The aim of this study was to develop artificial neural network models to predict ankle moment and position using only sEMG input for control algorithms of stair ascending and descending tasks. Time delay neural network and long short-term memory were compared for this aim. Features that represent sEMG signals better were investigated. Minimizing the number of sEMG signals from lower leg muscles can make prosthesis flexible while reducing the number of sEMG sensors required can make the prosthesis economic. Correlation of 0.90 between the predicted and actual values was set as the performance threshold. Long short-term memory based algorithms achieved significantly higher performances. 0.91 and 0.93 correlations were achieved for both motion tasks' position and moment, respectively. The minimum number of sEMG sensors was 2 for moment and 3 for position estimation. The minimum number of lower leg muscles required was 1 for moment and 2 for position estimation. The results show that there are promising EMG sensor combinations for the specified targets.

Thesis No.: 477 Fpga Implementtatıon Of Machıne Learnıng Algorıthms For Vıbrotactıle Feedback ın Prostheses

Name: İsmail Erbaş, Year: 2021

Advisor(s): Burak Güçlü

Abstract: This study aimed to apply discrete event-driven vibrotactile feedback using machine learning algorithms in real time. Previously acquired tactile and proprioceptive sensor data were input to an FPGA and classified by multinomial logistic regression (MLR) and decision tree (DT) algorithms. Calibrated force and angle values and their derivatives were used as features. Movement-type (stationary, flexion, contact, extension, release) and object-type (no object, hard object, soft object) classes were predicted as discrete events. Training of the models was performed in MATLAB offline; model parameters were implemented in the FPGA by using NI LabVIEW and FPGA module. Vibrotactile feedback stimuli were generated in the FPGA card according to real-time classification. FPGA outputs were sent to custom-made power amplifiers to drive two actuators (Haptuator) placed on both upper arms of participants. The classes were mapped to discrete prosthesis events by using two frequencies and two magnitudes (relative to each participant). Six able-bodied humans participated in psychophysical experiments for measuring absolute detection thresholds and sequential pattern recognition of vibrotactile feedback. DT performed better than MLR for both object-type (97% vs. 94%) and movement-type (88% vs. 59%) classification in real time. Furthermore, the participants could distinguish vibrotactile feedback signals associated resulting from discrete events with medium recall (0.38 ± 0.08), precision (0.38 ± 0.09), similar to offline identification in our previous work. The presented thesis shows that FPGA implementation of machine learning for vibrotactile feedback is feasible in prostheses. It is expected that human performance for utilizing the feedback may increase during daily use because of additional sensory cues and physical context. Keywords: FPGA, Somatosensory Feedback, Vibrotactile, Touch, Tactile Sensor, Proprioceptive Sensor, Decision Tree, Multinomial Logistic Regression, Machine Learning, Discrete Event-Driven Sensory Feedback Control

Thesis No.: 476 Development Of Powered Ankle Prosthesıs Classıfacıtıon Algorthms For Step-Up Vs.Step Down Movements Usıng Machıne Learnıng Fed Exc.By Surface

Name: Onur Sürhan, Year: 2021

Advisor(s): Can Yücesoy

Abstract: Rapidly increasing developments in the field of artificial intelligence yield implications for motion supportive devices. Powered ankle prostheses (PAP) employ actuation mechanisms that aim to support amputees during locomotion. Surface electromyography (sEMG) allows muscles contribution in developing such algorithms and their usage as the exclusive sensing source is novel. Different techniques of processing raw sEMG data exist, but their optimal usage in a PAP control algorithm has not been elaborated on. Despite their benefits, normalization of the raw sEMG data and usage of sliding window might be problematic for a real time application. The main aim of this thesis was to develop and test control algorithms for a PAP that successfully distinguishes step-up and step-down tasks of healthy population using exclusively sEMG. A specific aim was to assess the effects of normalization and windowing procedures of sEMG data on prediction success of the algorithms developed. An open database was used to acquire sEMG data of 50 participants. Four machine learning techniques namely, (i) ANN, (ii) LSTM, (iii) LightGBM and (iv) RF were used with windowed/non-windowed and normalized-non-normalized datasets. Comparison of their performances showed that LightGBM utilizing non-normalized and non-windowed dataset performed,(Accuracy=92.53%) not significantly different than the best performance obtained utilizing normalized and windowed dataset(Accuracy=94.02%). So, it is concluded that LightGBM can be used in step-up/down classification module of the control algorithm for PAP using non-normalized sEMG data.

Thesis No.: 475 A Modular Scalable Detector Acouısıtıon System For Medical X-Ray Applıcatıons

Name: Mert Deniz Polat, Year: 2021

Advisor(s): Cengizhan Öztürk

Abstract: This thesis project proposes an innovative acquisition system for line scanning X-ray detectors. Current linear X-ray detectors are either offered as fixed size or requiring cabling or grid systems. The new design aims to overcome these issues by offering iSAM, a sensor module where multiple modules attach to each other to extend the imaging area without leaving dark regions. Another feature is the ability to read the sensors from a single port, without a need for new cabling. The design of iSAM is conducted as hardware development and programming. In terms of hardware development, a printed board containing CMOS line sensors, digitalization circuitry and data lines is designed and manufactured. On the programming side, an FPGA design is developed to drive the sensor modules and collect the image data in a parallel concept. A microprocessor program finally, reads the memory blocks within the FPGA, and transfers the image data to the computer via a USB serial connection. The studies within this project showed that the usage of CMOS line sensors, combined with adequate scintillators on X-ray applications is feasible, and the hardware design of the acquisition system is operable. Significant work remains (harware design improvements, hardware/software programming, prototype development with larger arrays and advanced testing) to employ this innovative sensor design approach for the real life applications.

Thesis No.: 474 Preservation Of The Collogen Structure By Coaxial Electrospining Methods

Name: Efe Cuma Yavuzsoy, Year: 2021

Advisor(s): Bora Garipcan/ Murat Kazancı

Abstract: Collagen is one of the most important material for biomedical technologies. Both its biological and mechanical properties enable collagen to be used in many fields such as biomaterials, tissue engineering etc. The use of collagen in the production of electrospun nanofibers reveals promising results for both research and clinical based areas such as tissue scaffold. However, collagen can lose its natural structure by being affected by many parameters during the formation of nanofibers with desired physical properties. In this thesis, coating of collagen nanofibers with a biodegradable polymer, Poly Vinyl Alcohol (PVA), using coaxial electrospinning method is demonstrated. It was hypothesized that the structure could be protected by coating the collagen nanofibers with PVA. Thermal and spectroscopic analyzes show that collagen and PVA are present in the obtained nanofiber structures. With optical and scanning electron microscope images, the difference between the fibers produced by the coaxial electrospinning system and those produced by the conventional electrospinning system was demonstrated. This work is considered as a preliminary study, it is hypothesized that the nanofibers to be produced by the coaxial electrospinning method as used in this thesis may show biological activity enhancing properties in vivo and invitro experiments as tissue scaffolds in future research.

Thesis No.: 473 Measurıng Effortful Motıvatıon Wıth Heffort :Psychometrıc and Valıdatıon Usıng Machine Learnıng

Name: Alamira Hajjar, Year: 2021

Advisor(s): Daniela Schulz

Abstract: Lack of motivation can affect everyone in our modern world, with consequences ranging from poor work and school performance to decreased family functioning. Thus, it is important to understand the mechanisms of motivation and devise personalized treatments. Traditionally, motivational and other psychological states in humans are measured with questionnaires. However, none of the current questionnaires can distinguish between motivation and pleasure, two components of the reward system. This is in contrast to how the brain works which employs the dopamine system to mediate effortful motivation and the opiate system to mediate pleasure. Importantly, deficits in either system require a different treatment and thus it is pertinent that we can distinguish between these psychological states. To address this issue, our group has developed a novel questionnaire (HEFFORT) that we administered to a representative sample of Istanbulites varying in age, income, and lifestyle. We tested the hypothesis that HEFFORT can separate motivation from pleasure. First, we explored the relationships between the novel and validated questionnaires using Spearman correlations. Second, we developed an algorithm that predicts individual differences in effortful motivation using supervised machine learning classification techniques. Third, we determined the accuracy of the predictions by testing the algorithm on a separate testing dataset. Our results show that HEFFORT is reliable and able to distinguish between effortful motivation and pleasure. Future testing and use can establish HEFFORT as a research and clinical diagnostic tool that assesses different components of reward.

Thesis No.: 472 Predıctıng Glioma Molecular Subtype From Dıffusıon Anısotropy Indıces Dıstrıbutıons

Name: Hande Halilibrahimoğlu, Year: 2021

Advisor(s): Alpay Özcan

Abstract: Incorporation of glioma genetic mutations, including isocitrate dehydrogenase (IDH) and telomerase reverse transcriptase (TERT), provides information on overall survival and disease course. However, such mutations are determined from a biopsy sample which represent only the biopsied region. Non–invasive tumor genotype prediction have been studied, but they mostly focusing only on the tumor. Yet, gliomas are known to infiltrate along normal–appearing white matter (NAWM), where relevant genotype information might be available. Diffusion anisotropy indices (DAIs) and diffusion tensor eigenvalues (DTEs), derived from diffusion tensor imaging (DTI), can be used to quantify the diffusion in the NAWM of glioma patients with varying mutation status. We hypothesize that using full–distributions of DAIs and DTEs can better represent the complex tumor effects in the NAWM in comparison to usual summary statistics. In this study, we have compared the predictive values of summary statistics, full distributions and multi–Gaussian fitting (MGF) parameters of DAIs and DTEs in the NAWM for predicting IDH–TERT subgroups, IDH and TERT mutations in 70 glioma patients. Hemispheric variations were also investigated with hemisphere difference distributions.The results show that, full distributions can predict tumor genotype better than standard distribution parameters, and perform better than or as well as MGF parameters. Additionally, feature selection applied to full distributions further increased classification accuracy. IDH–TERT subgroups were best predicted with 78.6% accuracy, IDH mutation with 94.3% accuracy, and TERT mutation with 88.6% accuracy. In conclusion, full distributions are better predictors of genotype prediction. Future work will focus on increasing accuracy on a larger cohort and personalized MGF. Keywords: Glioblastoma, Magnetic Resonance Imaging, Diffusion, Diffusion Tensor Imaging, Anisotropy Indices, Distributions, Machine Learning

Thesis No.: 471 Braın Computer Interfacıng(BCI) Data Analysıs Usıng Graph Sıgnal Processıng

Name: Sevde Büşra Bayrak, Year: 2021

Advisor(s): Ahmet Ademoğlu

Abstract: Data have been growing enormously in various domains including society, economics, industry, security, transportation, and medicine. The high dimensional structure of these data requires new techniques that employ their underlying connectivity structure. Graph signal processing (GSP) has emerged as a processing tool for high dimensional datasets as an extension of classical signal processing performed in the Euclidean space. In this thesis, electroencephalography (EEG) data collected for brain-computer interfacing (BCI) are used for classification using GSP as a preprocessing tool. Two EEG datasets, one during emotion detection, and one during motor imagery are used. Support vector machines (SVM) and $K-$nearest neighboring algorithms are used for classification. The underlying connectivity structure of the EEG data is obtained using the distance and neighboring information of the electrode locations on the scalp. The results show that the classification accuracy is significantly improved when the data are projected to the underlying graph subspace determined by the graph spectral eigenvectors followed by a temporal filtering determined by Fourier spectral eigenvectors as a preprocessing step before classification.

Thesis No.: 470 Creatıng A 3D Neuronal-Culture Usıng Algınate And Collagen Hydrogels Optımal For Neuronal Survıval And Axon Growth

Name: Başak Dalbayrak, Year: 2021

Advisor(s): Hale Saybaşılı

Abstract: Alginate is a natural linear polymer that found in brown algae; also, it is biocompatible, biodegradable, and non-toxic. These properties make alginate favorable for biotechnological applications. In this thesis, 3D cell culture properties of extracted alginate from Cystoseira barbata was compared with commercially available alginic acid, sodium salt. Alginate hydrogels were used to create a three-dimensional neural cell culture to achieve survival and axonal outgrowth of two cell lines, mouse motor neuron (NSC-34) and neuroblastoma (SH-SY5Y). The cells were embedded with 1% (w/v) alginate hydrogels. Due to the lack of alginate receptors in these cells, cells in alginate tended to become together as aggregate. To decrease the clusters and increase cellular survival, the alginate was also mixed with collagen type I at a ratio of 2:1 alginate/collagen. In both cell lines, the alginate/collagen hydrogels did not signi cantly alter cell proliferation or axonal outgrowth when compared to only alginate hydrogels. In order to enhance axonal growth and survival in these hydrogels, NSC-34 cells were di erentiated with nerve growth factor (NGF, 50 ng/mL) and broblast growth factor (FGF, 10 ng/mL), while SH-SY5Y cells were di erentiated with serum withdrawal and retinoic acid (RA, 10 µM) treatment when seeding them in hydrogels. Survival of NSC-34 cells in hydrogels was improved with FGF and NGF treatment, and cellular clusters were decreased upon di erentiation with FGF, and survival was found to increase also with NGF treatment. On the other hand, SH-SY5Y cells were not successfully di erentiated within hydrogels upon serum withdrawal and retinoic acid treatment; the cells were observed to undergo stress after the addition of RA.

Thesis No.: 469 Biomimetric Apatite Coating On 3D Printed Scaffolds For Bone Tissue Engineering Application

Name: Anılcan Çakır, Year: 2020

Advisor(s): Bora Garipcan

Abstract: Bone-like apatite coating of polymeric materials by biomimetic coating to enhance their bone tissue healing capability is a very successful technique used in bone tissue engineering. Creating favorable environment for cells of the bone tissue by forming apatite layer is one of the best approaches for controlling the cell response. The purpose of this thesis is to obtain bone-like apatite layer onto 3D printed [Polylactic Acid (PLA)/Polycaprolactone (PCL); (70/30 w/w)] blend polymer scaffolds by means of using a simple biomimetic coating process and also to determine the most effective pretreatment and coating process. Before coating pretreatment was applied to all scaffolds with 1M NaOH alkaline solution and then 0.2M $CaCl_2$ and K_2HPO_4 solutions respectively to improve Ca-P layer attachment and formation. Simulated body fluid (SBF) was utilized to mimic physiological conditions of the body throughout immersion duration of the samples which were eventually observed under scanning electron microscopy (SEM) for their morphological development at the 8th, 14th and 21th days. Ca-P development on the scaffolds were confirmed with Electron Dispersive Spectroscopy (EDX) and X-ray diffraction (XRD).

Thesis No.: 468 Characterization Of Pulmonary Arterial Branching In Rat Fetuses W,ith Congenital Diaphragmatic Hernia

Name: Furkan Durmuş, Year: 2020

Advisor(s): Esin Öztürk Işık/ Bora Büyüksaraç

Abstract: Congenital diaphragmatic hernia (CDH) is one of the congenital anomalies leading to neonatal deaths and postnatal respiratory disorders. When the abdominal organs herniate into the chest through the defect on the diaphragm, pulmonary hypoplasia and pulmonary hypertension might occur. Pulmonary hypoplasia is defined as the underdevelopment of the lung. On the other hand, pulmonary hypertension is defined as the increased pressure applied to the pulmonary artery wall due to the structural changes of the arteries. During the fetal period, the fetus gets oxygen through the placenta instead of using its own lungs. Although the pathology starts in utero, the pressure levels in the respiratory system could be measured postnatally. Even there are studies in the literature that aims to predict the severity of the disease in utero, none of them widely accepted. The methods used to estimate the degree of CDH include lung-to-head ratio, total lung volume, and the presence of a liver hernia. In this study, the data of rat fetuses gathered via micro-computed tomography were employed to compute the morphometric measurements of the pulmonary arteries and evaluated to predict the outcome of CDH. In future studies, new methods could be developed to assess the degree of the CDH anomaly in utero to help doctors with a surgical intervention decision.

Thesis No.: 467 Mechanical Modelling And Design Of The 4 Fingers Of An Anthropomorphic Robotic Hand

Name: Muhammed Munzer Alseed, Year: 2020

Advisor(s): Mehmed Özkan

Abstract: Anthropomorphic robotic hands aim to resemble the functions and appearance of human hands. The increasing interest in their design arises from their importance in many medical and engineering applications. Controlling flexion and extension of each of the 4 fingers of an anthropomorphic robotic hand requires 3 motors to have full control of its joints. This study aims to construct a model for the 4 fingers to enable full control of all of their joints using only 2 motors by utilizing the correlation between proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints of human finger to use a single motor for their control. A mechanical model is established for a single finger with correlated PIP and DIP joints to be generalized for the 4 fingers. Inverse kinematics is solved for the angles of the joints in terms of fingertip position. Transfer functions are derived for the change in tendons lengths during flexion to find the appropriate design of the pulleys controlling them. Hand parts are designed, 3D printed, and assembled accordingly, and then controlled using an Arduino microcontroller. Joints angles of the 4 fingers are measured over their full range of motion to calculate their correlation. Inverse kinematics gives a unique solution for each different fingertip position, but the ratio between the correlated angles should be assumed slightly different than that of a human hand for an algebraic solution to exist. The derived transfer functions are found to be nonlinear and increasing, meaning that the designed pulleys need to be spiral instead of perfectly circular. However, circular pulleys are used for the designed hand for simplification. Measured PIP and DIP joint angles show strong correlations for all fingers and over the full range of motion for all joints.

Thesis No.: 466 Functionalization Of Carbon Nanotubes For The Drug Delivery In cancer Treatment

Name: Özde Zeynep Güner, Year: 2020

Advisor(s): Hale Saybaşılı/ Seniha Güner

Abstract: Cancer is a significant health problem and the main cause of death worldwide. Targeted drug delivery is a possible replacement for classical cancer treatment, which includes chemotherapy, surgery, and radiation therapy. With this treatment, single-walled carbon nanotubes (SWNTs) are widely exploited. They have the advantage over other materials with their conductivity, large specific surface area, and chemical stability. However, the cytotoxicity of SWNTs is still a challenge in this field. The goal of the study is to obtain biocompatible SWNTs to use in targeted drug delivery. To reduce the toxicity of SWNTs and get an excellent drug carrier, we were modified SWNTs with a novel noncovalent functionalization method: adsorption of 9-fluorenylmethyloxycarbonyl (Fmoc)-terminated aromatic amino acid-functionalized with poly(ethylene) glycol (PEG) chains onto pristine SWNTs. For that purpose, among biocompatible agents, we used a Fmoc-Cys(Trt)-OH, Fmoc-terminated aromatic amino acid, due to operational simplicity, and PEG, an FDA-approved safe polymer, with two different molecular weights (PEG5000 and PEG12000). With this work, we can say that we successfully obtained functionalized SWNTs (f-SWNTs). In addition, we determined the most competent coating among synthesized f-SWNTs in terms the stability, binding efficiency, and suspending properties. Consequently, the in-vitro effectiveness of functionalized SWNTs was tested on HEK293 cells. Our results show that modifications done improve the cytotoxicity of SWNTs, and f-SWNTs can be used in cancer drug delivery.

Thesis No.: 465 Comparison Of Open Source Tumor Growth Simulation Software And Multiscale Tumor Modelling

Name: Ahmet Fırat Çakmak, Year: 2020

Advisor(s): Albert Güveniş

Abstract: Cancer is a complex disease that is comprised of many different cellular and tissue level organizations. Tumor growth simulation is vital in predicting the way tumors grow. Tumor modelling is used to shed light on cancer biology and is considered a promising method for developing more effective cancer therapies. In this study, the biological inputs and their respective outputs using the simulation approaches were systematically reviewed. A comparison table was produced that shows in detail the biological inputs for each simulation code. This is in contrast to the current agentbased model reviews that mostly focus on computer efficiency. Physicell was selected among the reviewed open-source software due to its integrated basic cell functions and microenvironment simulation capabilities. Tumor growth has been simulated in the Physicell v1.6.1 tumor simulation software. The A549 cell specific parameters have been used during the simulation and the effects of the initial oxygen concentration in the microenvironment were examined on outcome images. Growth rate of tumor cells increases with the increasing oxygen concentration in the microenvironment. Formation rate of necrotic core in the tumor structure reduces with the increasing oxygen concentration due to small number of hypoxic cells in the tumor structure. Based on our findings in the simulation, physicians can predict the hypoxic regions in tumor structure to plan a chemotherapy treatment dependent localized peripheral tissue considering the correlation between oxygen concentration and tumor growth rate.

Thesis No.: 464 Investigating Skeletal Muscle Adaptations Due to BTX-A Injections Using Agent-Based Modelling

Name: Mohammed H. M. Hammouda, Year: 2020

Advisor(s): Can Yücesoy

Abstract: Local application of Botulinum Toxin Type-A (BTX-A) has been the gold standard for spasticity management in children with Cerebral Palsy. The treatment aims to reduce the passive resistance of force at the joint and increase the joint range of motion. However, recent studies have reported results contradictory to treatment aims including increased passive force, increased muscle stiffness and decreased length range of force exertion which have been attributed to the increased collagen content in the muscle Extracellular Matrix (ECM) confirmed by histological findings. Moreover, a recent finite element analysis study has reported that BTX-A injections were found to increase the injected muscle fibers' strain. Hence, to understand these muscle adaptations and the effects of strain on muscle structure and function, the Agent-Based Modelling (ABM) method was used. The advantages of this method over other methods is that it allows studying muscle adaptations at the cellular level with the complex interactions modelled. This study was modelled in three cases comparing the BTX-A model, BTX-A-Free model and a middle half paralyzed (MHP) model similar to that used in the recent finite element model. Two of the cases compared the BTX-A-Free fascicle against the BTX-A and the MHP fascicles and the third case compared the BTX-A-Free case to a modified MHP case which included the reported BTX-A induced atrophy and the decaying effects of BTX-A 7-10 days after injection. The collagen increase in the cases was approximately 33%, 33%, and 20.3% respectively. This study revealed that although the BTX-A induced strain increase was found to increase collagen content of the ECM, other important factors such as the BTX-A induced atrophy may also play a significant role in collagen increase in the muscle ECM.

Thesis No.: 463 Pectus Bar Bender and Designer Sorftware to Enhance Pectus Excavatum Surgerless

Name: Kenan Kaan Kurt, Year: 2020

Advisor(s): Özgür Kocatürk

Abstract: Pectus excavatum is caused by inward collapse of the rib cage, which may cause the patient's internal organs to become flush and fail to function. In 1986, Donald Nuss developed the most common treatment method today, also known as the Nuss technique. The Nuss technique is performed by opening incisions from each side of the patient's rib cage and placing a bent bar under the cage as required by the rib cage. It is still made with the help of machines that can be compared to simple hand tools. For this reason, it is difficult to adjust the bar according to the patient and usually more than one attempt is made to find the correct shape. In this process, the submerged rib cage is especially likely to come into contact with vital organs such as the heart and lung. Since the pericardium sticked to the sternum, it has to be torn in some surgeries, where the bar is in direct contact with the heart. For all these reasons, it is very important to place this bar in the patient's rib cage with least trials. In order to reduce the problems seen during the treatment phase, a web-based software using medical images is built to shape the drawn bar along with a bending machine. This allows the bender to bend the bar correctly using DICOM images of the patient before surgery, and any errors that may occur can be corrected beforehand. In addition, it is expected that the machine will shorten the operation time, reduce the number of life- threatening situations and improve the patient's quality of life. The system bends bars with an error rate under 8% at any given point on the bar, which is sufficient according to consultant surgeon. Also, the bending process is completed under 1 minute with the help of 28 Nm stepper motor.

Thesis No.: 462 Functional Characterization Of Graphene-Based Thin-Film MicroElectrodes On Rat Sonsorimotor Cortex

Name: Fikret Taygun Duvan, Year: 2020

Advisor(s): Burak Güçlü

Abstract: Neuroprostheses based on cortical implants are promising to provide partial sensorimotor function in severe neurological conditions such as spinal cord injuries and amyotrophic lateral sclerosis. One of the key components of these systems is the microelectrode array, which is used for recording brain activity to control a robotic limb and/or for stimulation to induce somatosensory feedback. Graphene is a good candidate as electrode material due to its intrinsic features such as high electrical conductivity and charge injection capacity, high mechanical strength, flexibility and biocompatibility. Evoked local field potentials were recorded epidurally at the hindpaw representation of SI in anesthetized Wistar albino rats. The vibrotactile stimuli were bursts of sinusoidal (5-, 40-, and 250-Hz) displacements (duration: 0.5-s, amplitude range: 19 - 270 μm) applied on the glabrous skin. Performance comparisons were made between matching research grade graphene and commercial Pt-Ir surface electrodes on the same subjects (active site diameter: 25-μm). Robust evoked potentials could be observed shortly after the onset of contralateral stimuli in both electrodes. Pt-Ir electrodes exhibited slightly higher SNR while the lowest impedances were recorded from the channels of the graphene array. Variance of the impedance values were smaller for the channels of the Pt-Ir electrodes. The performance of the graphene electrode channels was observed to be heterogeneous due to ongoing development efforts. This thesis includes one of the first functional tests of graphene electrodes during processing of the natural sensory stimuli in the brain.

Thesis No.: 461 Effects of Bisphosphonate/ Graphene Oxide Complex on Proliferation And Diifferentiation Of Mesenchymal Stem Cells And Breast Cancer Cells

Name: Gökçen Boran, Year: 2020

Advisor(s): Duygu Ege

Abstract: Bisphosphonates have strong healing impact on postmenopausal osteoporosis and also apoptotic effect on breast cancer cells (MCF-7). Zoledronic Acid (ZOL) is a third generation (nitrogen contained) bisphosphonate. In this study, the effects of ZOL, Graphene Oxide (GO), and conjugation of these two samples (ZOL-GO) were observed on both cell lines of human bone marrow mesenchymal stem cells (MSC) and of breast cancer cells (MCF-7). The conjugation of ZOL (Sigma, 10 mg powder) and GO (Sigma, 2mg/mL) was obtained via mixing them with magnetic stirrer and sonicator. During the preparation of samples; ZOL stock solution was obtained by mixing ultra pure water (5mg) with ZOL powder (10 mg) and GO stock solution was obtained by mixing ultra pure water (4500 µL) with GO (500 µL). The final concentrations that used in this study were for ZOL were 200 µM, 50 µM, 12.5 µM and for GO were 11.7 ng/mL, 2.91 ng/mL, 0.73 ng/mL and for ZOL-GO complexes were 200 µM ZOL - 11.7 ng/mL GO, 50 µM ZOL - 2.91 ng/mL GO, 12.5 µM ZOL - 0.73 ng/mL GO. Fourier Transform Infrared Spectroscopy (FTIR) results was obtained for the characterization of the samples. For cell proliferation, Alamar Blue viability test and Acridine Orange (AO) dying was conducted. The viability of MSC was not affected significantly in the presence of ZOL-GO complex however the viability of MCF-7 cells remarkably decreased on day 3. For observing cell differentiation, Scanning Electron Microscopy (SEM) and Alizarin Red S staining results was used. The mineralization of the MSC was reinforced by the presence of ZOL- GO complex.

Thesis No.: 460 EEG Data Classification Using Multilinear Regression Model

Name: Ayşe Akgün, Year: 2019

Advisor(s): Ahmet Ademoğlu

Abstract: Brain Computer Interfaces (BCI) are systems that facilitate people to use a computer, to control an electromechanical or a neuroprosthetic device without using their motor nervous system. It is possible to obtain an information about the brain tissues with electrodes placed on the skull which record the electrical activity called electroencephalogram (EEG) . The electrodes placed in di erent regions capture the activity in their neighborhood. BCI systems combining the electrical signals from these electrodes use signal processing and machine learning algorithms to identify the motor or the cognitive activity that is embedded in the brain signals so as to mobilize the peripheral devices according to the information gathered. Emotion estimation is often used in brain computer interface applications to improve and control the communication between man and machine. In recent years, emotion estimation studies based on brain electrical activity, which is the most widespread method used for accurate emotion analysis, have gained momentum. In this thesis study, multichannel EEG data taken from normal subjects who encountered emotionally pleasant and unpleasant pictures were classi ed with a multilinear regression algorithm. The results were compared with those of the Support Vector Machine (SVM) and proved to be better in accuracy.

Thesis No.: 459 Amino Acid Conjugated Self-Assembled Molecules Modified Titanium Surfaces

Name: Müge Türkaydın, Year: 2019

Advisor(s): Bora Garipcan

Abstract: The goal of this thesis is to increase biocompatibility of titanium (Ti) surfaces, which is an extensively used biomaterial in medicine, by an easy and timesaving surface modification procedure. For this purpose, 3-aminopropyltriethoxysilane (APTES) molecule was conjugated by 3 different amino acids (histidine, leucine, and tryptophan). Newly synthesized molecules were used to form amino acid conjugated self-assembled monolayers on titanium surface. After modification of the surfaces by each of the amido amino acids, histidine and leucine amino acids were chosen to make up hydrophilic and hydrophobic regions on the surface and they were mixed with changing concentrations (v/v, 80:20, 50:50, 20:80). X-ray photoelectron spectroscopy (XPS) analysis and water contact angle measurements were performed for the characterization studies of all of the modified surfaces. Human osteoblast cells culture studies were performed on the surfaces, which were modified by this method aimed at improving the biocompatibility of titanium, in order to investigate cell viability on the modified surfaces.

Thesis No.: 458 Design Of A Breathing Simulator Generating Adult And Pediatric Patterns

Name: Senad Tüzünoğlu, Year: 2019

Advisor(s): Can Yücesoy/Yekta Ülgen

Abstract: In this thesis, a mechanical breathing simulator is developed, constructed, tested and calibrated for the experimental use of medical devices such as nasal drug products, nebulizers and inhalers. The aim of the simulator is to protect users from inhaling hazardous materials, and also performance of the simulator is not affected by the users' breathing conditions. In order to increase reliability, the simulator has different flow pattern capabilities to match different devices.The design of the simulator uses a mechanical air piston, which is air thigh, controlled by a program for creating different types of volume-flow diagrams in order to be applicable for different breath patterns.Volume control, sine flow and sine volume breath patterns are programmed and the user can choose any of them with the desired volume for each.These flow patterns can provide relative comparison of individual respirators by measuring the performance under the same breathing conditions, which gives better results for repeatability.The calibration and testing of the simulator has completed by connecting to a flow measuring device in lab. The tests are done to measure the volume error between input volumes set by user and output volumes provided by the simulator. Also respiratory rates, inhalation time, exhalation time and inhalation to exhalation ratios are measured. Test results showed that the simulator for volume; gives minimum 0,04 \% error and maximum 3,52% error respectively, also for the respiratory rate minimum 0,67% error and maximum 5,44% error was calculated . Also a test was completed according to EN 13544 to measure aerosol output of Omron A3 nebulizer. Aerosol output of nebulizer was measured as 0,25 ml. The study showed that, the simulator can be used for testing nebulizers, CPAP devices and also inhalers and nasal drug products.

Thesis No.: 457 Evaluation And Analysis Of A Computer Aided Diagnostic System For Lung Nodule Assessment In Ct Scans

Name: Berna Eser, Year: 2019

Advisor(s): Albert Güveniş

Abstract: Throughout the process of detecting lung cancer, using CT scans to predict the malignancy level of pulmonary nodules will be complicated process for radiologists. CAD gives a second opinion to radiologists to identify lesions properly and distinguish malignant nodules at the early stage of lung cancer. In order to develop the CAD scheme, a coherent and consistent database such as the Lung Image Database Consortium (LIDC) database is the most crucial point to consider. In that database, CT scans are evaluated by four different radiologists and their annotations on nodule characteristics are highly efficient for researchers. One of these characteristics is malignancy that has 5 ratings: Highly - moderately unlikely, indeterminate, moderately- highly suspicious. In this study, the classifier performances of SVM, RF and ANN are compared using 1018 cases, 907 nodules and 110 extracted features. Experimental results demonstrate that best performing classifiers are respectively ANN, SVM and RF on malignancy prediction. The most critical gap of LIDC Database is the lack of ground truth data that is mainly caused by the absence of biopsy results. Therefore, by using arithmetic mean voting, this problem might be avoided and desired information might be acquired. The results of analyses show that grouping radiologists' malignancy ratings increases classification accuracy. Classifiers are examined with the use of 5 class, 3 class (benign, indeterminate, malignant) and 2 class (benign, malignant)ratings on malignancy datasets. Experiments show that the classification performance is enhanced by grouping malignancy ratings. Three groups of datasets' classification results indicate that moderately and highly malignant separation assessments affect classification performance negatively. However, using two classes under the name of benign and malignant, increases the accuracy rate up to 98%.

Thesis No.: 456 Image Reconstruction In Dental Tomosynthesis With Stationary Detector

Name: Yunus Burak Sur, Year: 2019

Advisor(s): Cengizhan Öztürk

Abstract: Tomosynthesis is an imaging modality for analyzing anatomical structures. X-ray images from different angles are used for reconstruction in tomosynthesis. In contrast to computed tomography, X-ray tube moves around a restricted pathway for acquisition. Therefore, number of projections are used for reconstruction are less than computed tomography. In this thesis, feasibility of tomosynthesis was explored for a stationary detector system, where x-ray tube had a limited circular movement around isocenter. Algorithms are both used for simulation and physical phantom. X-ray simulation is created based on x-ray attenuation and ray tracing. Physical phantom is produced for acquisition of images with x-ray machine. Observations were made for different conditions in image creation. Effects of the range of circular movement and step size were analyzed. Also, influence of angles between selected plane and axes in image formation were studied. Additionally, effect of selected plane to isocenter distance was experimented. Lastly, artifact and blur removal was applied to achieve better structure identification. Analysis of reconstructed images showed that tomosynthesis could improve the identification of structures. Wider acquisition arcs, artifact and blur removal were the most important factors in getting better images. Planes other than the focused plane caused artifacts and blur in reconstructed image. Therefore, planes with high contrast objects were subtracted from reconstructed plane to improve the visibility of the objects. Histogram analysis also showed the suppression of higher contrast pixels in the reconstructed image. Keywords: Medical imaging, X-ray imaging, Tomosynthesis, Limited angle imaging, Stationary detector.

Thesis No.: 455 Design Of A Virtual Environment For Discrimination Tasks To Determine The Psychometric Function

Name: Taha Süleyman Hasekioğlu, Year: 2019

Advisor(s): Burak Güçlü

Abstract: In this thesis, we used the Gazebo simulation software to develop a virtual environment for interactions of objects to perform psychophysical tasks to distinguish between objects at differing stiffnesses. The virtual environment is composed of a probing device, a cube, and a slider. The probing device is used to touch the cube which moves on the slider. The environment includes objects of different stiffnesses, and the user attempts to discriminate between these objects. To simulate the effect of deformation in the cube, we modeled the cube as a mass-spring-damper system, so the object generates a force proportional to the distance it is pushed by force generated from the probe contacting the cube. The virtual environment was tested by recording the step response of each cube with different k constants. The cube deformed according to the model. Six users were asked to perform psychophysical trials on the virtual environment for stiffness discrimination. Six identical cubes with different stiffnesses were used, where the stiffest cube was used as the reference. The subjects were asked to discriminate between each cube and the reference object. Then we plotted the psychometric curve and determined the discrimination threshold from the data produced. The experiment was done in three phases with twenty trials in each phase. In the first phase, the user would see the virtual environment and also listen to the auditory signal. In the second phase, the user was blindfolded and only received the audio signal. In the third phase, the auditory signal of the virtual environment was muted, and the user only received the visual signal, which was the distance the cube moved. The psychophysical trials show that the virtual environment can be used to determine the psychometric curve and discrimination threshold of the user's ability to discriminate between objects of different stiffnesses.

Keywords: Psychophysics, Psychometric Function, Virtual Environment, Stimulus, Discrimination Threshold.

Thesis No.: 454 Patient Specific Musculoskeletal Modeling To Relate Intra Operative Muscle Force Data To Gait In Cerebral Palsy

Name: Utku Can, Year: 2019

Advisor(s): Can Yücesoy

Abstract: Increased pathological resistance against knee extension is a characteristic pathological condition in cerebral palsy (CP). Active and passive forces of spastic knee flexor muscles have been associated with the high forces which constrain the knee movement in flexed positions. However, studies quantifying these forces directly are rare. The aim of this study was to determine (1) if the range for spastic muscle-tendon complex length is comparable to that of healthy muscle and (2) how spastic muscle force changes as a function of muscle-tendon complex length. Musculoskeletal patient specific models were developed using OpenSim software by using the gait analysis data of CP patients. The results suggest that the muscle-tendon complex length trends of the patients are similar to those of healthy individuals. The difference between the minimum and maximum MTL is 13% and 8% for healthy ST-GRA muscles respectively, while this difference oscillates between 7% and 14% for spastic ST muscles and 4%-9% for spastic GRA muscles of the patients. In addition, at longer muscle-tendon complex lengths higher passive and active forces of spastic muscles were measured and the dominant component of the total force is the active muscle force. For the GRA, peak active muscle force is more than 5 times that of passive force. For the ST, peak active muscle force is approximately 4 times that of passive force. The outcome of this assessment suggests that mechanical characteristics of spastic muscles may not necessarily differ from those of healthy muscles. This implies that, an explanation for the restricted joint movement of CP patients via the consideration of spastic muscles as shortened and mechanically abnormal muscles is a simplistic one.

Thesis No.: 453 A Novel Left Atrial Appendage Occluder Design

Name: Almila Ceren Baykan, Year: 2019

Advisor(s): Özgür Kocatürk

Abstract: Percutaneous left atrial appendage (LAA) occlusion is a viable nonpharmalogical alternative for prevention of thromboembolic stroke in patients with atrial fibrillation (AF), especially for the patients who are unable to respond to oral anticoagulants. However, several device- or procedure-related complications were reported associated with existing implants. The aim of this study is to design and prototype a novel left atrial appendage occluder in order to prevent life-threatening complications. The proposed system allows to reduce LAA sac volume using a distal nitinol anchor while sealing the LAA ostium using a coated nitinol occluder frame. The sealing capability test of the prototyped occluder frame was performed on the phantom system mimicking left atrial with 12-30 mmHg pressure. Results have demonstrated LAA was successfully occluded and suggested that the percutaneous LAA closure with coated nitinol frame is favorable. The mechanical assessments have shown polyurethane is the promising candidate as coating material against other fabrics using in commercially available occluders. As a part of this thesis study, proof-of-concept coaxial catheter delivery system was prototyped to perform delivery and deployment of occluder frame and distal anchor, respectively. Consequently, this study presented a novel occluder design and provided a good starting point for further applications of prototyping.

Thesis No.: 452 Botulinum Toxin Type A Spread Into Non-Injected Antagonistic Muscles Causes Increased Extracellular Matrix Collagen

Name: İsmail Orkun Akcan, Year: 2019

Advisor(s): Can Yücesoy

Abstract:

Thesis No.: 451 Predicting Von Hippel Lindau (Vhl), Polybromo-1 (Pbrm1) Mutations And Stages Of Clear Cell Renal Cell Carcinoma From Computed Tomography Images By Machine Learning

Name: Harika Beste Ökmen, Year: 2019

Advisor(s): Albert Güveniş

Abstract: RCC is the most prevalent renal malignancy and ccRCC is the most common subtype of RCC. It is reported that the prognosis has a strong association with VHL alteration, and VHL mutation plays a role as a predictive and survival marker for ccRCC. It is also reported that PBRM1 gene has great potential to identify ccRCC and a critical role in ccRCC progression. It is the second most common alteration in ccRCC. Moreover, available treatment opportunities are mostly related to stage information. More than 50% of patients with early-stage RCC are cured, but the treatment options are limited in stage 3 and 4. Therefore, early diagnosis is major for the patients. The commonly used diagnosis method, namely biopsy, always has the potential to devastate the patient emotionally, damage the healthy tissue, or spread the tumor. In addition, studies of ccRCC indicate that there is a correlation between cancer CT imaging features and gene expression (radiogenomics). We hypothesized that from quantitative 2D CT images via one slice with the biggest tumor, both VHL and PBRM1 mutations and stages can be predicted with accuracy using machine learning algorithms. TCGAKIRC data were collected and divided according to specific gene mutations and stages. The tumor was segmented by an expert radiologist. After feature extraction, feature selection was performed. Finally, classification was done by using CL and ANN on Matlab. Our results showed that Fine Gaussian SVM model is able to predict VHL and NON-VHL data with 68.6%, k-NN with Random Subspace model is able to predict PBRM1 and NON-PBRM1 with 84.9% ,and ANN predicted stages with 91.90% accuracies. From this study, it appears that ML-based quantitative 2D CT analysis using one slice for each patient is a feasible and potential method for predicting the status of VHL and PBRM1 mutations and stages of patients with ccRCC.

Thesis No.: 450 Non-Contact Breathing Abnormality Detection Using Machine Learning

Name: Sefa Erdoğan, Year: 2019

Advisor(s): Ahmet Öncü/Cengizhan Öztürk

Abstract: Respiratory diseases are widely seen in the world and they are not seriously handled until they start affecting the patient's life very badly. Respiration motion contains information about the patient's health status which can be measured with non-contact measurement techniques. Non-contact continuous measurement of respiration rate and pattern is desirable for both the patients and the caregivers. Doppler radar can measure the chest wall displacement, accurately. It is also cheap and accessible. Once the chest wall motion is captured, machine learning algorithms can predict the type of the breathing pattern. Different types of breathing patterns contain distinctive features that the classification algorithms can focus on. In this study, a Doppler radar measurement setup was prepared. The accuracy of the system was tested with a linear actuator and it found to be accurate enough to measure the chest wall displacement. 5 breathing patterns including normal, hypoventilation, Kussmaul, Cheyne-Stokes and Biot's breathing were collected from 10 subjects. Since each subject reproduced 5 breathing patterns, a total of 50 measurements were taken. Results show that prediction accuracy is 96% for linear discriminant and subspace ensemble classifier, and other used algorithms also predict the patterns with more than 90% accuracy.

Thesis No.: 449 Development Of Cancer Theraphy Wıth Icg-Pdt Supported By Gold Nanopartıcles

Name: Sena Salta, Year: 2019

Advisor(s): Murat Gülsoy

Abstract: Photodynamic therapy (PDT) is an application based on the killing of unwanted cells with photochemical reactions based on photosensitizer induced by light at an appropriate wavelength and the use of oxygen in the environment. Spherical gold nanoparticles (AuNPs) have been interesting because of their easy synthesis and easy functionalization thanks to their conjugation properties. The aim of this study is to investigate the efficacy of PDT on cancer cells with an 809-nm laser, which has higher optical penetration to biological tissues than other lasers using the indocyanine green (ICG) as a photosensitizer loaded onto a gold nanoscale carrier. For this purpose, PDT was applied to the cells of the prostate (PC-3) and colon (Caco-2) cancer and the results were compared with control groups and each other. Cell viability was monitored by MTT test to measure the efficacy of the dose of AuNP-ICG used during these experiments. On Caco-2 and PC-3 cell lines, 25 μM, 50 μM and 100 μM ICG concentrations and 25, 50 and 100 J/cm2 laser power density groups were compared. As a result of these studies, it was found that the AuNP-ICG had a toxic effect on treated cell lines. It was also observed that colon cancer cells were more resistant to PDT with AuNP-ICG than prostate cancer cells. Although there was no significant decrease in cell viability without toxic effect in PC-3 cells, they showed a significant viability decrease compared to the control group. In Caco-2 cells, this significant decrease was observed at higher dosages and higher energy density.

Thesis No.: 448 Comparing Bacterial Colonization Of Laser Etched And Acid Etched Enamel In Bonding Orthodontic Ceramic Brackets

Name: Sibel Sofuoğlu, Year: 2019

Advisor(s): Murat Gülsoy

Abstract: The aim of this project comparing bacterial colonization of laser etched and acid etched enamel in bonding orthodontic ceramic brackets and also to develop a method which reduces the risk of enamel demineralization and tooth decay caused by acid etching. In this project, after cleaning bovine teeth, before the embedding gypsum block, 10*10 mm area was created a labial surface of teeth. Then, they were buried in gypsum block as the labial surface. They were put in the gypsum block as parallel as possible. Then, the first step is the bonding of ceramic brackets by using acid etching (for acid etching group phosphoric acid solution is used within the ratio of 37% to the bonding surfaces. Then laser etching method was applied. Universal testing machine was used to debond the brackets. The second step was inoculation of bacteria to measure colonization of bacteria on the teeth after laser etching and acid etching techniques. There were 4 different experimental groups: Acid etched group, Laser etched group, Non-etched group, and Gypsum group. Each group was composed of 12 samples. After the inoculation part, S. Mutants colonies were counted on a counting aid manually and the colony-forming units (CFUs) were examined. Results show that there was a significant difference between debonding forces (nonetched vs acid etched, laser etched) and there was a significant difference between CFU values of laser etched and acid etched groups. Mean value and average CFU values for laser etched groups were lower than acid etched groups.
Keywords: Acid Etching, Laser, Debonding, Ceramic Brackets, Bacteria

Thesis No.: 447 Optimizing Sh-Sy5y Cell Differentiation Into Neurons And Investigating The Effects Of Flavonoids On Neurodegeneration

Name: Meryem Şahin, Year: 2019

Advisor(s): Hale Saybaşılı

Abstract: Parkinson's disease is the second most common neurodegenerative disease both in Turkey and in the world. The studies show the effects of inflammatory mechanisms and reactive oxygen species in the neurodegenerative diseases. In this respect, studying anti-inflammatory and antioxidant drugs on the models of Parkinson's is of great importance. Sideritis brevibracteata (P.H. Davis) is a plant endemic to Turkey that is being consumed by local people as tea to treat rheumatic pain, gastrointestinal tract problems and the common cold. Previous studies show the water-soluble flavonoids of the plant have antioxidant and anti-inflammatory effects. SH-SY5Y neuroblastoma cells are commonly used in the literature as neuronal models, however, there is no agreed-upon differentiation protocol to conduct reliable research. In this thesis, differentiation of SH-SY5Y cells into neurons was optimized, then Parkinson's Disease was modeled in SH-SY5Y neuroblastoma cells using rotenone. Then, S. brevibracteata extract was investigated to see whether or not it has an effect on these cells in terms of protection, using a cell viability assay. Results showed that 1 μg/mL S. brevibracteata can protect the cells against 20 μM rotenone induced toxicity.

Thesis No.: 446 Novel Flat Interface Nerve Electrode (Fine) Design By Electrically Driven Shape Memory Alloys (Smas)

Name: Abdülsamet Şahin, Year: 2019

Advisor(s): Özgür Kocatürk/Burak Güçlü

Abstract: Flat Interface Nerve Electrodes (FINE) reshape the nerve, which results in an oval geometry and causes the fascicles to be arranged on an axis. In this way, they can provide selectivity at the fascicle level without penetrating the nerve. However, the constant pressure exerted on the nerve during the reshaping process causes nerve damage. Therefore, a dynamic design is required to apply the required force for shaping the nerve when excitation or receiving signal is necessary. The aim of this study is to design a dynamic FINE that can apply gradual pressure on the nerve using shape memory alloys (SMA). In this study, the actuation mechanism that will apply pressure on the nerve is provided with an SMA shaped as a spring. The main frame of the electrode was fabricated with a 3D printer. Electrode contacts were produced with chromium and gold coated with PVD technique on polyimide. The overall design performance was evaluated by a forcemeter. As a result of driving the actuator with various current values, it has been proved that it can perform gradual and controlled compression. In addition, the actuator can produce up to 0.7 N force. This demonstrates that this design can be used in the manufacture of an electrode capable of gradual compression, as well as in a system designed to cause controlled damage to the nerves.

Thesis No.: 445 Design And Optimization Of A Miniature Actuator Using Shape Memory Alloy (Sma) Wires

Name: Morteza Teymoori, Year: 2019

Advisor(s): Özgür Kocatürk

Abstract: Microfluidic systems have proven to be very beneficial in many fields such as chemical and biomedical sciences. The reduced sample volume, among many other advantages attracts researcher's attention to this technology. Consequently the need for a precise fluid handling and flow control is greater than before. Although many micropump systems have been invented over the last decade, there is still a need for a small, fast, quiet, and robust pump design. Because various applications have their own specific pumping requirements, the search for application driven novel micropump designs still continues. Shape memory alloys have been gaining more attention recently, for their idiosyncrasies, namely shape memory effect and pseudoelasticity. The ability of the shape memory alloy to recover high deformations makes them appealing for various applications. Here we use both of its hallmark behaviors, shape memory effect and pseudoelasticity, to design an electrically driven actuator. We kept a micropump development in mind during the design and characterization of this actuator. Consequently, the obstruction level of a conductive fluid filled channel was quantified using impedance measurements of control fluid and used as an indicator of the actuation amplitude and rate. The fabricated actuator successfully closed the fluid channel even under fluid pressures of up to 150 mmHg. This scalable design can be used in different applications such as micropump development, and microfluidic World to Chip interface.

Thesis No.: 444 Surface Based Morphometry In Alzheimer’s Disease

Name: Esma Ece Uluğ, Year: 2019

Advisor(s): Ahmet Ademoğlu

Abstract: Alzheimer's disease (AD) is a neurodegenerative disorder especially affecting the elderly population which is growing worldwide. In this study, surface-based morphometry analysis was performed on anatomical MR images of patients with Alzheimer's Disease (AD) and healthy control (HC) subjects using a computational anatomy toolbox called CAT(Computational Anatomy Toolbox) on SPM (Statistical Parameter Mapping) platform. MR images were obtained from a database named Minimal Interval Resonance Imaging in Alzheimer's Disease (MIRIAD) consisting of 46 AD patients and 23 HC subjects. The cortical thickness measurements were performed over 34 different regions on each hemisphere defined by Desikan-Killiany anatomical atlas. The t-statistics parameters of the cortical thickness values were found to be decreased in 24 regions in AD patients compared with the HC subjects. Additionally, the linear correlation values between the MMSE scores and cortical thickness values of AD and HC individuals were estimated for each atlas region. Accordingly, 28 regions exhibited a significant correlation between MMSE(Mini Mental State Examination) scores and cortical thickness values. Significant regions that were affected by AD were observed to be as parietal, temporal, frontal, cingulate and occipital lobes as reported in previous studies.

Thesis No.: 443 Comparison Of Mega-Press And Short Echo Time Press On Classification Of Idh Mutation Using Machine Learning At 3t

Name: Ayhan Gürsan, Year: 2019

Advisor(s): Esin Öztürk Işık

Abstract: Malignant glioma is a type of frequent and lethal cancer the brain. Recent World Health Organization (WHO) criteria has included genetic mutations in glioma classification. One of these mutations, isocitrate dehydrogenase (IDH) is common in grades II and III gliomas, and has been related to metabolism of the cancer tissue. IDH mutant gliomas have better prognosis than IDH wild type ones. As a result of this mutation, an onco-metabolite 2-HydroxyGlutarate (2HG) accumulates in tumor tissue. Detection of IDH mutation before surgical procedure could play an important role in treatment planning. Magnetic resonance spectroscopy (MRS) is a noninvasive technique that could be used to provide IDH mutation information. In this study, first, a 3D printed MRS phantom was designed and produced to analyze spatial distribution performances of MRS sequences. Then, 82 glioma patients, whose IDH status have been determined by immunohistochemistry, have been included. Short echo time Point Resolved Spectroscopy (PRESS) and Mescher-Garwood PRESS (MEGA-PRESS) MRS sequences were acquired on a 3T Siemens MRI scanner. Metabolite concentrations have been estimated with LCModel spectal fitting program using corresponding basis sets. Machine learning models have been developed to determine IDH mutation using metabolite concentrations as features. Our results indicated that a decision tree model using features from short TE PRESS profile could detect IDH mutation with 75% accuracy, while maximum accuracy attainable with MEGA-PRESS was 68%. The MRS phantom that was produced as a part of this study could be used as a validation tool for new MRS sequences. Future studies will aim to detect other genetic alterations in gliomas on a larger patient cohort.

Thesis No.: 442 Acoustic Impedance Measurement Of Tissue Mimicking Phantoms By Using Scanning Acoustic Microscopy

Name: Burak Altun, Year: 2019

Advisor(s): Bora Garipcan

Abstract: Phantoms are imaging objects used as stand-ins for human tissues to guarantee that algorithms and methods for monitoring the human body are functioning properly. Thus, characterization of them prior to clinical trials plays a vital role. By that, in this thesis, we aimed to characterize breast, liver and blood tissue mimicking phantoms through acoustic impedance measurements recorded by 80 MHz Scanning Acoustic Microscopy (SAM) and propose a novel and fast technique for measuring a variety of soft tissue phantoms. To our best knowledge, it is the first study that suggests SAM operating at acoustic impedance measurement mode for the quantification of tissue-mimicking phantoms. We achieved to produce breast (soft) tissue mimicking phantoms which have acoustic impedance values between the range of 1.373±0.031 and 1.707±0.036 MRayl. Our acoustic impedance measurements provide the result of 1.693±0.085 MRayl for the liver tissue mimicking phantom and 1.624±0.006 MRayl for the blood tissue mimicking phantom which is very close to acoustic impedance values of human tissues.

Thesis No.: 441 The Effect Of Bone Surface Mimicked Magnetic Particle Embedded Pdms Membranes On Human Osteoblast Behavior

Name: Berkay Erenay, Year: 2019

Advisor(s): Bora Garipcan/Sedat Odabaş

Abstract: Cell microenvironment can be defined as all biophysical, biochemical, biomechanical properties that affect cell behaviour and cell fate. These factors include surface topography, roughness, stiffness along with the extracellular matrix (ECM) and presence of other soluble factors. Changes in the microenvironment are directly or indirectly converted into signalling pathways inside the cell and affect cellular metabolism. In this thesis, effects of surface topography and surface chemistry were investigated by synthesizing magnetic particle embedded (MP) (0.5%w/w) bone surface mimicked (BSM) polydimetylsiloxane (PDMS) membranes on osteoblast behavior. Bone tissue microenvironment were imitated by chemically modifying membrane surfaces with extracellular matrix proteins Fibronectin (FN) and type-I Collagen (Col-I). Human fetal osteoblast cells (hFOB) were seeded on these magnetic particle embedded bone surface mimicked scaffolds in order to observe potential differences in osteoblast behavior. Material characterization for these plain, bone surface mimicked (BSM), magnetic particle embedded PDMS (mpPDMS) membranes were done using Water Contact Angle (WCA) measurements, Vibrating Sample Magnetometry (VSM), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM). Cellular behaviour on these membranes were investigated using alamarBlue cell proliferation assay, indirect MTT assay, actin and nuclear fluorescent stainings. Results of these study indicated that the protein modifications and surface topography resulted from bone surface pattern transfer to membrane surfaces have increased osteoblast adhesion and proliferation. Additionally, cell morphologies were natural and consistent with previous findings but further experimentations are required to understand possible effects of embedded magnetic particles (Fe_3O_4) on mechanotransductive and intracellular signalling pathways.

Thesis No.: 440 Decellularization And Characterization Of Leek: A Potential Cellulose-Based Biomaterial

Name: Melis Toker, Year: 2019

Advisor(s): Bora Garipcan

Abstract: Cement industry is energy-intensive and harmful effects (emissions) to the environment during manufacturing are the leading industries.In this study, the amount of energy consumed and emitted to reduce emissions from cement production, clinker to be a substitute for, the availability of recyclable materials were investigated. Despite having the largest market share of Portland cement, blended cement production and use is expected to continue to increase even more in future years, as a new material used in this study instead of clinker ceramic waste (floor and wall tiles, granite), and zeolite and as an additive in standard the blast furnace slag, fly ash and limestone used in the manufacture of cement in different proportions. With the use of artificial and industrial waste recycling by providing reduced the amount of clinker in the cement, thus the cement production process, the amount of fuel, energy consumption and CO2 emissions reduction is recognized facility. In addition, higher strength cement was obtained with he contribution of floor tiles.

Thesis No.: 439 Multiple-Parameter Optimization Of The Sln Spect /Ct Imaging Protocol Using Monte Carlo Simulation For Precision Medicine

Name: Hilal Yıldız, Year: 2019

Advisor(s): Albert Güveniş

Abstract: The most encountered cancer type among women is the breast cancer. Advanced clinical treatment applications are currently present, and the effectiveness of treatment is closely related to early diagnosis. Detectability of sentinel lymph nodes (SLNs) in breast assumes noteworthy role in order to predict breast cancer before metastasis. This study intended to scan SLNs in breast by using SPECT/CT and to enhance image quality of SLNs and find out optimal values of different parameters by using the design of experiments methods. The SIMIND Monte Carlo Simulation package and Design of Experiments were used to evaluate SLNs in breast. A Zubal torso phantom was modelled. Typical imaging conditions were utilized from published guidelines and literature. The OSEM algorithms were used for reconstruction. Seven parameters were specified as attenuation correction(+ ; -), number of projections (120; 90), collimator type (low- energy-high-resolution (LEHR); low-energy-general-purpose (LEGP)), energy window (20%; 15%), iteration number (20; 10), subset (15 ; 5) and count activity. An orthogonal array with 8 experimental runs was used. Contrast-tonoise ratios were calculated from lesion and background statistics. From the response table, the highest CNR value was found 9.63 with a combination of LEHR collimator type, attenuation correction, 20% energy window, 20 iterations, 15 subsets, 120 projections and higher count activity. According to results, collimator type, number of projections and attenuation correction had the highest effect. More research is needed to include other correction algorithms.
Keywords: sentinel lymph nodes, SPECT/CT, Monte Carlo simulation, breast.

Thesis No.: 438 Tactile Processing And Vibrotactile Discrimination Capacity In Children With Tourette Syndrome

Name: Ürün Eşen, Year: 2019

Advisor(s): Burak Güçlü

Abstract: Tourette Syndrome (TS) is a childhood-onset developmental psychiatric disor- der. Pediatric patients are diagnosed with TS if they show multiple motor tics and at least one vocal tic for at least one year. The tic severity is known to be reduced in most of the cases as the patient progress into adulthood which suggests a cerebral adapta- tion over time. The pathology of TS is not clear; however, neurotransmission deficits, especially of γ-aminobutyric acid (GABA), and structural alterations in the cerebral structures are believed to be play a role in disorder's occurrence. Existing literature suggests the tics to arise from hyperexcitability due to GABAergic dysfunction, and the adaptive somatosensory mechanisms in TS to be disrupted. This study aimed to extend the GABAergic adaptive dysfunction in TS hypothesis by assessing the detec- tion and difference thresholds through a psychophysical vibrotactile battery. Thirty TS children (7 female, 23 male) and 25 healthy controls (7 female, 18 male) participated in the experiments. Vibrotactile stimuli were generated by a portable device and applied to the fingertips of the subjects. The vibrotactile battery consisted of Choice Reaction Time (cRT, amplitude: 200 μm, Static Detection Threshold (DT_s), Dynamic Detec- tion Threshold (DT_c , amplitude ramp: 2 μm/s), Amplitude Discrimination (AD, standard stimuli: 50, 100, 200 μm), and Amplitude Discrimination with single-site adaptation (cAD, the same standards, adapting stimuli: 100, 300 μm, adaptation dura- tion: 1 s) measurements. The analyses showed that both groups produced comparable detection thresholds. Amplitude discrimination tasks produced further support for the GABAergic adaptive dysfunction in TS hypothesis, since in the baseline AD tasks TS group produced significantly higher difference thresholds, and in the cAD tasks control group closed the gap by showing a more prominent adaptation.

Thesis No.: 437 Effects Of Basal Forebrain Stimulation On The Distribution Of Cholinergic Receptors In The Sensorimotor Cortex Of Rat Brain

Name: Begüm Devlet, Year: 2019

Advisor(s): Burak Güçlü

Abstract: In this thesis, the effects of basal forebrain stimulation on the distirbution of α4 and α7 type nicotinic acetylcholine receptors were studied in three different brain areas: primary motor cortex, hindlimb somatosensory cortex and barrel field somatosensory cortex. Basal forebrain, the main source of cholinergic inputs, was electrically stim- ulated (for each trial: 0.5-ms bipolar pulses with 50 μA, at 100 Hz for 0.5 s). In total, the experiment was carried out with 2400 pulses and it took 4 hours. After stimulation, transcardially perfusion was applied, and their brains were used for im- munofluorescence staining. According to hemisphere in which the stimulation was applied and histological sections were obtained, the animals were separated into three experimental groups: control (no stimulation, n=7), ipsilateral (same hemisphere as stimulation, n=7) and contralateral (opposite hemisphere of stimulation, n=7). The results show that basal forebrain stimulation has a significant effect on the distribution of only α7 type nicotinic acetylcholine receptor. Ipsilateral and contralateral groups are statistically different from control group but there is no difference between ipsilateral and contralateral experimental groups. Specifically the number of receptor α7 complexes and their density of receptor complexes (normalized with layer thicknesses) were increased significantly with respect to control. Additionally, the number of α7 type receptor complexes and the density in primary motor cortex were mostly lower than those in the hindlimb area and barrel field of primary somatosensory cortex. A similar finding was found for only α4 type receptor count but not for the density. Over- all, this thesis shows anatomical evience for cholinergic modulation of somatosensory system. The results may be important for understanding attentional processes, and neuropsychiatric diseases which affect them.

Thesis No.: 436 In Vitro Models Fro Studying Neurogenerative Diseases Based on SH-SY5Y Cell Line

Name: Morteza Abbaszadeh, Year: 2019

Advisor(s): Hale Saybaşılı

Abstract: The main objective of this study was to use a variety of biophysical assays such as electrophysiological recordings, flourescent microscopy and in-silico tools to evaluate an in-vitro model based on differentiated SH-SY5Y neuroblastoma cell lines. To validate the model a demonstration study was conducted to investigate effects of Brain Derived Neurotropic Factor (BDNF) on state of transmembrane currents during neurodegeneration caused by Amyloid beta peptides. Two protocols were developed to use BDNF as an adjacent drug to a control group differentiated by Retinoic Acid (RA). Morphological and fluorescent assays, including F-actin staining, were used to verify and characterize cell differentiation and uptake of amyloid beta peptides by the cells. Upon uptake of amyloid beta, whole cell patch clamp technique was used to observe changes in transmembrane current in control and BDNF groups. Furthermore a Hodgkin Huxley based stochastic search engine was employed to extract ion channel composition data from whole cell recording experiments. The results demonstrated that however BDNF significantly increase cell survivability against amyloid beta, the transmembrane currents would be highly altered, indicating possible functional alterations of survived cells in Alzheimers disease. Furthermore the model was utilized for development of a new electrophysiological recording technique from the subject cells. Lipid coated recording which has been presented in this thesis uses a bi layer of synthesized lipids such as 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) to obtain gigaseals before touching the cells with glass micro pipettes. results presented in this thesis represent an initial optimization phase and proof of concept for further development of the technology and increase in its applications

Thesis No.: 435 Can Smart Phones Be Used In A Teleradiology Setting For Evaluating Lung Cancer Therapy Response?

Name: Ezgi Kara, Year: 2019

Advisor(s): Albert Güveniş

Abstract: Works to be done daily can be done with mobile technology in more practical, flexible times, in desired environments. The transformation of smart phones and tablets into daily life leads to changes in the personal activities of individuals. With mobile health applications developed, individuals can access personal health services at any time and place they want. Imaging methods are an indispensable tool in modern medicine. In radiology, clinical depression affects radiologists because of working in low working conditions. With this study, it is aimed to increase productivity for radiologists by the use of some techniques to improve the performance of mobile displays at normal conditions. It was chosen a mobile dicom viewer which is called Medfilm in the Iphone 6S model smartphone. As a DICOM viewer in the computer, Radiant Dicom Viewer Version 4.1.16 was executed to examine the images in the Viewsonic VA2410-mh model monitor. For case analysis, nodules in lung CT images were examined. Data was taken from TCIA collection. TCIA is a service which de-identifies and hosts a large archive of medical images of cancer accessible for public download. 271 cases were included in the study. In both the observer 1 and the observer 2, the nodule was detected in 266 cases (98.2%) and no nodules were found in 5 cases (1.8%). In the evaluation made by the telephone, the first observer detected nodule in 251 cases (92.6%), while the second observer detected nodules in 252 (93%) patients. It was used Bland-Altman analysis, which is the most accurate method used to describe the harmony between the two measurements. According to Bland-Altman test with 95 % confidence interval, the difference between observer 1 and 2 were calculated as 0,6740,39 mm and 0,660,387 mm respectively. If the differences are normally distributed, we would expect 95% of the nodule measurement differences to lie between -0.095 mm and 1.443.It can be said that nearly all pairs of measurements by the two methods will be closer together than these extreme values, which we call 95% limits of agreement. The difference between observer 1 and observer 2 for smartphone and monitor measurement were calculated as -0,190,662 mm and -0,1620,55 mm respectively. If the differences are normally distributed, we would expect 95% of the nodule measurement differences to lie between -1.5 mm and 1.12 mm for observer 1 ; -1.25 mm and 1.12 mm for observer 2. The encouraging results show that smart phones can potentially be used in tele-radiology for evaluating therapy response in lung cancer during clinical trials or actual therapy for large tumors.

Thesis No.: 434 A Comprehensive Medical Equipment Management Software System For Increased Patient Safety

Name: Neslişah Akyüz, Year: 2019

Advisor(s): Esin Öztürk Işık/ Yekta Ülgen

Abstract: A medical equipment system was developed to include the inventory of medical equipment, the failure management process, the maintenance and repair periods, the management and the scheduling for calibration and preventive maintenance. The software system keeps all necessary information, analyses and converts this information into meaningful results and graphical charts. It can report the failure types, the leading causes for the failures, and the cost analysis for each failure. The user determines the frequency for the preventive maintenance according to this information. Scheduling makes it easier to control and stick by the layout of the hospital process. This web-based software project was written by Entity Framework code first system in ASP.NET MVC 5 area on SQL server 2016 database, which was created on the Microsoft Azure Cloud System server. The upgrades and maintenance of the system could be done while the system is operational. The screens are limited by access authorisation of each type of user.

Thesis No.: 433 Increasing Photodynamic Therapy Efficacy By The Natural Compound Curcumin

Name: Firas Şueki, Year: 2019

Advisor(s): Murat Gülsoy

Abstract: Photodynamic therapy (PDT) is a cancer treatment in which an injected or applied photosensitizing agent is activated by light of a specific wavelength which causes a sequence of photochemical and photobiological processes resulting in irreversible selective damage to the target tissue. PDT is a promising antitumor treatment method for its high selectivity, non-invasiveness and minimal side effects. However, due to the resistance of some cancer cell lines to PDT, it exhibits results with low efficiency. Therefore, there is an urgent need to overcome this resistance to increase the PDT's efficiency, making PDT more widely applicable. Thus, this M.Sc. study introduces the usage of Curcumin, which is a non-toxic natural compound that has antitumor characteristics, with 5-ALA-PDT to increase PDT's efficacy. First, 5-ALA mediated PDT and Curcumin antitumor characteristics were evaluated on two cell lines, PC-3 and Caco-2. Then, the determined PDT doses were applied to the cell lines together with two different Curcumin concentrations. Illumination was performed using 635-nm diode laser after 6-hr incubation of 5-ALA and Curcumin. The outcomes of this study prove the success of the proposed combination on the highly resistive colon cancer (Caco-2 cell line) with 62.4% decrease in cell viability.

Thesis No.: 432 Structural And Mechanical Characterization Of Calcium Phosphate Cements (CPCs) With Different Powder-Liquid Ratios

Name: Şule Yetiş, Year: 2019

Advisor(s): Duygu Ege

Abstract: Calcium phosphate cements (CPCs) are promising osteoconductive bone substitutes for bone grafting. In this study, new bone cements were prepared by mixing powders of tetra calcium phosphate (TTCP), dicalcium phosphate dihydrate (DCPD) and calcium sulfate dehydrate (CSD) to polymeric solution including CMC and gelatin. Samples with different powder-to-liquid ratio (62.5, 65, 67.5, and 70%) were fabricated and characterized. Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), X-ray diffraction (XRD), Thermo-gravimetric Analysis (TGA) and mechanical testing were performed to characterize structural and mechanical properties of synthesized composites. FTIR results confirmed the electrostatic interaction between COO□ groups in carboxymethyl cellulose (CMC) and Ca2+ ions released from CPCs. Hydroxyapatite (HA) formation was observed and evaluated by XRD and SEM analysis on the samples incubated in phosphate buffer saline (PBS) solution for 28 days. Furthermore, the compressive strength values of composites were calculated as 1:63 0:046, 1:53 0:053, 0:91 0:015 and 1:28 0:072 MPa for P62.5, P65, P67.5, and P70, respectively. The overall results show that composite with 65% powder ratio may be suitable for bone tissue engineering as it has the most proper mixing of the powder and liquid phase, high HA formation and sufficient mechanical properties for bone regeneration.

Thesis No.: 431 In Vitro Studies Of Carboxymethyl Cellulose/Gelatin And Calcium Phosphate/Calcium Sulfate Cement Based Composites For Bone Tissue Engineering

Name: Esra Güben, Year: 2019

Advisor(s): Duygu Ege

Abstract: In this study, a calcium phosphate (CPCs) and calcium sulfate-based cement was introduced into carboxymethyl cellulose (CMC)-gelatin (Gel) and citric acid (CA) hydrogel for bone tissue engineering. Bone tissue is composed of organic collagen and inorganic hydroxyapatite (HA) crystals which are mimicked in bone tissue engineering approach. In many studies, CPCs such as tetracalcium phosphate (TTCP) and dicalcium phosphate dihydrate (DCPD) are used instead of directly using HA due to low solubility and difficulty of shaping of HA. Calcium sulfate dihydrate (CSD) is also used to control setting and degradation characteristics of the cement. Polymers which are mixed with the powder phase provides a composite material that mimics the organic phase of the bone tissue and prevents potential toxic effect of CPCs degradation. In this study, CMC which is a soluble cellulose derivative became a hydrogel by esterification with CA. Gelatin is a collagen derivative which provides cellular attachment and mechanical strength to the composite. In here 2 w/v% CMC was mixed with 20 wt% CA and 10 wt% Gel to obtain the liquid phase. After that, TTCP was synthesized with solid-state reaction and 76.65% of TTCP was mixed with 23.35% of DCPD. This mixture was blended with 20 % of CSD in the total powder phase. Combined liquid and powder phases were molded in a syringe and set at 50 C for 72h. Morphology of the composites were examined after setting and incubation in PBS by using Scanning Electron Microscopy (SEM). Physical characteristics of the composites were investigated with swelling, degradation and pH studies after incubation in PBS at 37 C. Cell culture studies were performed with bone marrow-derived mesenchymal stem cell (BMDMSCs). Cell viability was measured with direct contact method with Alamar Blue assay. Finally, in vitro cell adhesion was observed again by using SEM. The results indicated the homogenous structure of P62.5 and P65 and micropores in all composites. According to swelling-degradation results, except for P70, all the composites had the same swelling-degradation trend. At the end of 72h, when powder ratio was increased, the swelling degree was decreased. The powder ratio and degradation were inversely proportional. pH study showed that at first 8 hours, pH was around 12 because of the initial degradation of powder phase, at the end of 72h it reached around 7 which is similar with the physiological value for all composites. Cellular viability was calculated and only significant decrease was observed for P65 between 1-3 and 14 days. Overall, composites were successfully produced and according to results they had a potential for bone tissue engineering in terms of their biocompatibility.

Thesis No.: 430 Breastis: A Software Tool For Flexible Breast MRI Analysis

Name: Başak Bayrambaş, Year: 2019

Advisor(s): Esin Öztürk Işık

Abstract: Magnetic resonance imaging of breast provides valuable information about breast tissue composition. A common breast MRI protocol may include dynamic contrast enhanced (DCE) MRI, diffusion weighted MRI (DWI) and proton MR spectroscopic imaging (1H-MRSI). There have been several software tools that can analyze each of these data types separately. In this study, a flexible and open-source postprocessing software called 'BreastIS 'was developed to analyze DCE-MRI, DWI, and 1H-MRSI and store them in a database for further exploration. BreastIS image processing software was implemented using MATLAB and the graphical user interface was developed using MATLAB GUI and Java. The software could be run onWindows, Mac and Linux computers. A retrospective study was conducted to test the suitability of the analysis algorithms of BreastIS tool for the use with clinical dataset. DCE-MRI data of 16 and DWI data of 6 breast cancer subjects were analyzed with BreastIS. For DCE-MRI analysis, the semi-quantitative parameters such as early and maximum percentage enhancement, signal uptake pattern and maximum pixel intensity were calculated for healthy and tumor regions of each subject. For DWI analysis, mean and maximum apparent diffusion coefficient (ADC) values were calculated for tumor and healthy regions of each subject. A Mann-Whitney rank sum test with Bonferroni multiple comparison correction was applied to find statistically significant differences between healthy and tumor regions. Maximum and early percentage enhancements and maximum pixel intensity were higher ($P<0.001$), and mean ADC values were lower in tumor regions ($P=0.002$). The DCE-MRI signal uptake pattern displayed wash-out in tumor regions. The sample analysis results indicated the suitability and usability of BreastIS tool for analysis of clinical breast MRI datasets.

Thesis No.: 429 Simulation Software For A Human Ventricular Myocyte Model

Name: Ömer Oylar, Year: 2019

Advisor(s): Özgür Kocatürk

Abstract: Cardiovascular diseases (CVDs) are major health problems and the leading cause of death around the world. Cardiac arrhythmias form a significant portion of CVDs which are the electrical production and conduction problems of the heart. Diagnosis and treatment of the cardiac arrhythmias can benefit significantly from a comprehensive understanding of the underlying arrhythmogenic mechanisms. However, the limited availability of experimental data is still a major problem in this field. Computational modeling is a quite valuable tool in cardiac electrophysiology as it constitutes a backbone for in silico simulations based on the existing experimental data. Validated mathematical models can help to uncover the underlying ionic mechanisms of cardiac arrhythmias. Moreover, they can provide benefits to investigate the drug-ion channel interactions and come up with new treatments for cardiac disorders. On the other side, the complexity of the modern cardiac cell models is quite high as they include higher level of physiological details. It can be an error-prone and time-consuming process to code them using conventional programming languages in order to conduct simulations. Thus, an easy-to-use cardiac action potential simulation software and application are designed and developed in this thesis. Furthermore, human ventricular cell models are implemented in order to conduct simulations for heart failure condition and various channel blocker drug effects.

Thesis No.: 428 A Phantom Study: Evaluation Of A Novel Three-Lumen Balloon Catheter Fro Treatment Of Intractable Limb Ischemia

Name: Efecan Tatarlar, Year: 2019

Advisor(s): Özgür Kocatürk

Abstract: Peripheral artery disease (PAD) is a serious health problem that includes occlusive arterial syndrome. Critical limb ischemia (CLI) which is the most severe form induces extremity gangrene or ulcers extremity rest pain which mostly can lead to limb loss. The most common CLI criteria: (a) 30 mmHg or less toe systolic pressure, (b) 0.4 or less ankle-brachial index (ABI), (c) 50 mmHg or less systolic ankle pressure. In this study, a custom made three lumen catheter (9 Fr) including a distal inflatable balloon in between the inflow and outflow lumen holes was constructed based on Hyper Perfusion Catheter patent (patent no: 2011/07038) owned by Emir Yusuf, MD. The aim of this catheter design is to elevate ankle and/or toe systolic pressures above 50-60 mmHg to promote healing and/or alleviating intractable pain due to intractable ischemia for patients with CLI. To simulate the blood circulation of related anatomy, in vitro CLI model phantom was designed and constructed by using a modified hemodialysis circuit; a hemodialysis pump and a tube set were used in bypass surgery procedures. 10% aqueous glycerol solution (by weight in water) was used to mimic human blood plasma. The data was collected by a custom-made circuit in real time and all measurements were verified with industrial certificated medical devices. In vitro CLI model phantom experiments have shown that it is feasible to elevate the pressure distal to the occlusion (representing ankle pressure) up to 80 mmHg without increasing the systemic pressure in certain conditions.

Thesis No.: 427 Optimization Of Acquisition And Processing Parameters In Sentinel Lymph Node Scintigraphy Using Spect/CT Monte Carlo Simulation

Name: Ayşenur Yüksel, Year: 2019

Advisor(s): Albert Güveniş

Abstract: Although single photon emission computed tomography/computed tomography (SPECT/CT) systems have been in use to enhance the detection of sentinel lymph nodes SLNs with lymphoscintigraphy, recently no study has focused on optimization of acquisition and processing parameters of SPECT/CT imaging of SLN detection in breast cancer examinations using simulations. The purpose of this study was to carry out SLN detectability optimization with a SPECT Monte Carlo simulation for the first time. SIMIND Monte Carlo simulation program was used to model The Symbia T6; Siemens, Erlangen, Germany SPECT/CT system that was equipped with LMEGP and LEHR collimators. In order to simulate SPECT imaging of a realistic patient with breast cancer, a voxel-based anthropomorphic phantom by ZUBAL torso phantom was constructed. Image reconstructions with or without attenuation and scatter corrections were performed with CASToR software. Quality of reconstructed images was evaluated according to SLN contrast with respect to background. Reconstruction with attenuation correction was found to be the optimum reconstruction method for both collimators. SPECT imaging with LMEGP collimator yielded competitive results over LEHR collimator in terms of SLN contrast. The results of the study are in agreement with the literature. The method presented in this study will enable optimization of acquisition and processing parameters of SLN SPECT imaging such as different gamma camera(s), collimator settings, patient dimensions, and reconstruction correction methods (attenuation, scatter) in breast cancer examinations realistically, accurately and at a lower cost than physical phantom or patient studies.

Thesis No.: 426 Optimization Of Spect For Parathyroid Imaging With Varying Instrumentation Parameters: A Simulation Study

Name: Ayşegül Oral, Year: 2019

Advisor(s): Albert Güveniş

Abstract: Parathyroid problems are frequently experienced problems. Nuclear medicine has a significant role in determining treatment. The study tried to find out the visibility of the small adenoma with a simulation method and the usefulness of the simulation with changing optimal instrumentation and reconstruction parameters for parathyroid SPECT imaging. In previous studies, parathyroid SPECT Imaging has been optimized using physical phantoms only. In this study, an anthropomorphic phantom (Zubal Phantom) and a sphere as a parathyroid adenoma were simulated. Simulated adenoma was chosen small (0.58 cm3). In order to create a parathyroid adenoma SPECT image, 99mTc-Sestamibi SPECT was used.SPECT acquisitions were done simulating two separate SPECT devices and different types of parallel hole collimators. It was found that the optimal parameters were LEUHR collimator, 16 iterations and no scatter correction for Siemens Symbia gamma camera (CNR:3.74). LEHR collimator, 16 iterations, without scatter correction gave better result according to the other parameters for General Electric Infinia gamma camera (CNR:2.81). Scatter correction did not result in a significant improvement in this study. The study showed that a small parathyroid adenoma could be studied with computer simulation methods. The optimal parameters could be investigated without the necessity of the machine itself. With this flexibility, optimal parameters for each camera could be studied in a shorter time in comparison with using real SPECT devices.

Thesis No.: 425 The Effect of Nanofiber Surface Modification On Osteogenic stem Cell Differantitation

Name: Günnur Onak, Year: 2019

Advisor(s): Bora Garipcan/Ozan Karaman

Abstract: Optimization of nanofiber (NF) surface properties is critical to achieve an adequate cell response. Here, the impact of conjugation of biomimetic aspartic (ASP) and glutamic acid (GLU) templated peptides with PLGA electrospun NF on osteogenic differentiation of bone marrow stromal cells (BMSCs) was evaluated. Cold atmospheric plasma (CAP) was used to functionalize the NF surface and thus to mediate the conjugation. The influence of the CAP treatment following with peptide conjugation to the NF surface was assessed using scanning electron microscopy (SEM), contact angle measurements, Fourier-transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS), Both the hydrophilicity of NFs and the number of the -COOH groups on the surface increased with respect to the duration of CAP treatment. Results demonstrated that CAP treatment significantly enhanced peptide conjugation on surface of NF. Osteogenic differentiation results indicated that conjugating of biomimetic ASP templated peptides sharply increased alkaline phosphatase (ALP) activity, calcium content, and expression of key osteogenic markers of collagen type I, osteocalcin, and osteopontin compare to GLU conjugated and neat NF. It was further depicted that ASP sequences are the major fragments that influence mineralization and osteogenic differentiation in non-collagenous proteins of bone extracellular matrix.

Thesis No.: 424 Effect of Different Laser Power Densities On Efficinecy Of Photobiomodulation Of Mouse Fibroblasts In Vitro

Name: İpek Düzgören, Year: 2019

Advisor(s): Murat Gülsoy

Abstract: The purpose of the present study was to investigate the efficiency of photobiomodulation (PBM) with respect to different energy and power densities, as well as different incubation times on fibroblast cells. Photobiomodulation (PBM) was performed with visible (VIS) laser light at a wavelength of 635 nm. Murine fibroblasts (L929 cell line) were irradiated at 50 mW/cm2, 125 mW/cm2, 200 mW/cm2 of power densities, separately. Laser irradiation time was varied with respect to the selected power density to keep constant the energy density for the laser groups (i.e. 1 J/cm2, 3 J/cm2, and 5 J/cm2). Cell viabilities were determined by MTT (3-(4,5-Dimethyiazol-2-yl)-2,5 diphenyltetrazolium bromide) assay test. Results showed that photobiomodulation effect was determined by energy density, power density, and incubation time. It can be proliferative or none and even under some circumstances inhibitory. For future studies, same paradigm should be tested with in vivo models.

Thesis No.: 423 Screenıng Post-Menopausal Women For Bone Mıneral Level By Bıoelectrıcal Impedance Spectroscopy Of Domınant Arm

Name: Nermin Öztürk, Year: 2018

Advisor(s): Esin Öztürk Isık/ Yekta Ülgen

Abstract: Dominant arm bioimpedance spectroscopy (BIS) and lumbar and hip dual energy x-ray absorptiometry (DXA) measurements were conducted simultaneously on 48 post - menopausal women, aged between 43 and 86 years, with no hip or arm fracture history at Department of Radiology of Istanbul University Cerrahpasa Hospital. According to lumbar DXA results, 21 women were classified as normal, 22 as osteopenia and 5 as osteoporosis; whereas hip DXA results classified 30 women as normal, 15 as osteopenia and 3 as osteoporosis. Only 26 participants had identical lumbar and hip BMD diagnostic results. Dominant arm characteristic frequencies of normal subjects were significantly different from osteoporotic subjects based on both lumbar ($p < 0.005$) and hip classification groups ($p < 0.001$). Hip and lumbar spine DXA BMD values were significantly correlated ($r = 0.55$, $p < 0.005$). The dominant arm BIS characteristic frequency, considered as the one of the single predictors in earlier diagnosis of osteoporosis, was found negatively correlated with DXA measurements for both hip and lumbar spine regions. The Spearman rank correlation coefficient of BIS values with the hip DXA values ($r = -0.53$, $p < 0.001$) was higher than that of lumbar spine ($r = -0.37$, $p < 0.001$). In receiver operating characteristic (ROC) curve analysis, the best discrimination of dominant arm characteristic frequency was made between normal and osteoporotic subjects based on the hip subgroups ($p < 0.001$). Both lumbar bone mineral content (BMC) ($r = -0.47$, $p < 0.001$) and hip BMC ($r = -0.4340$, $p < 0.005$) were significantly correlated with dominant arm characteristic frequency.

Thesis No.: 422 Measurıng Eye Fatıgue Of Radıologıst At Readıng Room And Daylıght Illumınatıon Condıtıons

Name: Erberk Alpan, Year: 2018

Advisor(s): Albert Güveniş

Abstract: With the revolutionary development in technology, diagnostics methods that are used in radiology have started to change with visual display terminals; however, traditionally the ambient light should be as low as feasible in order to maintain image contrast which may have a negative effect on the amount of eye fatigue of radiologists. The main objective of this study is to investigate the relation between the eye fatigue and ambient light as well as to show the amount of eye fatigue at reading room (0, 50 lux) and daylight (500 lux) conditions using three different eye fatigue measurements methods (CFF, Eye Blink rate (EB), Subjective Test (ST)). In order to stimulate eye fatigue, 400 X-ray chest images with pre-marked nodules were given to the five non- radiologist subjects for evaluation under three different ambient lighting settings. Each image was present on the screen for 10 seconds; therefore one session took 66 minutes for each subject to complete and was repeated for each ambient lighting settings. Mea- surements were taken before and after each session. Repeated measures ANOVA for eye blink results showed that there was a trend to be significant (p=0.065) and pairwise comparison showed that the difference in respect of eye fatigue came from mainly the difference between 0 - 50 lux (p=0.061) as well as 0 - 500 lux (p=0.045). According to the Friedman statistics for subjective test, subjects felt significantly different fatigue under different ambient lighting settings (p=0.008). There was a trend to be significant correlation between ST and CFF and between ST and EB at 0 lux (p = 0.065 and 0.068 respectively). In conclusion, eye fatigue was found to be diminishing with increasing ambient light between 0 and 50 lux and between 0 and 500 lux; however, there was no statistically significant difference between 50 and 500 lux.

Thesis No.: 421 Magnetıc Resonance Imagıng Based Dıfferentıal Dıagnosıs And Prognosıs Of Mıld Cognıtıve Impaırment In Parkınson’s Dısease Usıng Machıne Learnıng

Name: Ozan Genç, Year: 2018

Advisor(s): Esin Öztürk Isık

Abstract: Parkinson's disease mild cognitive impairment (PD-MCI), which is one of the major risk factors for dementia, is present in 26.7\% of PD patients. In this study, we classified PD-MCI, cognitively normal Parkinson's disease (PD-CN) and healthy control (HC) groups based on multimodal magnetic resonance imaging (MRI) using machine learning methods. We also investigated time dependent changes in PD-MCI patients through a longitudinal study. 33 PD-MCI, 27 PD-CN and 17 HC participated in this study. The participants were diagnosed by neurologists according to the neuropsychological test scores and physical examination results. MRI data was obtained at a 3T Philips clinical MR scanner using a 32-channel head coil. Mean cerebral blood flow (CBF), arterial blood volume (aBV) and bolus arrival time (BAT) maps obtained from arterial spin labeling MRI (ASL-MRI), fractional anisotropy (FA) and mean diffusivity (MD) maps obtained from diffusion tensor imaging (DTI), and metabolite peak ratios obtained from proton MR spectroscopic imaging (1H-MRSI) at various brain regions were used as features. Various machine learning methods were employed with appropriate hyperparameters. Random forest recursive feature elimination (RF-RFE) technique was used for feature selection. For longitudinal analysis, linear mixed effects model was utilized with age, education, gender, visuospatial disorder status, and genotype as covariants. The best classification accuracies were 77\% for PD-MCI versus HC, 71\% for PD-MCI versus PD-CN, and 86\% for PD-CN versus HC. Machine learning based on multimodal MRI might be helpful in early diagnosis of PD-MCI. Reduced aBV and FA, and higher MD values were observed in time in PD-MCI. Future studies will aim to improve the classification of PD-MCI in a larger patient cohort.

Thesis No.: 420 Combıned Effects Of Foot Placement Technıque And Sport Specıfıc Habıtual Traınıng On Landıng Mechanıcs

Name: Göktuğ Şanlı, Year: 2018

Advisor(s): Can Yücesoy

Abstract: Correct technique that provides efficient and safe dissipation of ground reaction forces (GRF) is crucial during landing motions. Parkour practitioners (traceurs) intrinsically developed a landing technique in which they solely land on their forefoot (FFL) to counter extreme loading demands of their practice. Traceurs attenuate impact forces substantially during FFL compared to traditionally used toe-heel landing (THL). However, traceurs are already expected to execute their habitual foot placement technique (FPT), FFL, more efficiently via favorable adaptations in their musculoskeletal and neuromuscular system. Up till now, it has not been tested specifically if FFL is superior over THL in shock absorption, regardless of performers habitual and/or preferred FPT. Additionally, it is not known how sport specific habitual training (SSHT) in FPT affects landing mechanics. Presently, to fill those gaps FFL and THL mechanics were analyzed during drop landings from 75 cm in three groups (n = 3 x 12); (1) traceurs (habitual FFL practice), (2) basketball players (habitual THL practice) and (3) nonathletes (no habitual training). GRF metrics, lower body joint kinematics, activation patterns of tibialis anterior (TA) and gastrocnemius medialis (GM) muscles, and mechanical characteristics of the Achilles tendon (AT), TA and GM were measured to examine the effects of FPT and SSHT on landing mechanics. Results indicate that FFL is considerably advantageous than THL for shock absorption, independently of SSHT and preferred FPT. Furthermore, kinematic and neuromuscular strategies were altered between groups to achieve similar shock attenuation for each technique, based on the potential adaptive effects of their SSHT. These findings present valuable insights into the effects of FPT on landing mechanics which may have practical implications for every practitioner and trainer whether in sports or recreational activities.

Thesis No.: 419 Computatıonal Analysıs Of Acds In Ca1 And Ca3 Pyramıdal Neurons Wıth Axon Carryıng Dendrıtes

Name: Gül Öncü, Year: 2018

Advisor(s): Hale Saybaşılı

Abstract: Pyramidal neurons are the most abundant excitatory cell type in cortex and hippocampus. The canonical topology of these glutamatergic neurons consists of a pyramidal-shaped soma, an apical dendrite extending vertically between layers, basal dendrites extending horizontally in the same layer and an axon extending from soma. However, the recent studies show that some hippocampal pyramidal neurons on Cornu Ammonis (CA) of healthy mammalian brain possess an axon that is placed on the basal dendrite in many instances. This phenomenon is observed in 50% in CA1 and 30% in CA3 and in these cell types the stimulus is privileged on the AcD. The effect on information processes is thought to be in hippocampal trisynaptic circuits are not clarified yet. Neither the reason behind this differentiation nor the circumstances under which this phenomenon occurs is discovered. In this study, CA1 and CA3 pyramidal neurons with AcDs and with regular neurites are modeled on NEURON simulation platform for understanding the function of axon-carrying dendrites. The results showed a significant difference in the potential conservation in AcD cells compared to nonAcD cells and privilege on the AcD branches which can enhance the plasticity and LTP processes.

Thesis No.: 418 Characterization Of Non-Faradaic Label Free Impedimetric Electrochemical Sensor.

Name: Nurcan Güngördü, Year: 2018

Advisor(s): Bora Garipcan

Abstract: The developments in microfluidics and BioMEMS have led to miniaturized high-performance droplet-based sensors. These sensors must be reliable, simple, fastresponding and cost-effective to be used in biomedical applications. In this work, the non-faradaic electrochemical impedimetric approach is studied to measure different salt concentrations and different pH values. Label-free measurements are done to characterize electrical double layer capacitance (Cedl) and solution resistivity (Rs). For this purpose, gold interdigitated electrode (AuIDE) is fabricated on a glass wafer. Three different salt (LiCl, KCl and NaCl) solutions in different molarities between 0,001M to 0,1M and with different pH values (pH range between 2.0 to 11.50 at constant conductivity) are prepared. Impedance measurements are taken from an AuIDE at a frequency range of 20 Hz to 10 MHz, with an amplitude of 10 mV using an Impedance Analyzer (E4990A) to extract the values of Cedl and Rs. The data is interpreted according to both Cedl and Rs values and Nyquist plots. Results for both salt and pH solutions exhibit that as solution molarity increases, the Cedl values also increases and each solution shows different patterns on Nyquist plots. This study can lead to label free measurement of analyte type, concentration and pH values upon data processing of multiple reference and analyte measurements.

Thesis No.: 417 Graphene Oxide As A Drug Carrier For Delivery Of Zoledronic Acid In Secondary Bone Cancer Treatment

Name: Sepideh Tavakoli, Year: 2018

Advisor(s): Duygu Ege

Abstract: In this study, Zoledronic acid (ZOL), a type of nitrogen containing bisphos- phonate, was loaded on graphene oxide (GO) particles to increase the particle size of the drug-nano-carrier complex which reduces drug ltration by the kidney and conse- quently, increases drug circulation time and its tumor uptake. The conjugation between ZOL and GO occurs via pi-pi stacking and hydrogen bonding interactions, and there- fore, the drug may be gradually released from GO in physiological conditions which eliminates the need to apply high doses of the drug. Loading and release pro le of ZOL on GO particles was investigated by using UV-Vis spectroscopy. Samples with di erent concentrations of 0.025-1.25 mg/ml of ZOL were loaded on 0.2 mg/ml GO. UV analysis showed that the maximum loading happens at ZOL to GO ratio of 1:0.2. This loading was obtained when 1 mg/ml of ZOL was initially loaded on 0.2 mg/ml of GO nanoparticles. The drug and drug carrier complexes were characterized using Fourier-Transform Infrared Spectroscopy (FTIR), Atomic Force Microscopy (AFM), and UV-vis spectroscopy. Cell culture studies were carried out with MCF-7 breast cancer cells and mesenchymal stem cells (MSCs) for three dosages of ZOL, ZOL conju- gated with GO (ZOL-GO) and GO. Cell proliferation was investigated by Alamar blue assay and cell viability was evaluated by staining dead cells with propidium iodide (PI) and live cells with acridine orange (AO). Overall, the characterization results con rm loading of ZOL on GO nanoparticles and cell studies results show that GO conjugated ZOL complexes are promising to reduce MCF-7 breast cancer cells proliferation and viability. Keywords: ZOL, GO, Drug Loading, MCF-7, MSC.

Thesis No.: 416 Effects Of Affectıve Touch On Ultrasonıc Vocalızatıon And C-Fos Expressıon In Rats

Name: Elçin Tunçkol, Year: 2018

Advisor(s): Burak Güçlü

Abstract: The sense of touch has two functional dimensions: discriminative and affective. Discriminative properties of tactile stimuli are relayed via myelinated and fast conducting Aβ fibers while affective properties are transmitted via unmyelinated, slow- conducting C- tactile fibers. Gentle stimulation of CT- fibers was shown to elicit feeling of pleasantness and activate insular cortex. In the present study, hairy skin of male Wistar rats was stimulated with slow, moderate and fast velocities (3, 9, and 18 cm/s, respectively). Affective state was measured with ultrasonic vocalization recordings; neural activity was indicated by c-Fos expressions in primary somatosensory, posterior insular cortex and periaqueductal gray. Fast stimulation was shown to increase the amount and duration of 22- kHz USVs, yet not cause a difference in c-Fos expressions. Furthermore, number and duration of calls emitted in the last minute of stimulation were found to correlate with c-Fos expressions in PAG and contralateral S1. Thus, gentle stroking alters the affective state, albeit in a negative manner. Results of the current study may highlight the importance of the source of gentle touch. Gentle touch originating from con-specifics or familiar other sources may be processed more posi- tively compared to unfamiliar sources. Therefore, future research may focus on this familiarity effect and mimic the setting of con-specific touch to study the processing of CT- afferent stimulation.

Thesis No.: 415 Comparıson Of Machıne Learnıng Algorıthms For Blood Glucose Predıctıon On Aıda Sımulator

Name: Doğugün Özkaya, Year: 2018

Advisor(s): Albert Güveniş

Abstract: of real patient data is that it is easy to collect data, and it disregards external factors like pregnancy or stress. For estimates with prediction horizons (PH) with 15,30 and 60 minutes, support vector regression (SVR), decision tree regression, Gaussian process regression, k-NN regression, random forest regression and for neural networks: recurrent neural network (RNN) with long short-term memory (LSTM) unit and neuro-fuzzy network and feed-forward neural network (FFNN)have been employed. Among multiple algorithms neuro-fuzzy network (ANFIS) has the best results with RMSE values of 1.19 mg/dl, 2.53mg/dl and 5.81mg/dl for 15,30 and 60 minutes prediction horizons (PH). The audience for this paper is the research community who works on BG prediction and looking for ways to design a model for an algorithm for their selected set of inputs. This study presents a guide to selecting an algorithm and build a model for in silico simulation. This research can be extended to real world data or converted into a tool to create benchmark tests for models with given features and hyperparameters.

Thesis No.: 414 Effects Of Low Intensıty Blood Flow Restrıctıon And Hıgh Intensıty Resıstance Traınıng On Muscle Stıffness

Name: Ömer Batın Gözübüyük, Year: 2018

Advisor(s): Can Yücesoy

Abstract: Blood flow restriction training (BFR) has become a popular training method recently. Both athletic and non-athletic populations prefer BFR over high-intensity training (HI) due to the use of much lower loads. Although the mechanical tension of BFR is considered lower than that of HI, the metabolic stress is much higher. It has been shown that imposing high loads on a muscle during training affects the stiffness of the muscles acutely. However, the long-term effects of HI training on the subjected muscle's stiffness is not studied extensively. Moreover, it is not known how the BFR training affects this property. We compared the effects of 6 weeks of BFR and HI -elbow flexion- training on the stiffness of biceps brachii muscle. Seventeen healthy participants volunteered for the study, randomly divided into BFR (n=8) and HI (n=9) groups. BFR group trained with 30-40% of their 1 repetition maximum (1-RM) and HI group trained with 75-85% of 1-RM. Prior to and at the end of the study, the passive stiffness of the biceps brachii was measured with shear-wave elastography (SWE) and Myoton-Pro device. Hypertrophy effects (B-mode ultrasound) and strength gains (1- RM test) were also measured. Training did not induce a significant change of SWE in HI group (13.83±2.49 kPa pretraining, 14.72± 3.01 kPa posttraining) or in BFR group (14.26±3.64 kPa pretraining, 14.69±4.87 kPa posttraining) ($p>0.05$). Stiffness measured by Myoton device did not change in HI group (202.52±16.42 N/m pretraining, 205.12±18.6 N/m posttraining) or in BFR group (208.92±19.62 N/m pretraining, 206.15±15.52 N/m posttraining)($p>0.05$). Both groups improved in terms of hypertrophy ($p<0.001$) and strength gains ($p<0.0001$). Our study showed that BFR training did not alter passive mechanical properties of the subjected muscle in the long term, thus providing information regarding the efficacy and safety of BFR training.

Thesis No.: 413 Fıber Optıc Based Force Sensor Desıgn For Prostate Bıopsy Procedure Under Mrı

Name: Nurettin Okan Ülgen, Year: 2018

Advisor(s): Ozgur Kocaturk

Abstract: Fabry-Pérot Interferometry (FPI) fiber optic sensors with low error ratio and high sensitivity can provide reliable feedback to optimize needle insertion for MRIguided prostate biopsy. FPI based force sensing has also potential for diagnosis of prostate cancer (PCa) directly by providing data regarding mechanical characteristics of the tissue.In this thesis, design and fabrication of a fiber optic sensor based on FPI for force measurement at the tip of an prostate biopsy needle (18-gauge) is presented. The sensor is built upon an air cavity between two cleaved optical fibers with a diameter of 125 µm which are embedded and fixed into a borosilicate glass capillary with an inner diameter of 200 µm. Fixation of optical fibers within the glass capillary are achieved by applying medical grade UV adhesives through two micro-holes formed with CO2 laser processing on the glass capillary. The initial distance between the fiber endings is adjusted by using manipulators controlled by piezoelectric actuators and strain gauge readers with a resolution of 10 nm. A laser diode which has a wavelength of 635 nm is used as a light source for the operation of the sensor. The intensity from the laser diode is kept constant during operation with current feedback mechanisms and temperature controllers. Model predictive control approaches are adapted and implemented for the temperature control of the light source. A circuitry for the operational control of the system and signal processing is implemented. The sensor is calibrated and optimized with a commercial pressure sensor and a force testing machine. Dynamic range of the sensor is set to the linear operation region to avoid signal ambiguity while being able to provide a force measurement range of 0-13 N with a resolution of 0.1 N based on needle insertion experiments conducted.

Thesis No.: 412 Potassium Iodide Potentiated Photodynamic Inactivation Of Enterococcus Faecalis Using Toluidine Blue: Comparative Analysis, Photothermal Effect, And Post-Treatment Biofilm Formation Study.

Name: Sahand Ghaffari, Year: 2018

Advisor(s): Murat Gülsoy

Abstract: Antimicrobial Photodynamic Inactivation (aPDI) has recently gained interest as an alternative modality to fight pathogenic entities. Its effect can also be further enhanced by using certain inorganic salts. Here, the Potassium Iodide (KI) – mediated a PDI effect on Enterococcus faecalis using Toluidine Blue Ortho (TBO) as photosensitizer (PS) has been evaluated, and the Photothermal effect as well as subsequent Biofilm formation extent are accounted for. The comparative photoinactivation of TBO and TBO/KI on E.faecalis was investigated by quantifying surviving bacterial colonies after laser irradiation with 30,60,and 180 second exposure times and different PS/Potentiator concentrations. The degree of hotothermal effect was measured by obtaining a temperature profile using thermocouple. The biofilm formation capability of E.faecalis was observed by calculating Optical Density (OD595) of samples 0, 24, 48, and 72 hours post- aPDI treatment. Scanning Electron Microscopy (SEM) was used as a qualitative measure of bacterial biofilm growth. More than 4 LOGS of photokilling was obtained for experimental groups with the highest PS/KI concentrations at 180 s exposure time. All KI-potentiated groups showed enhancement in aPDI effect when compared to non-potentiated counterparts. Moreover, an average temperature increase of about 2°C,with 180 s laser exposure, proved photothermal effect to be negligible. The degree of recurring biofilm for laser-treated groups also showed to be much less than that of control group, as confirmed by both OD595 measurement and SEM imaging.

Thesis No.: 411 Layer Specıfıc Dıstrıbutıon Of Muscarınıc Receptor M2 In The Sensorımotor Areas Of Rat Braın

Name: Sedef Yusufoğulları, Year: 2018

Advisor(s): Burak Güçlü

Abstract: Current understanding of attentional mechanisms within the tactile modality is not fully known. We have recently studied muscarinic receptor-mediated responses of vibrotactile neurons which vary according to cortical depth due to the differences in the local connectivity in the cortex. The aim of this study is to characterize specific muscarinic receptor subtype (M2) by immunofluorescence technique for understanding the role of these receptors within the associated cortex. In particular, differences between barrel field (S1BF), motor cortex (M1) and hindlimb area (S1HL) of the rat SI were investigated. Coronal sections (50 µm) from 7 Wistar Albino rats were obtained for each area. Mouse monoclonal anti-mAChR2 was used as primary antibody and goat anti-IgG1 with Alexa Fluor 594 was used as secondary antibody. Ethidium bromide was used on additional sections to determine layer thicknesses and total number of cells within a layer. Statistical analyses were performed on three dependent variables: Average number of M2 receptor complexes (M2RC) in a layer (N), average number of M2RC normalized with layer thickness (D), and average number of M2RC per total number of cells in a layer (C). 2-way ANOVA showed significant main effects of layer on N, D, and C ($p<0.001$, $p=0.002$, $p=0.053$, respectively). Area and layer interaction was only observed for N ($p<0.001$). On the other hand, area did not have a main effect for any dependent variable. The number of M2RC was highest in layer V, VI, IV for M1, S1BF and S1HL, respectively. Additionally, when the average number M2RC were normalized according to thickness, highest M2 density were observed in layer II and III for all areas. In other layers, M2 density was similar for S1HL and S1BF, but lower than M1. There was no general difference among the three cortical area regarding the number and density of M2RC which is consistent with the cholinergic innervation in the sensory-motor areas. However, the distribution of M2RC varied within each area.

Keywords: Somatosensory, Cortex, Immunofluorescence, Cholinergic, Attention.

Thesis No.: 410 Effects Of Botox On Non-Injected Muscles' Mechanıcs And Myofascıal Force Transmıssıon

Name: Ferah İlter Vardal, Year: 2018

Advisor(s): Can Yücesoy

Abstract: Studies show that Botulinum toxin type A (BTX) injection causes a force decrease in the injected muscle. However, if BTX has effects beyond the injected muscle via diffusion and altered epimuscular myofascial force transmission (EMFT) is not known. It is hypothesized in this study that (1) BTX injection into the rat tibialis anterior (TA) has an impact on mechanics of adjacent extensor digitorum muscle (EDL) and (2) BTX has an impact on EMFT. The goal of this study was to test these hypotheses by measuring changes in total and passive forces exerted proximally and distally by the EDL muscle on both muscle length changes and muscle relative position changes. Two groups of Wistar rats were tested: Control (no BTX injected) and BTX (0.1 U of BTX injected to the mid-belly of the TA). Five days after injection, injection of BTX into the TA: (1) altered total and passive EDL forces exerted proximally and distally and after imposing muscle length changes. This does indicate that BTX changed EDL mechanics. The passive forces showed an increase (up to 13 folds) and the total forces showed a decrease (up to 81.7%). (2) Changed EMFT. EDL relative position changes towards the distal positions caused EDL total forces to significantly decrease also in the BTX group (64.1% decrease in BTX compared to Control) The findings indicate that BTX administration diminishes EMFT. Our findings support our hypotheses and improve our understanding of BTX effects on muscular mechanics and EMFT showing that BTX injected into one muscle affects the remainder of the compartment via leakage into other muscles and altered EMFT.

Thesis No.: 409 Determınatıon Of Dıffusıon Weıghted Magnetıc Resonance Imagıng Based Bıomarkers Of Mıld Cognıtıve Impapırment In Parkınson’s Dısease

Name: Özge Can Kaplan, Year: 2018

Advisor(s): Esin Ö. Işık

Abstract: Parkinson's Disease (PD) results in structural changes on white matter (WM) of the brain, creating cognitive deficits in addition to motor problems generally ending up with Parkinson's disease dementia (PDD). Mild cognitive impairment (MCI) is the middle stage of this cognitive decline. There is a need for finding non-invasive biomarkers for early diagnosis of PD-MCI. In this study, 27 cognitively intact PD (PDCI), 32 PD-MCI and 18 healthy controls (HC) were included to assess the structural differences. Diffusion weighted magnetic resonance images (DW-MRI) were obtained at a Philips 3T clinical scanner. Fractional anisotropy (FA) and mean diffusivity (MD) maps were estimated from DW-MRI via FMRIB Software Library (FSL) tools. Mean FA and MD values were calculated at regions of Johns Hopkins University (JHU) 81 WM atlas and Montreal Neurological Institute (MNI) atlas. For each region, a Kruskal Wallis test was applied to detect statistically significantly FA or MD differences between the three subject groups, followed by a Mann Whitney rank sum test for pairwise comparisons. FA and MD maps were also fed into tract based spatial statistics (TBSS) tool of FSL and permutation tests were applied. Region based results showed that mean FA and MD values significantly differed in some WM regions mostly between PD-MCI and HC groups. TBSS results showed that there was a statistically signifi- cant difference between PD-MCI and HC FA maps at all of the regions assessed. Less number of regions had significant FA differences between PD-MCI and PD-CI groups, but no regions were found to be different between PD-CI and HC. The results obtained with this study may contribute into an early detection of PD-MCI. Keywords: Parkinson's disease, mild cognitive impairment, diffusion weighted magnetic resonance imaging.

Thesis No.: 408 Development Of Neural Network Based Algorıthm Of Actıve Ankle Prosthesıs Usıng Gaıt Analysıs Data

Name: Ahmet Doğukan Keleş, Year: 2017

Advisor(s): Can Yücesoy

Abstract: Amputation is the removal of a part or all of a limb due to disease, accident or trauma and it has a large incidence rate. For example, in the United States, an average of 500 people loses at least one limb every day, approximately 65% of which is comprised of lower limb amputations. Since energetically active prostheses are costly, amputees usually continue with their daily lives using a wheelchair or a passive prosthesis. The aim of this study is to determine the optimum sensor needs for an active ankle prosthesis and to develop an algorithm suitable for this sensor infrastructure. In the long run, design of a device that is both easy to use and financially feasible is aimed at and the present work is central to that aim. In this context, three neural networks structures with different inputs were developed to facilitate ankle movement and their performances were evaluated. The results show that if a device in which only EMG signals are to be used as network inputs, a total of 5 signals should be collected from different muscles that are responsible for hip, knee and ankle movements. The results also show that, if the use of a smaller number of EMG sensors is preferred, it is necessary to incorporate also a force or torque feedback into the system. In such application, three EMG signals collected from tibialis anterior, soleus and gastrocnemius medialis muscles were shown to suffice. These findings shed an important light to our understanding of the number and kind of sensor inputs necessary for an active ankle prosthesis requirements of which can be variable depending on the amputation level of the patient and the mechanical design flexibility.

Thesis No.: 407 Desıgn Of A Cardıovascular Sımulatıon Cırcuıt Drıven By Tıme Varyıng Elastance

Name: Doğan Onur Arısoy, Year: 2017

Advisor(s): Cengizhan Öztürk

Abstract: Chronic Heart Failure (CHF) is a major cause of death for which only known non-palliative treatment is Heart Transplantation (HTx). Due to donor shortage, only a small cohort of people can be treated. Left Ventricular Assist Devices (LVADs) are widely used to sustain patients on the HTx waiting lists. LVADs are pumps that are implanted between the ventricular apex and ascending aorta, unloading the left ventricle. Before clinical use, LVADs must be thoroughly tested in-vitro, commonly with Cardiovascular Mock Circuits (CVMCs), for safety and efficacy. The first step to design a CVMC is mathematical modeling, and validation of its efficacy, stability, robustness and limitations. In this thesis, a zero-dimensional lumped model of the cardiovascular system, consisting of left and right hearts, and systemic, pulmonary and coronary circulations, was established. A novel time-varying elastance generation method, originating from biomechanical characteristics of the myocardium, was created based on previously published experimental data, and a unique auxotonic length-tension-velocity relationship for the myocardial sarcomere was derived. Tension values were converted into ventricular pressures, and controlled with a binary activation signal to introduce myocardial active state. The resulting time course of state variables, load-dependent and -independent performance indexes were observed to be in accordance with the literature. The system showed stability and robustness against external disturbances and parameter variations under various physiological conditions (normal/disease and rest/exercise). In conclusion, the model constituted a very promising simulation platform to test LVAD performance.

Thesis No.: 406 Self-Assembly Technıque For Producıng L-Argınıne/Hydroxyapatıte Coatıngs On Ti6al4v Implants

Name: İlayda Duru, Year: 2017

Advisor(s): Duygu Ege

Abstract: In the present study, we introduce a self-assembly method to produce L-arginine (L-Arg)/Hydroxyapatite (HA) coatings. Firstly, Ti6Al4V substrates were etched in a concentrated solution of HCl/H2SO4. ZrO2 was reactively sputtered on Ti6Al4V as an intermediate layer between HA and Ti6Al4V. Reactive magnetron sputtering was performed at 200 W and 200 °C for 4 hours. HA was deposited on ZrO2 layer by electrophoretic deposition (EPD) at 30 V in 205 seconds. HA suspension was obtained by ultrasonic and magnetic agitation of 1 g HA in 35 ml isopropanol for 3 hours. Finally, the samples were immersed in L-Arg solution in phosphate buffered saline (pH=7.4) and incubated at room temperature for 24 hours. Scanning Electron Microscopy (SEM), XRay Diffractometry (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Raman and X-Ray Photoelectron Spectroscopy (XPS) analyses were performed to characterize the coated and uncoated Ti6Al4V implants. Raman and XRD spectra of ZrO2 layer demonstrated the characteristic peaks of monoclinic structure. The most characteristic bands on Raman spectrum were a doublet at 181 and 189 cm-1, a broad peak at 477 cm-1. Moreover, XRD spectrum revealed that ZrO2 coating had a monoclinic crystal structure. FTIR and C1s spectra spectra of L-Arg/HA coating revealed the formation of new bonds which were C-O/N and protonated O-C=O. According to XPS analyses, C/Ca ratio increased with the addition of L-Arg and Ca/P ratio was decreased. It can be concluded that L-Arg particles were self-assembled on HA layer by binding of the carboxyl group of L-Arg to calcium atoms of HA. Overall, L-Arg/HA coatings were successfully coated on ZrO2-coated Ti6Al4V orthopedic implants by self-assembly method.

Thesis No.: 405 Effects Of Frequency On The Temporal Summatıon In The Pacınıan Psychophysıcal Channel

Name: Deniz Kılınç, Year: 2017

Advisor(s): Burak Güçlü

Abstract: According to the temporal summation theory, increasing stimulus duration causes a decrease in detection psychophysical threshold. Unlike previous psychophysical studies based on the fast adaptive tracking procedure, in this thesis, psychometric functions of the Pacinian channel were measured with the method of constant stimuli to investigate the effects of frequency on temporal summation in more detail. Six female and four male subjects (age: 25-30) participated in the experiment. Sinusoidal bursts of mechanical displacement were applied on the middle fingertip of each subject by using a cylindrical contactor ($r = 2$ mm) at six frequencies (100, 150, 250, 350, 500, and 750 Hz), and five durations (10, 30, 100, 300, and 1000 ms). For each frequency-duration pair, six different amplitudes were used with 40 repetitions to obtain detection probabilities in a two-interval forced-choice task. The data points were fitted by sigmoidal curves to find psychometric functions. Average goodness of fits (R2) was 0.88. Midpoints and the slopes of psychometric curves were statistically analyzed. Following aligned rank transform, repeated measures ANOVA was used to study the the effects of duration, frequency and their interaction. As expected, the thresholds had the characteristic U-shape ($F(5,45) = 42.50$, $p < 0.001$); the slopes had an inverted U-shape ($F(5,45) = 29.64$, $p < 0.001$). Both thresholds ($F(4,36) = 60.34$, $p < 0.001$) and slopes ($F(4,36) = 26.58$, $p < 0.001$)) were affected by duration due to temporal summation. However, there was no interaction between frequency and duration for the thresholds ($F(1,9) = 4.84$, $p = 0.055$), which means that temporal summation in the Pacinian channel does not signicantly vary with frequency.

Thesis No.: 404 Effect Of L-Argınıne Conjugated Carbon Nanotube (Cnt) Reınforced Sulfonated Polyether Ether Ketone (Speek) Nanofılms on Cell Proliferation

Name: Hatice Kaya, Year: 2017

Advisor(s): Duygu Ege

Abstract: Poly ether ether ketone (PEEK) exhibits distinct properties which are favorable in designing a novel load-bearing implant for bone reconstruction. It overcomes the adverse effects of metallic implants such as stress shielding, release of toxic ions and radiotherapy interference. PEEK has comparatively closer elastic modulus to that of cortical bone than metallic implants, which in turn prevents stress shielding and subsequent bone resorption. Furthermore, elastic modulus of PEEK is tunable by incorporation of additives. However, hydrophobic bioinert surface of PEEK which are not favorable for cell adhesion brings about some limitations in its application due to inefficient osseointegration. Furthermore, although the addition of fillers promote the mechanical attributes, PEEK nanocomposite might be still insufficient regarding inducement of bioactivity. Many studies show that presence of L-arginine (L-Arg) assists cell attachment and proliferation. In this thesis, functionalized multi-walled carbon nanotubes (f-MWCNT) reinforced sulphonated poly ether ether ketone (SPEEK) was fabricated by solvent casting. Previously, PEEK was dissolved in high concentric sulfuric acid (H_2SO_4) to gain SPEEK andMWCNT was oxidized with mixing of sulfuric acid (H_2SO_4, 98%) and nitric acid (HNO_3, 65%) to obtain carboxyl groups on the sidewall and ends of MWCNT. The surface of the obtained nanofilms were covalently conjugated with L-arginine. The samples were characterized with Proton Nuclear Magnetic Resonance Spectroscopy (H-NMR), Fourier Transform Infrared Spectroscopy (FTIR), X-ray Photoelectron Spectroscopy (XPS), Water Contact Angle (WCA) measurement, Atomic Force Microscope (AFM) and Dynamic Mechanical Analysis (DMA).Finally, impact of CNT and L-arg existence on cellular response was analyzed using human fetal osteoblast (hFOB) via Alamar blue test. The chemical characterization of surface with FTIR and H-NMR, functional sulfur and carboxyl groups formed were confirmed. Immobilization of L-Arg was confirmed via XPS showing the Nitrogen (N) atom presence and chemical state of N atom. The mechanical strength of nanofilms were improved which was proven by DMA. Cell viability was observed the highest for L-arg grafted nanofilm. In conclusion, this study indicates that arginine modified CNT/PEEK films are promising candidates for femoral replacement applications.

Thesis No.: 403 A Novel Desıgn Of Mrı Visible Prostate Bıopsy Needle

Name: Gökçe Kasacı, Year: 2017

Advisor(s): Özgür Kocatürk

Abstract: A reliable diagnosis is vital to apply the proper treatment for prostate cancer. Conventional prostate biopsy methods have limited accuracy for the diagnosis. Magnetic Resonance Imaging (MRI) provides superior anatomical images of the prostate, offering precise tumor targeting which in turn increases diagnostic yield. For that purpose, we aimed to develop a novel MRI compatible and visible prostate biopsy needle. The visible distal tip of the needle is expected to provide accurate placement while the proposed biopsy mechanism can reduce the bleeding and infection risk. The prostate biopsy needle has been designed using MRI compatible nitinol hypo tubes and fabricated using an Nd: YAG laser cutting system. Furthermore, the distal tip sharpness and force resistance of the three different needle designs were tested in vitro (silicon mold). According to the results the needle with high walled biopsy groove was preferable. Equally spaced Iron Oxide (Fe2O3) nano-particle coatings were placed over the distal tip of the outer needle surface to enhance its visibility under real time MRI. The coating concentration and marker size were optimized using different MR sequences. MRI visibility experiments indicate that spin-echo acquisitions should be preferred over gradient-echo acquisitions and Fe2O3 coatings with moderate concentrations appear to be more suitable for the passive tracking of penetration depth. The biopsy needle handle also has been designed in Solidworks 2015 and generated using a rapid prototyping system. Finally, the in-vitro performance of the biopsy mechanism was carried out on fresh veal meat. Obtained samples indicate that Nd: YAG laser cutting can be successfully utilized in nitinol needle production and the biopsy handle design provided repeatable successful biopsy sample collections through in vitro trials.

Thesis No.: 402 Deformation Along Human Medial Gastrocnemius Muscle Fibers in vivo During Low Level Plantar Flexion Activity

Name: Arda Arpak, Year: 2017

Advisor(s): Can Yücesoy

Abstract: Mechanical behavior of skeletal muscle has been previously shown to be determined by the interactions between contractile elements of the muscle and the extracellular matrix. Moreover, in the level of a whole limb, interactions between muscles and non-muscular structures through connective tissues have been shown to affect muscular mechanics causing varying force and movement production. The central determinant of those effects is sarcomere length changes and their heterogeneity along the muscle fibers. Quantification of that for human muscles in vivo is lacking. This study utilized magnetic resonance imaging (MRI) in combination with non-rigid demons image registration method to quantify local muscle tissue deformations. Additionally, diffusion tensor imaging (DTI) was used in order to determine muscle fiber direction. Combination of those methods allowed quantifying length changes along muscle fibers, in vivo. Presently, this method was applied to the medial gastrocnemius muscle (GM) of female subjects (n=4) following a transition from 15% to 5% maximal voluntary contraction (MVC) in sustained isometric plantar flexion activity. The aim was to test the hypothesis that low-level plantar flexion activity tested results in non-uniform distribution of strain along the muscle fibers. The results show sizable simultaneous lengthening (by up to 32.7%) and shortening (by up to 15.5%) occurring along the same muscle fiber tracts. In addition, average distribution of strain across fiber tracts was also found to be heterogeneous. Therefore, the posed hypothesis was confirmed. The findings are explained through the effects of myofascial force transmission on skeletal muscle function. Insight from this work can find practical application in surgical interventions such as aponeurotomy, tendon transfer surgery, or procedures like botulinum toxin treatment.

Thesis No.: 401 RF Shielding Optimization for Non Planar Surfaces in Interventional MRI Devices

Name: Çağla Özsoy, Year: 2017

Advisor(s): Özgür Kocatürk

Abstract: Magnetic Resonance Imaging (MRI) is a potential candidate for interventional cardiovascular procedures since it is ionizing radiation-free and thus safe for human use. However current devices suffer from mechanical and electrical constraints and face with safety issues. Interventional MRI devices incorporate RF receiver antenna and long transmission lines for active visualization purpose are prone to RF induced heating. Therefore, alternative non-metallic transmission line technologies such as acousto-optic transmission line has been developed. The ultrasonic transducers used in acousto-optic transmission lines can couple with local E-field changes during MRI scan and generate noise. This work aims to develop RF shielding coating methodology on non-planar surface to achieve the highest sensitivity for signal transmission by eliminating , noise generating factors. For this purpose, a compact housing design was constructed for the piezoelectric transducer that is coupled with an optical transmission line and a radio frequency solenoid coil. Also, the cross-talk between the ultrasound transducer and Magnetic Resonance Imaging scanner's electric field aimed to be removed using different shielding materials. Shielding effectiveness simulations were performed by using CST software and measurements were performed within a gelled phantom as described in the ASTM F2182 standard. RF performances of the antennas and different shielding materials were measured using a vector network analyzer in terms of the scattering parameters. Network analyzer results demonstrated that MRI compatible copper powder-epoxy combination and conductive silver ink are feasible RF shielding materials because they show similar behavior compare to pure copper material.

Thesis No.: 400 Observable Real-Time Pulsed Field Gel Electrophoresis

Name: Deniz Ece Kaya, Year: 2017

Advisor(s): Cengizhan Öztürk /Zühtü Tanıl Karagöz

Abstract: Pulsed-Field Gel Electrophoresis (PFGE) is a very important molecular researchand diagnostic technique, used for the separation of very large DNA molecules. It enables DNA fingerprint analysis which can differentiate small number of sequence differences in genomes belonging to the same species. In this method the genome digested first by a restriction enzyme into large DNA fragments analyzed by PFGE. While DNA fingerprinting is used in forensic medicine for identifying the suspects or paternity, it enabled also the development of molecular epidemiology of infectious diseases. It is possible to identify the source and transmission routes of an epidemic by DNA fingerprinting of the strains of infectious agent isolated from a series of samples. It is very important to follow the transmission routes of the infectious agent in a hospital, country or even around the world, in order to take the precautions to stop the epidemic. Although DNA fingerprinting by PFGE is a very important and powerful technique, its application is very cumbersome, requires long time, experienced personnel and expensive equipment. These hinder the method from being widely used. In a project that was completed four years ago, a method and an instrument called "Observable Real Time Electrophoresis (ORTE)" was developed and it won the Akın Cakmakcı Award, of Turkish Technology Development Foundation. In this thesis work the aim is to develope an Observable Real Time PFGE system. Its efficiency is evaluated by comparing the genomic fingerprints of bacterial and fungal strains that were previously isolated from hospital infections by Observable and classical PFGE. Observable PFGE has the potential to eliminate the need for hazardous ultraviolet light and carcinogen ethidium bromide. It provided pictures at every stage of electrophoresis enabling to choose the best picture for analysis of the results. Since Observable PFGE enables to see the results early during electrophoresis we believe that compared to classical PFGE, it could save a lot of time and effort, in many diverse applications, once the system that we present the technological feasibility in this thesis work, is developed and tested further.

Thesis No.: 399 Fabrication of Bone Surface Mimicked Biodegradable Chitosan-Graphene Oxide Nanocomposite Membranes

Name: Fatih Puza, Year: 2017

Advisor(s): Bora Garipcan

Abstract: Biomaterials and tissue engineering applications are promising to heal defected bone tissue. Direct interaction of cell and biomaterial surface occurs and surface properties are able to change cellular responses. In this thesis, it was aimed to fabricate chitosan (CH) and graphene oxide (GO) based biodegradable membranes, which are able to mimic natural bone surface topography. Micro and nanostructures of bone surface was copied by soft lithography technique with using polydimethylsiloxane(PDMS). Human osteoblast cells (hFOB 1.19) were used to evaluate effects of surface topography and GO addition. Surfaces were modified with hydroxyapatite (HA) nanoparticles to enhance osteoconductivity. Physical and chemical characterization of membranes was performed by scanning electron microscopy, confocal microscopy and spectroscopy techniques. SEM and confocal microscopy imaging of membranes showed that bone surface topography mimicked, successfully. Spectroscopy techniques, namely FT-IR, XPS, Raman and XRD demonstrated chemical compositions of CH, GO and HA modification. hFOB cell morphology was evaluated by using SEM at day 7. HA modification and bone surface mimicking provided more surface area, so that spread of cell was in- creased and surface of membranes covered with the cells. In addition, GO addition had positive impact on cell spreading when it is compared with pure CH. Cell viability was analyzed by performing MTT assay. The obtained results demonstrated that cell viability increased in bone surface mimicked membranes.

Thesis No.: 398 Developing Artificial Corneal Endothelium Micro-Environment Using Bioinspired Approach

Name: Fatma Zehra Erkoç, Year: 2017

Advisor(s): Bora Garipcan

Abstract: In this thesis, micro-environment of healthy corneal endothelium was prepared by mimicking the stiffness and chemistry of underlying layer of endothelium, and inspiring from topography of corneal endothelium. Polyacrylamide (PAAm) hydrogel cell substrates were synthesized with in the stiffness range of Descemet's membrane's elastic modulus value of 20-80 kPa. Hexagonal patterns with dimensions 20μm in diameter and 4μm in depth which inspired from mostly hexagonally shaped corneal endothelial cells (CECs) were created on silicon wafer mold via photolithography and transferred to PAAm hydrogels by using soft lithography technique. PAAm hydrogels which have hexagonal patterns were modified with Collagen IV (Col IV), hyaluronic acid (HA) and different amount mixtures of Col IV and HA to mimic corneal endothelium biochemically as well. Chemical modifications were confirmed with Fourier Transform Infrared Spectroscopy (FTIR), Water Contact Angle (WCA) Measurements and Immunofluorescence imaging. After characterization, adhesion, viability and morphology of corneal endothelial cells on these substrates were investigated. The results of cell culture studies indicate that surface topography of substrates enhances cell viability significantly while altering cell morphology. Moreover chemical composition of substrate surface was shown to be an important parameter for growing cell sheets. These results provide a proof of concept for biomimetic and bioinspired strategies for corneal recovery through clinical translations of cell sheet growth approaches.

Thesis No.: 397 Amino Acid Conjugated Alginate-Graphene Oxide Scaffolds

Name: Ecem Şahin, Year: 2017

Advisor(s): Bora Garipcan/ Ayşe Ak

Abstract: In this thesis, fabrication and characterization of neat alginate and alginate/graphene oxide (GO) composite 3D porous scaffolds were investigated in order to achieve a material suitable for wound care applications with enhanced properties such as biocompatibility, high mechanical strength, stability, high absorbance and positive cell behaviour. Alginate (Al) was used as the main polymer and GO was used as additive. L-Cysteine (Cys) was conjugated on GO in order to enhance biocompatibility. Initially, neat Al scaffolds were fabricated by ionic crosslinking (CaCl2 as cross-linker) and lyophilisation. Then GO (1mg/ml) was added to the structure and Al/GO scaffolds with different crosslinker concentrations (0.01-0.03 M) were fabricated in order to determine optimal crosslinker concentration. Next, 0.03M crosslinker concentration was kept constant and scaffolds with different GO concentrations (0.5-2 mg/ml) were prepared in order to determine optimal GO concentration. Finally, Cys was immobilized to GO (1:1 ratio) and Al-3/CysGO-0.5 scaffold was fabricated. FTIR and SEM were used for the characterization of Al/GO scaffolds. Swelling ratio and porosity were investigated by conducting swelling test. Viscoelasticity of the non-lyophilized hydrogels was investigated with rheometry method. Viability of fibroblast cells was investigated by MTT assay. According to the results, adding GO to the structure provided stability and immobilization of Cys increased biocompatibility, and a porous, more stable material with high absorbance, biocompatibility and positive cell response was obtained.

Thesis No.: 396 Fabrication and Characterization of Sharksin Mimicked Chitosan-Graphene Oxide Nanocomposite Membranes

Name: Sabra Rostami, Year: 2016

Advisor(s): Bora Garipcan

Abstract: In the presented thesis, fabrication and characterization of sharkskin mimicked polymeric membranes were investigated with the aim of achieving membranes with enhanced biological, physicochemical and mechanical properties namely biodegradability using Chitosan as the main polymer and Graphene Oxide(GO) as the additive. Sharkskin micro-patterns are known to have antibacterial effects therefore possibility of replicating its surface topography with chitosan, was hypothesized and proved to be achievable. In order to replicate sharkskin surface structure, soft lithography method was chosen by using Polydimethylsiloxane (PDMS). Chitosan solution was prepared by dissolving purified pristine Chitosan in dilute acetic acid solution (2%v/v). For Chitosan/GO nanocomposites membranes, solutions of chitosan containing various amounts of GO (0.1%w/w, 0.2%w/w and 0.3%w/w) were prapared using solvent-casting method, Chitosan/GO solutions were cast upon sharkskin negative PDMS molds. Mechanical characterizations including Elongation at Break and Tensile Strength were done using Chitosan based plain membranes. Scanning Electron Microscopy(SEM) was conducted as morphological characterization along with Raman Spectroscopy, X-ray Photoelectron Spectroscopy (XPS), Water Contact Angle and Swelling Ratio as chemical characterizations. According to the results, the hypothesis of possibility of mimicking the surface micro-pattern of sharkskin using biodegradable natural polymer was verified. Additionally, preparation of sharkskin mimicked chitosan/GO nanocomposite membranes proved to be possible with acceptable quality of replication. Furthermore, adding GO to chitosan, resulted in considerable improvements of chemical and mechanical properties of polymer.

Thesis No.: 395 Production and Characterisation of Poly(L-Lactic Acid)/Graphane Oxide Nanofibers for Nerve Regeneration

Name: Hayriye Öztatlı, Year: 2016

Advisor(s): Duygu Ege

Abstract: The development of biodegradable polymeric nanofiber scaffolds for a potential effort to repair injured nerve cells attracts great interest in nerve tissue engineering field. Poly (L-lactic acid) (PLLA) has being widely used in development of nerve fiber studies due to its biocompatibility, easily shaped properties and degradation to low toxic lactic acid. However, its hydrophobicity and lack of binding sites for cellular activities restricts its use as implants. In this regard, this study involves the incorporation of Graphene Oxide (GO) into PLLA either electrospun GO with PLLA or coating GO onto the PLLA and PLLA/GO nanofibers to fabricate ideal scaffolds with appropriate physical, mechanical and chemical properties of nanofiber mimicking the properties of the peripheral nerve. Hence, PLLA and PLLA/GO nanofibers were prepared via processing PLLA and PLLA/GO solutions with electrospinning and solution parameters (the concentration of PLLA, GO ratio and composition of binary system) were optimized to obtain thin and bead free nanofibers. Then, the fabricated nanofibers were functionalized with 1,6-Hexamethylenediamine (HMDA) and then coated with GO sheets. The fabricated PLLA, PLLA/GO and GO coated PLLA and PLLA/GO nanofibers were characterized via Light Microscopy, Scanning Electron Microscopy (SEM), Raman Spectroscopy, Ninhydrin assay, X-Ray Photoelectron Spectroscopy (XPS), tensile test and Water Contact Angle (WCA) measurement. The characterization results revealed that addition of GO either as filler or coating material enhanced physical, mechanical and chemical properties of nanofiber scaffold. In conclusion, the developed nanofiber scaffolds are promising for possible nerve regeneration application.

Thesis No.: 394 Bone Surface Microenvironment Mimicked Biodegradble Scaffolds for Osteogenic Stem Cell Differentiation

Name: Merve Birgün Özçolak, Year: 2016

Advisor(s): Bora Garipcan

Abstract: The change of the surface roughness, topography and stiffness as well as the chemical and/or biochemical components of the surfaces; might affect the cell-surface, cell-scaffold interface characteristics and may influence cellular behavior, which are important to investigate new bioprosthesis for tissue engineering applications. Thereby, in this thesis, mimicking bone surface microenvironment was aimed. Firstly, to produce a mould, bovine femur surface was mimicked by using Polydimethylsiloxane (PDMS). A biodegradable polymer, Poly (L-Lactic acid) was poured on the mould to obtain bone surface mimicked (BSM) scaffolds. Then, Bone Morphogenic Protein-2(BMP- 2) was loaded on the scaffolds and its release profile was examined in-vitro conditions with Enzyme-Linked ImmunoSorbent Assay (ELISA). BSM scaffolds was modified either with hydroxyapatite (HA) or collagen type-I (Col-I) to construct these scaffolds, similar to the bone‘s natural micro- environment. Modified scaffolds were characterized with Water Contact Angle (WCA) measurements, Scanning Electron Microscope (SEM), X-Ray Photoelectron Spectroscopy (XPS), X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR). Characterization studies were followed by cell culture studies. To analyze cell viability on the scaffolds, MTT was performed. To examine cell proliferation on the scaffolds, Alamar Blue was performed. The effect of the modifications on the controlled and directed osteogenic differentiation in in-vitro conditions was evaluated by using Alkaline Phosphatase Activity analysis, Alizarin Red and SEM EDAX tests.

Thesis No.: 393 Determination of Biomarkers for Mild Cognitive Impairment in Parkinson's Disease Using Magnetic Resonance Spectroscopic Imaging

Name: Sevim Nalçacı Cengiz, Year: 2016

Advisor(s): Esin Öztürk Işık

Abstract: Parkinson’s disease (PD) patients could be categorized as PD with cognitively normal (PD-CN), PD with mild cognitive impairment (PD-MCI), and PD with dementia (PDD). There is a need for finding noninvasive biomarkers for the early diagnosis of PD-MCI. Proton magnetic resonance spectroscopic imaging (1H-MRSI) is a non-invasive MR technique that provides spectroscopic information about metabolic activity of the brain. 19 patients with PD-MCI and 21 patients with PD-CN were included in this study and neuropsychological tests were performed. Multi-voxel 1HMRSI data were acquired in all patients. An MRSI data analysis tool was developed to create 1H MR spectroscopic peak parameter maps out of raw MRSI data and overlay them onto reference T2- weighted MR images. FMRIB Software Library (FSL) tool was used to register metabolite maps overlaid onto T2- weighted MR images to an MNI152 brain atlas. A Mann-Whitney rank-sum test was applied to compare the differences of metabolic parameters and neuropsychological test scores between PD-MCI and PD-CN. A Friedman test was used to analyze the MR spectroscopic metabolite ratio variations in different brain regions of PD-MCI and PD-CN. Spearman rank correlation coefficient was used to find correlations of neuropsychological test scores and MRS metabolite ratios. There were no significant differences in MRS metabolite ratios in different brain regions of PD-MCI and PD-CN after accounting for multiple comparisons. However, frontal lobe and cerebral white matter showed trends for metabolic differences. Neuropsychological test scores were correlated with several spectroscopic parameters. The results of this study might enable a definition of a biomarker for PD-MCI diagnosis in the future, when combined with possible other MR based biomarkers.

Thesis No.: 392 Measurement of Cerebral Perfusion in Parkinson's Disease with Mild Cognitive Impairment Using Arterial Spin Labeling MRI

Name: Dilek Betül Arslan, Year: 2016

Advisor(s): Esin Öztürk Işık

Abstract: Mild cognitive impairment is a common symptom of Parkinson’s disease (PD). Objective imaging biomarkers are required for the diagnosis of PD with mild cognitive impairment (PD-MCI). Arterial spin labeling MRI (ASL-MRI) enables the measurement of cerebral blood flow (CBF) without using contrast agent or ionizing radiation. In this study, ASL-MR images of 19 PD-MCI and 19 cognitively normal PD (PD-CN) patients were acquired at 3T. CBF maps were calculated with arterial blood volüme (aBV) correction using the quantitative imaging of perfusion using a single subtraction (QUIPSS II) formula. CBF and aBV maps were fused into T2 weighted (T2w) MR images, and registered to MNI152 brain atlas in FSL. The CBF and aBV values of several brain regions were compared between PD-MCI and PD-CN patients. The differences in histogram parameters of CBF maps, which were estimated with and without aBV correction, were assessed. The correlations between the neuropsychological test scores and CBF values were assessed. The CBF values in different brain regions of each group were compared with each other. A graphical user interface (GUI) was designed in order to calculate CBF maps out of ASL-MRI in MATLAB. There were not any statistically significant differences between the CBF values of PD-MCI and PD-CN patients. There were some variations between the CBF values of the brain regions in PD- MCI and PD-CN groups. There was a trend of a negative correlation between the neuropsychological test scores and the CBF values in some brain regions of PD-MCI patients. The results of this study combined with other MR parameters might enable the definition of an MR based biomarker for PD-MCI diagnosis.

Thesis No.: 391 Image Denoising and Image Enhancement on the Applications of Confocal Laser Scanning Microscopy

Name: Yunus Engin Gökdağ, Year: 2016

Advisor(s): Özgür Kocatürk

Abstract: Confocal laser scanning microscopy (CLSM) is a developing optical imaging device enabling non- invasive examination of live biological tissues with laser light in realtime. CLSM provides optical sectioning of samples. Image can get corrupted with noise of different levels due to out-of-focus light back-scattered above and below the focal plane. Construction of the CLSM setup is established and several images are captured. This work attempts to analyze the effects of different denoising and contrast enhancement techniques by using real CLSM images with the help of different image quality metrics. Additive White Gaussian noise (AWGN) is used as a noise model. A reliable method for estimating the standard deviation of AWGN in a single image is also performed on real CLSM images. Wavelet transform is the most effective candidate for noise suppression since it is capable of preserving energy conservation during inverse transformation. A denoising algorithm is developed to make it applicable on CLSM. An important issue that affects the performance of 2D-DWT is the selection of components employed in the algorithm along with their parameter selection. This study examines the effect of employing different combinations of 2D-DWT components and tuning parameter values on different image quality assessments. Design of Experiments (DOE) is presented as a systematic approach to catch the best combination of these parameter values. Analysis of variance (ANOVA) is used to inspect the main effect and interaction effects of the treated parameters. Computational results verified the efficacy of the proposed algorithm and the methodical approach for the image denoising of CLSM images. After denoising, several histogram equalization methods are put into practice for contrast enhancement. The comparison of methods that give better enhancement result is provided with the means of different quantative measures for better visualization.

Thesis No.: 390 An MR Safe Nitinol Guideware Design For Intravascular Applications

Name: Burcu Başar, Year: 2016

Advisor(s): Özgür Kocatürk

Abstract: Magnetic resonance imaging (MRI) offers excellent soft tissue contrast and radiation free imaging. Conventional guidewires employ long metallic materials for versatility and mechanical characteristics, and are subject to RF-induced heating, therefore are inappropriate for use in MR. This work describes the design and testing of a metallic guidewire that is intrinsically MR-safe with preserved mechanical performance. The MR-safe guidewire was constructed using nitinol rod segments less than a quarter wavelength of RF transmission at 1.5 T within the body to eliminate standing wave formation, hence RF heating. The insulated nitinol segments were connected by short nitinol tubes for a stiffness- matched guidewire core. Mechanical integrity was tested in vitro according to ISO standards. RF-safety was evaluated in vitro according to ASTM standards, and in vivo in swine in a 1.5 T MR system. Tests were performed on the prototype and a commercially available guidewire (Glidewire, Terumo, Japan) for comparison. Mechanical tests demonstrated that the segmented-core guidewire behaves similarly to its comparator. In vitro and in vivo RF heating tests confirmed that RF heating is under 2 ◦C as required by US Food and Drug Administration. The feasibility of an intrinsically safe passive metallic MRI guidewire design is demonstrated. The prototype exhibits negligible heating at high flip angles in conformance with FDA guidance documents (<2 ◦C), yet mechanically resembles a highperformance conventional metallic guidewire. This may represent a significant advance once applied to clinical MRI catheterization.

Thesis No.: 389 Inter and Intra-Individual Behavioral Variability Predicted by Neural Activity in the Multiple Demand Network

Name: Moataz Assem, Year: 2016

Advisor(s): Ahmet Ademoğlu/ Evalina Fedorenko

Abstract: A wide range of cognitive tasks consistently identify a Multiple Demand (MD) network in frontal and parietal brain regions. Its activity is closely linked to executive functions (EFs) such as attention, task switching, solving novel problems and manipulating information in the working memory. We here investigate the relation between MD neural activity and EFs using a large fMRI dataset (n=120). We examine this relation through two approaches (1) inter-individual variability, addressing several methodological challenges: We and that MD activity - which varies substantially across individuals, but is consistent within individuals across time - can explain a substantial proportion of variance in individual performance on a spatial working memory task such that individuals who and the task challenging, increase their MD activity substantially to improve their performance. This suggests that MD activity tightly reflects the executive demand of an individual. In the second approach we examine (2) trial-by-trial variability by employing three different models to fuse reaction time (RT) data with the BOLD time-series. We and that BOLD amplitude increases with longer RTs. This is consistent with the findings from the first approach showing increased MD activity for slower individuals. Together both findings support the view that within and between individual differences are manifested in the same brain regions. These results have implications for (1) understanding brain processes of EFs through ID studies (2) given that ID in EF are largely genetically determined, genetic variability can be linked to the neural activity of the MD network as an intermediate stage to link genetics with behavior (3) using ID in fMRI responses as clinical biomarkers.

Thesis No.: 388 Reliability Improvement Of Computer Aided Daignostic System Using Mutual Information

Name: Esra Polat, Year: 2016

Advisor(s): Albert Güveniş

Abstract: Computer aided diagnosis (CAD) is one of the most important topic in recentyears since the systems are able to provide a second reliable opinion to physicians and early diagnosis with these systems are possible. In this study we aim to construct a system for the detection of Alzheimer's disease (AD) using PET images from a database. The CAD system includes a database consisting of a 3D PET image for every query. Via using a similarity metric namely mutual information(MI), every query compares to all other query in database. According to their similarity results, a decision index is calculated. The decision index demonstrate presence or absence of AD. The system was developed and evaluated using two different databases extracted from Alzheimer's disease Neuroimaging Initiative (ADNI) database. All normal and Alzheimer's images are stored and ordered in database. First database consists of 259 normal and 138 AD patient whereas second database consists of 102 normal and 95 AD patient. Main difference of two database is registration. Images in second database are warped with talairach atlas. CAD performance was evaluated using Receiver Operating Characteristic analysis. For every query, a decision index was calculated. According to our results we observed that accuracy and speed of the CAD system is a-effected by certain parameters. The method proposed in the article is adequate to distinguish the disease. The mutual information method is very simple, applicable and fast enough to use in clinic area.

Thesis No.: 387 Development Of A Computer Controlled Fabrication System For Interventional Magnetic Resonance Imaging Device Production

Name: Dursun Korel Yıldırım, Year: 2016

Advisor(s): Cengizhan Öztürk/ Özgür Kocatürk

Abstract: Magnetic Resonance Imaging (MRI) is a promising candidate against X-Ray fluoroscopy for interventional cardiovascular procedures due to its ionizing radiation free mechanism and superior soft tissue contrast. However, Interventional MRI field lacks of dedicated clinical grade MRI safe and visible devices. Aim of this thesis study is to design and develop a Computer Numerical Control (CNC) based 4-axis conductive ink dispenser system for developing low profile "active" interventional devices for cardiovascular procedures under MRI. The proposed 4 axis CNC controlled dispenser system allows to form three dimensional receiver antenna configurations automatically onto non-planar catheter shaft surfaces. The developed system decreases the process time and increases the repeatability significantly compared to alternative lithography based techniques also used for low profile active device development. The validation and calibration test results showed that the motion control system works within tolerance of 3.1µm and the dispenser unit works with more than %90 accuracy during several trials. As a part of this thesis study, a resonator marker on a 6 Fr catheter shaft was designed and formed based on former Electromagnetic (EM) simulation results. The resonator marker is basically an LC tank circuit incorporating a solenoid coil and a capacitor. It is used to visualize the distal tip of a 6Fr catheter under 1.5T MR systems. The impedance and resonant frequency of resonant marker were measured with a vector network analyzer and necessary modifications were made via copper electroplating until the resonant marker is tuned to 63.66 MHz. The visibility and RF induced heating tests were performed successfully for prototype marker device under MRI.

Thesis No.: 386 Investigation Of The Effect Of FMOC Amino Acids Modifications To Osteoblast Behaviour On RGO/ Ti Surface

Name: Elif Dönmez, Year: 2015

Advisor(s): Bora Garipcan

Abstract: In this thesis, adhesion, proliferation and morphology of osteoblast cells on functionalized RGO/Ti surface were investigated. Firstly, amino-functionalization with 3-aminopropyl phosphonic acid (APA) molecules on Ti surface was carried out. Graphene oxide flakes were immobilized on APA/Ti surfaces through interaction between the epoxy groups of GO and the amine groups of APA molecules. Reduced graphene oxide sheet on APA/Ti surface were performed by using hydrazine monohydrate treatment. In order to enhance further surface bioactivity, Fmoc amino acids having different the hydropathy indexes modified on RGO/Ti surface by the π-π bond. The chemistry and morphology of unmodified and modified Ti surfaces were characterized by using Water Contact Angle (WCA) measurement, X-ray Photoelectron Spectroscopy (XPS), Raman Spectroscopy, Atomic Force Microscopy (AFM) and Scanning Electron Microscopy (SEM). According to characterization results, Ti surfaces were coated with GO and RGO, as well as the surface hydrophilicity was controlled by functionalization with Fmoc amino acids successfully. Then, cell viability, proliferation and morphology were examined by using the MTT, Alamar Blue Assays and SEM, respectively. The in vitro studies indicated that the surface chemistry and nanometric roughnesses on designed materials remarkably enhanced cell behavior, especially with respect to initial adhesion and proliferation. Consequently, the development of novel interface at cell/implant has a great potential for increasing osseointegration in the field of bone tissue engineering.

Thesis No.: 385 Time-Windowed Block For Unmyelinated Fibers in The Sciatic Nerve Of The Frog

Name: Samet Kocatürk, Year: 2015

Advisor(s): Burak Acar

Abstract: An artificial sensation can be produced in neuroprotheses by functional electrical stimulation of the sensory fibers in the peripheral nerves. The stimulation amplitude has effects on the perceptive field and the sensation modality. Increase beyond a certain threshold causes annoying sensations such as itch and pain. In this thesis, a novel method is proposed to improve this problem by blocking these unwanted sensations. In this study, a DC hyperpolarizing stimulation with a subsequent exponential decay was employed to block the conduction of C fibers of the frog's sciatic nerve. The block was applied in a time window to allow the propagation in myelinated fibers. The neural activity was measured by CAPs. For the blocking stimulus, two delays (4, 6 ms), three durations (4, 6, 8 ms), and five amplitude levels relative to the excitation threshold of C fibers were used. The excitation characteristics were also measured. In the CAP traces, the C component was reduced in 44% of the valid trials (n=67). The valid trials were the recordings in which the blocking stimulation did not evoke activity in myelinated fibers. After aligned- rank transform, 2-way ANOVA was performed to test the effects of block duration and amplitude on the reduction of C components. There were no significant effect of block duration (p=0.87) and amplitude (p=0.12). There was also no significant interaction between block duration and amplitude. Data from all trials (n=292) were included in Pearson correlation analysis to test the change of activity in the CAP component from myelinated fibers due to electrical charge applied by the blocking stimulation and there was no correlation (p=0.7). According to these results, the performance of neuroprostheses can be improved by a hyperpolarization block. Although the C fibers could not be blocked in all trials, when they did, the activity in the myelinated fibers was not significantly affected.

Thesis No.: 384 Ablation Efficiency and Thermal Damage Of Infrared Lasers On ex vivo Lamb Brain Tissues

Name: Baturay Özgürün, Year: 2015

Advisor(s): Murat Gülsoy

Abstract: The objective of this investigation is to guide to select the most su-cient infrared laser for the neurosurgery. For this reason, 1940-nm thulium fiber laser, 1470- nm diode laser, 1070-nm ytterbium fiber laser and 980-nm diode laser were operated with the ex vivo lamb brain tissues. Combination of some parameters such as brain tissue (subcortical and cortical tissues), laser output power, energy density, mode of operation (continuous and pulsed-modulated modes) and exposure time were applied. Pre-dosimetry study was conducted to determine coagulation and carbonization onset times for the lamb brain tissues. In this way, safe operation zone could be described for the dosimetry study. In the dosimetry study, both tissues were exposed to some energy densities (2J-4J) and power levels which are 200mW-400mW-600mW-800 mW and 0.5W-1W-1.5W-2W for 1940-nm and 1470-nm laser applications, respectively. The last two laser emitted light to both brain tissues with some power levels (1W-2W-3W-4W) and energy densities (20J-40J). After each laser application, coagulation and ablation diameters were calculated under a light microscope. It was aimed to-nd suitable laser parameter so as to perform the greatest ablation e- ciency which is determined as ablation diameter over coagulated diameter. Consequently, 1940-nm and 1470-nm lasers created ablated and coagulated areas while the other two lasers made only coagulated areas. Ablation efficiencies were calculated for 1940-nm and 1470-nm lasers. It was found that the former and the latter can be subcortical and cortical tissue ablator, respectively.

Thesis No.: 383 Functional Connectivity During Rest and Task: A Study Based on Graph Theoretical Metrics

Name: Hüden Neşe, Year: 2015

Advisor(s): Murat Gülsoy/Ata Akın

Abstract: In this study, task-related network organization were examined, and the association between network integration at rest and cognitive performance was investigated using n-back task. Global e-ciency, local efficiency and modularity were computed at rest and during n-back task. Task-related metrics were compared with resting state metrics to understand the neural mechanism underlying working memory. Correlations between resting state metrics and performance in the n-back task were computed to investigate the optimal topology. The results revealed that performing n-back task required a reorganization of resting state network. Task-related topology showed higher global efficiency and modularity, and lower local efficiency compared to rest. Moreover, it was reported that the resting state topology was an indicator of cognitive performance. Performance in n-back task was positively correlated with global efficiency, local efficiency and modularity of resting state network.

Thesis No.: 382 Protein Absorption on Amino Acid Conjugated Self Assembled Molecules

Name: Sezin Eren, Year: 2015

Advisor(s): Bora Garipcan

Abstract: In this thesis, novel amino acid (conjugated histidine, leucine, serine, tryptophan) conjugated self- assembled molecules (SAMs) were synthesized and used to modify model metallic [Gold, (Au)] and inorganic [Silicon Oxide, (SiO2)] surfaces to investigate protein adsorption. In the first step, Au and SiO2 surfaces were cleaned and modification of surfaces were carried out with 3-mercaptopropanoyl and 3 - (trimethoxysilyl) propane functional groups conjugated amino acids (for Au; histidine, leucine, serine, tryptophan, for SiO2; histidine and leucine), respectively. Syntheses of amino acid conjugated SAMs were characterized with 1H-Nuclear Magnetic Resonance (1H-NMR) Spectroscopy. Au and SiO2 surfaces modified with amino acid conjugated SAMs were characterized water contact angle measurements. We aimed to manipulate and change the adsorption of the proteins (Albumin, Fibrinogen and Immunoglobulin G) on these surfaces using amino acid conjugated SAMs. Protein adsorption was investigated insitu by using Quartz Crystal Microbalance (QCM) biosensors. According to results, target proteins have shown different affinity to the amino acid conjugated Au and SiO2 coated crystals depending the type of the amino acids and concentration. For instance, according to comparison of Histidine modified SiO2 and Au surfaces, properties of surfaces have shown a clear difference and effect on protein adsorption. In addition, according to comparison of Leucine modified SiO2 and Au surfaces, properties of surfaces have shown a clear effect on protein adsorption as having the same surface chemistry. Consequently, it has been observed that these controlled chemistry on the surfaces of materials have a great potential to manipulate protein adsorption for biomedical applications.

Thesis No.: 381 Evaluation Of A Fuzzy Logic Based Computer Aided Diagnosis System For Chest X-Ray Nodule Detection And Characterization

Name: Nurhan Öztürk, Year: 2015

Advisor(s): Albert Güveniş

Abstract: Computer aided systems has a crucial importance on lung nodule studies, since lung cancer is the leading cause of cancer related death for both men and women worldwide. Accurate characterization of lung nodules as malignant or benign may be difficult. CAD can assist radiologists in improving the accuracy of classification. The computer-assisted characterization of lung nodules involves several steps including segmentation, feature extraction and classification. In this study, we aim to optimize each step in order to improve the overall accuracy through on classification accuracy. The main objective of this study is to improve the characterization of detected nodules on chest x-rays by performance comparison of algorithms and optimum selection of classifier parameters. In this study, 154 posteroanterior chest x-ray images included in JSRT Database were used as test materials. The database consists of 100 malignant and 54 benign nodules. Our system involves pre-processing, detection, segmentation, feature extraction and classification steps. The aim of the pre-processing was to improve the quality of the images by contrast enhancement and noise reduction. We have determined 14 features (morphological features, statistical features and textural features) from each segmented nodule to make the classification more efficient. Initially in this work we have used k-nearest neighbor classifier and fuzzy classifier to classify the nodules as malignant or benign. We have tested the algorithm for different parameter values. According to our initial results, the optimal accuracy for k-NN classification is 68.8% and for the fuzzy classification it is 61.3%. The initial results reveal that this methodology has the potential to assist radiologists as a second opinion tool in the classification of benign and malignant lung nodules.

Thesis No.: 380 Probabilistic Determination Of Brain Tumor Locations

Name: Yasin Çotur, Year: 2015

Advisor(s): Mehmed Özkan/ Aziz Uluğ

Abstract: Determination of the origin of tumor locations is an important issue in terms of diagnosis and treatment of patients with glioma. The aim of this study was to determine and analyze a probabilistic brain tumor map reflecting tumor observation frequencies in different brain locations. T1-weighted MR images of 232 patients diagnosed with high and low grade brain tumors were analyzed. The data were collected from both online MRI brain tumor data resources shared for academic usage as well as brain tumor patients from Baskent University Hospital. We obtained 78 high and 54 low-grades MRI scans from Baskent University Hospital, and 20 high and 10 low-grades images from the MICCAI 2012 Challenge on Multimodal Brain Tumor Segmentation (BRATS). Combining all these MRI scans together with the use of brain imaging techniques created the probabilistic brain tumor map. Following brain extraction, image registration is implemented to transfer all MRI scans to the reference image coordinates, and individual transformation matrices are obtained for each data. Then brain tumors are segmented, and a radiologist confirmed the segmentation results. Then segmented images are registered to the standard coordinates by multiplying them with their specific transformation matrices. Our results indicated that there is a difference between high and low-grade tumor regions. Many of tumor positions were around the frontal and temporal ventricular zone for high- grades while the low-grade tumors were located around the posterior ventricular wall. These findings also support the theory that there is a close relationship between gliomas and ventricle region where neural stem cells are emanated.

Thesis No.: 379 Effect Of Tumor Deliniation Strategies On ANN Clasification Accuracy in Lung CAD

Name: Adem Cihan Aslan, Year: 2015

Advisor(s): Albert Güveniş

Abstract: Lung Cancer is a serious illness and patient survival rate depends on early and accurate detection. CAD systems are commonly used for detection and characterization of nodules. The type of tumor segmentation algorithm or radiologist segmentation may a_ect the accuracy when characterizing lung nodules on chest x-ray images. In order to segment and classify nodules better, preprocessing step is needed. Histogram equalization, fuzzy minimization, bone subtraction, cropping can be some steps of preprocessing. In this study, the main object is to evaluate the accuracy of the characterization of lung nodules on bone subtracted chest x-ray images by using di_erent types of boundary segmentation algorithms and an arti_cial neural network based classi_cation method. Another aim is to evaluate the contribution of CAD systems and accuracy of radiologist segmentation on raw chest X-ray. The standard digital image database with chest lung nodules (JSRT database) that was created by the Japanese Society of Radiological Technology in cooperation with the Japanese Radiological Society (JRS) is used. To subtract the bones a bone shadow elimination algorithm is used. Preprocessing and look up tables are used if nodule is not clearly seen. Active contour, spline active contour and radiologist based delineation methods are used. Arti_cial neural network classi-cations are used and their accuracy is evaluated. At the end, high speci-city and sensitivity ratios are obtained and di-erent segmentation techniques are compared. As a result, results are satisfying and interesting. Future work is possible to extend the study to other segmentation techniques and modalities.

Thesis No.: 378 Novel Mouthpiece Device Design for the Treatment of Mild to Moderative Obstructive Sleep Apnea

Name: Sefa Zülfikar, Year: 2015

Advisor(s): Özgür Kocatürk

Abstract: Sleep is essential for good health and well-being of humans and it lasts for one third of a person's lifetime on average. Therefore, sleep disorders must be taken care quite seriously. Obstructive sleep apnea syndrome (OSAS) is considered as one of the most common sleep disorder which is even thought to be as prevalent as diabetes. This disorder is characterized by temporary pauses in airflow due the pharyngeal collapsing. Obstructive sleep apnea has mostly been treated by oral appliances and continuous positive airway pressure (CPAP) devices which aim to improve airway caliber in the pharyngeal zone. However, the patient compliance for these preferred treatment op- tions has been low due to the adverse effects that they have caused.
In this study, we aim to come up with a novel mouthpiece device design for the treatment of mild to moderate obstructive sleep apnea which is more comfortable for patient use, yet as effcient as current treatments. Thus, prototype devices have been developed by using a 3D printer and been evaluated on eight volunteers throughout MRI scans. After performing MRI scan with and without the use of the novel mouth- piece device prototype, the oropharyngeal volumes of the participants have been re- constructed as 3D models. The oropharyngeal volume comparisons have demonstrated that the use of the novel mouthpiece device prototype has significantly enlarged the volume of oropharynx. The enlargement has not only been observed on OSA patients but also on healthy subjects. Consequently, the results can be perceived as this study offers an alternative treatment device for patients with mild to moderate obstructive sleep apnea.

Thesis No.: 377 Clinical Evaluation of Table, Large Screen Tr and Medical Grad Monitors for Teleradiology and General Use Purposes

Name: Roya Nouri Rikabad, Year: 2015

Advisor(s): Albert Güveniş

Abstract: One of the most important points in the whole process in digital radiology is to have high quality displays due to deteriorate any information received data acquisi- tion and image processing phases. Nowadays the common display device in observing medical imaging is medical grade TFT LCD monitor. In diagnostic radiology, medical monitors are mainly recommended because of their higher luminance and better con- trast ratio. However; the remarkable problem with medical grade monitors is its high cost. In order to find the solution for decreasing the cost; in this study we want to evaluate the clinician's performance of the other display devices such as large screen TV and tablet for observing the medical imaging. Another objective is to evaluate the potential of tablet as Teratological tool for assessing chest X-ray images with nodule.
In this experiment, the data set consisting of 60 chest radiographs were assessed by three experienced radiologists. The area under curve (AUC) of each ROC curve was used as a metric for detecting lung modules in the radiographs. AUC for medical monitor for viewer 1, 2 and 3 were calculated as 0.634, 0.703 and 0.755 respectively. AUC for Tablet for observer 1, 2 and 3 were calculated as 0.634, 0.703 and 0.755 respectively. AUC for large screen TV for radiologist 1, 2 and 3 were calculated as 0.634, 0.703 and 0.755 respectively. According to Analysis of variance or ANOVA test with 95 % confidence interval, there is statistically not significant differences between Medical monitor, tablet, and Large screen TV. Consequently, it is possible to implement Tablet and large screen TV as a medical monitor for medical diagnosis purposes without sacrificing any diagnostic value.

Thesis No.: 376 Assessment of Local Deformations Along Muscle Fibers of Human Bastrocnemius on Submaximal Isometric Maintained Plantarflexion Using MRI

Name: Agah Karakuzu, Year: 2015

Advisor(s): Can Yücesoy

Abstract: Comprehensive understanding of the mechanical interactions between skeletal muscles within their integral system of connective tissues requires simultaneous quantification of the architecture, force and deformation during in-vivo muscle action. For that purpose, magnetic resonance imaging (MRI) along with nonrigid Demons registra- tion were applied together to quantify 3D local deformations. Additionally, diffusion tensor imaging (DTI) was utilized to reconstruct 3D muscle fiber architecture. Use of such multi-method approach and specifically designed experimental equipments to- gether enabled the in-vivo quantification of local strains along the orientation of the skeletal muscle fibers occurring due to activation. The specific goal of this study was to test the hypothesis that 15% of maximal voluntary isometric contraction (MVIC) of sustained plantar flexion results in a serial strain distribution along the muscle fibers of medial gastrocnemius (GM) of female subjects (n=5). Results indicate that considerable local lengthening and shortening occurs simultaneously within individ- ual GM tracts (e.g. from 12.4% shortening up to 36.7% lengthening within a single tract) through the muscle.The hypothesis is therefore confirmed. Moreover, a parallel distribution was also found to be heterogeneous. Such findings are the characteristic indications of myofascial force transmission effects that highlights the interdependent mechanical functionality of skeletal muscles. To our knowledge, this is the first study in the literature that enables the evaluation of in-vivo deformations caused by submax- imal isometric contraction with respect to the muscle fiber orientations of GM. Such experimental work therefore is expected to lay the groundwork for the investigation of in-vivo myofascial force transmission effects on clinical applications like botulinum toxin treatment and tendon transfer surgery.

Thesis No.: 375 MRI Analyses in the Lower Leg to Asses Mechanical Effect of Drop Foot Taping Applied Over Tibialis Anterior

Name: Ayça Aklar Çörekçi, Year: 2015

Advisor(s): Can Yücesoy

Abstract: Kinesio Taping (KT) is used by physiotherapists e.g., to reduce adhesions in the fascia. Leading to disorganization of connective tissue after trauma, underlying muscle tissue may not function optimally and the circulation in the area gets disrupted. When there is inefficient circulation, the connective tissue network gets denser, creating even more adhesions. To increase the blood circulation and muscle performance, and to decrease pain that may occur after injuries, KT is used during treatment. Numerous studies assessed the effects of KT over pain, range of motion(ROM) and muscle func- tion. However, the mechanical effects of KT applications remain unclear. The present study assesses the mechanical effects of KT in the lower leg of healthy subjects. Drop foot correction is used as a KT application for such testing. The results show that, KT application over the tibialis anterior muscle (TA) causes sizeable and heteroge- neous tissue deformations within not only the target but also within all muscles of the lower leg: up to 38.7% lengthening and 26% shortening in the TA, 21% lengthening and 14.2% shortening in mm. peronei, 15.9% lengthening and 16.9% shortening in the deep flexor muscles, 24.7% lengthening and 20.3% shortening in the m. soleus, and 24.9% lengthening and 20.3% shortening in the m. gastrocnemius. It was concluded that, KT plays a major role on the fascia network such that all the tissues starting from the epidermis to individual muscles and intermuscular connective tissue units are utilized to transmit the externally imposed mechanical loading leading to variable local mechanical effects. Although this experiment was conducted in passive conditions, KT application over the TA caused considerably high tissue deformations within the entire lower leg. These findings are very important for physiotherapists to explain the mech- anism of effects and limits of such therapeutic mechanical loading applied externally over the epidermis.

Thesis No.: 374 Desing of A Computer-Controlled Current Stimulator for Nerve and Muscle Excitation

Name: Mahmud Esad Arar, Year: 2015

Advisor(s): Mehmed Özkan / Burak Güçlü

Abstract: Electrical stimulation of excitable tissues has been widely used for diagnosing and treating neurological and muscular disorders. Electrical stimulation is also used to analyze and understand inherent functions of nerves and muscles. This study includes the circuit design of a current stimulator and its custom LabVIEW interface. The device is based on a modified Howland current-source topology due to its effciency for injecting precise current without being affected by load resistance variations. Modified Howland current source converts voltage signals to desired current signals. The device is powered by an external power supply with high compliance ±37 Vdc. Waveforms are produced by using a computer audio output which is controlled by LabVIEW. There- fore any user can create its own user interface with any programming environment. Sinusoidal, square and triangle waveforms, in different frequencies, amplitudes and pulse widths, can be generated within the range of the sound card specifications. The device can generate both monopolar and bipolar current pulses with pulse duration of 0.05 − 10 ms. Reliable frequency range of the system is 10 − 10, 000 H z and it can deliver 6.6 mApp at 10 kΩ dummy load. This system can be easily constructed and is very inexpensive compared to commercial units. Both electrical and physiological tests are performed in order to prove that the device is running properly and it can be utilized in laboratory experiments of electrophysiology especially for somatosensory evoked potentials.

Thesis No.: 373 Photothermal Ablation of Liver Tissue with 1940-nm Thulium Fiber Laser: Ablation Effciency and Temperature Measurement

Name: Heba Alshorafa, Year: 2015

Advisor(s): Murat Gülsoy

Abstract: The purpose of this study was to investigate the effectiveness of 1940-nm Thulium fiber laser for liver surgery. This was done by determining the ablation efficiency of different working modes and power settings of 1940-nm Thulium fiber laser on liver tissue, in addi- tion to utilizing a real time temperature monitoring to provide the necessary feedback for adjusting laser parameters to minimize the collateral thermal damage to adjacent tissues. Thulium fiber laser was delivered to lamb liver tissue samples via 400 μm flat-cut bare-ended tip fiber in contact mode. Continuous-wave and pulsed modes were used, each at 4 different laser power values (200, 400, 600, and 800 mW) and exposure times. Exposure times were chosen to give the same total applied energy of 4J for comparison purposes. A total of 64 laser applications were performed in order to study 8 laser parameter combina- tions with each parameter combination repeated 8 times. Following laser irradiation, tissues were processed and stained with H&E for macroscopic evaluation of ablation and total al- tered areas, and ablation efficiencies were calculated. Temperature of the nearby tissue was measured using a K-type thermocouple that was inserted at a distance of 1 mm from the fiber, and rate of temperature change was calculated.
A strong correlation between the rate of temperature change and ablation area was depicted. Larger ablation and total altered areas were obtained for higher power values for both continuous-wave and pulsed modes, while ablation efficiencies were not significantly different. Continuous mode yielded higher ablation and total altered areas, and higher abla- tions efficiencies than pulsed mode. Histological evaluation revealed a narrow vacuolization zone and negligible carbonization for higher power values.

Thesis No.: 372 The Effects of Femoral Anteversion on Knee Power in Children with Cerebral Palsy

Name: Seçil Önal, Year: 2015

Advisor(s): Can Yücesoy

Abstract: The knee is the most adversely affected joint in children with cerebral palsy (CP). The aim is to assess wheter a correlation can be found between femoral antever- sion (FA) and knee power in children with CP. If there is a relation, the surgery to fix FA may better control an arthosis, which occurs at very young ages in children patients with CP. The measurements conducted using motion analysis techniques allowed determi- nation of the degree of FA without doing a CT scan. 23 children with CP participated. Human gait analysis was performed using the Vicon System with the Berthec force plates. The particular analysis is done at the instant the knee atteins a full extension position because of presence of a neglectable muscle activity occurring at that time.
Data of this research led to the conclusion that the Pearson and Covariance coeffcients do show a perfect correlation. However, Covariance coeffcients also define the direction that the variables move. Direction of the variables may not have signifi- cance in anatomical correlations as in FA and knee power relation. In this research, a relationship between the increase in knee extension and the loading on the knee may conclude to one of FA's effects on knee. This result contributes to the thought that states the increased femoral anteversion (IFA) can develop early arthosis. Since there isn't a linear relationship, the findings suggest that the surgery to fix FA to delay the arthosis may not be a priority action to take on CP children who have IFA.

Thesis No.: 371 Optimization of Fnirs Probe Geometry to Eliminate Non-Brain Tıssue Contamination

Name: Ayşegül Tümer, Year: 2014

Advisor(s): Yekta Ülgen/Ata Akın

Abstract: Functional near infrared spectroscopy (fNIRS) is a developing non-invasive technique used for measurement of oxygenation in the adult and newborn human brain during cognitive tasks. The oxygenation in the brain is expressed as the change in the concentrations of the major absorbers such as oxy- and deoxy-haemoglobin in blood as a response to the brain activation during light-tissue interactions. The absorption of these absorbers at different wavelengths are calculated by using a Modified Beer- Lambert Law (MBLL). Depending on the aim of the fNIRS measurement, at least two different wavelengths are selected from the optical window (600-900 nm) for the detection of the concentration changes of these absorbers in order to minimise the undesired effect of “crass-talk”. The probe of fNRIS containing a combination of various light sources (LD, LED, etc.) and detectors aims to pinpoint the activated regions of the brain relying on the theory of light path distribution known as “banana-shape” in literature. As a well proven technique, Monte Carlo Simulations which describes the photon migration multi layer media is used for modelling of head and fNIRS probe for investigation of the system. The most important disadvantage of the technique is the contamination of the brain signal with the signals received from the superficial layers of the head, namely; scalp and skull layers. For the decoupling of these signals, various signal regression and filtering techniques are used. In this thesis as a signal regression technique is presented, where a real fMRI data is used in Monte Carlo Simulations for assigning a near-far detector position which respectively contains the signal from the superficial layers only and the signals obtain from both the superficial layers and brain matter. The positions of these detectors were found to be around 17, 18 and 19 mm from the source for the head model with an average human skull thickness of 7 mm.

Thesis No.: 370 Amino Acid Conjugated Self Assembly Molecules Modified Si Wafers

Name: Bengü Aktaş, Year: 2014

Advisor(s): Bora Garipcan

Abstract: In this thesis, Si wafer surface was modified with newly synthesized self- assembled monolayers to mimic a biocompatible micro-environment for the cells and to observe their behavior. Begin with; Si wafer is chosen as its availability is easy and well-established structures can be obtained in the surface modification without any interference. In the first step, Si wafers were cleaned and modification of surfaces was carried out with amino acid conjugated self-assembled molecules [Histidine-Self Assembled Molecule (His-SAM), and Leucine-Self Assembled Molecule (Leu-SAM)], (3-aminopropyl)triethoxysilane (APTES) and also poly-L-ornithine (PLO). The char- acterization of these samples were analyzed with contact angle measurements, X-Ray Photoelectron Spectroscopy (XPS), Atomic Force Microscopy (AFM), and ellipsometry. After characterization results were acquired, the cell culture studies were performed with L929 cells. In order to obtain information about cell proliferation, MTT assay (a colorimetric assay) was performed. According to these results, enhanced cell prolifer- ation was achieved by the contribution of surface functional groups. Consequently, it has been observed that these controlled molecular structures on the surfaces of mate- rials have a great potential for biomedical applications.

Thesis No.: 369 Predictability of Cognitive Performance Based on Functional Neuroimaging via fNIRS

Name: Fırat Şansal, Year: 2014

Advisor(s): Murat Gülsoy/Ata Akın

Abstract: In neuropsychology many tasks have been used to determine the cognitive ability and/or flexibility of individuals to have any prior knowledge about the psycho- logical condition or to state the level of neuropsychological disease of a person. This study presents the relations between behavioral performances and neuronal activa- tion within and between two cognitive tasks; Tower of London (TOL) and color-word matching Stroop test which are utilize to obtain cognitive flexibility on decision mak- ing, attention and planning. Functional Near Infrared Spectroscopy method is used as functional neuroimaging tool. fNIRS results revealed that activations for both tasks mainly located in both left and right lateral side of prefrontal cortex. Behavioral out- comes such as reaction times of interference effect of stroop task and total planning time of TOL tasks were compared with neuroimaging findings. Right superior lateral prefrontal cortex (RSLPFC) activity during incongruent-neutral interference showed positive correlation with difference of mean response times for correct answered incon- gruent and congruent trials. In addition we also observed negative correlation with activation of 7-move TOL task and reaction time in left and right lateral prefrontal cortex. At last, it has been presented that subjects have negative brain response(NBR) which is related with good performance (according to results of correlation analysis) during stroop task showed relatively positive brain response (PBR) during TOL task which indicates also good performance, whereas, lateral activation during TOL task is reduced for subjects have PBR in stroop task which can be stated as bad performance.

Thesis No.: 368 Functional Connectivity Network Analysis of Alzheimer and Mild Cognitive Impairment Patients

Name: Duygu Şahin, Year: 2014

Advisor(s): Ahmet Ademoğlu

Abstract: In our era, while the life span is expanding, neurodegenerative diseases, such as Alzheimer's disease (AD), pose a great threat upon the quality of life. In such a case, the best course of action would be to detect, modify or treat the pathologies before they become too severe. Since the main cause of AD is still unknown, further studies for possible biomarkers are needed. Therefore, in this study, the objective is to find a distinctive agent for AD and mild cognitive impairment (MCI) from an optimized auditory oddball task fMRI data via functional connectivity analysis. In order to achieve that, a group ICA approach using temporal concatenation of the subject data is adopted. Since, there are no studies investigating functional connectivity of AD and MCI during an oddball task, especially via group ICA, this study can enrich the literature. As the results are concerned, in group comparisons, no significant differences are found in spatial maps. On the other hand, there are promising findings in temporal course analysis of the components such as the multiple regression outcomes. Therefore, our next aim will be to perform a longutidinal study including both resting state and task related data for finding a better biomarker.

Thesis No.: 367 Modeling and Evolutionary Analysis of Gene Regulatory Networks

Name: Seher Uğurcuklu, Year: 2014

Advisor(s): Albert Güveniş/Cem Özen

Abstract: In Systems Biology and more recently emerging field of Synthetic Biology, mathematical modeling has become an indispensable component of research. As complementary to the experimental studies, computer simulations are used to accelerate the hypothesis generation-validation cycle of research in biological systems.
This thesis is mainly concerned with modeling and inference of gene regulatory dynamics on the basis of gene expression patterns. At first, we make a statistical analysis over randomly generated genetic networks, based on their oscillatory dynamics. Then, in our model problem, we aim to design a family of genetic networks that exhibit stable periodic oscillations with a prescribed period. Later, we investigate the temporal behaviour of a system utilizing a computer simulation. We design such circuits on the basis of in silico evolution of the corresponding network model.
The approach starts with a randomized gene network. Then, structural rewiring mutations are applied to the networks. In this process, evolving networks are selected depending on their closer approach to the targeted dynamics, after a mutation. By us- ing this method, networks with required oscillation periods are constructed by changing the architecture of regulatory connections between the genes.
In addition, we choose a small genetic network that exhibits chaotic dynamics, and look at the change of its dynamics against a system parameter. Such an approach is useful in deriving the characteristics of these systems under specific variations.

Thesis No.: 366 Biochemical Modification of Biodegradable Nanofibers

Name: Onur Arslan, Year: 2014

Advisor(s): Bora Garipcan

Abstract: Organ and tissue losses caused by a disease or a trauma can be treated by vari- ety of sources such as; autograft, allograft and xenograft. Providing the cells from these sources have many disadvantages like; diffculty of finding a suitable donor, rejection of the tissue by the body and immune system related problems. In order to overcome those problems tissue engineers try to produce required tissue in the laboratories with few cells which are taken from the patient. In this context, in order to fabricate desired tissue cultures, many efforts are going on development of various cell scaffold mate- rials, surfaces and biochemicals. Although our knowledge on this subject increases in time, more studies are needed to be done. In the purpose of this thesis, histidine and fetuin immobilized Poly-ε-caprolactone (PCL) membranes and nanofiber meshes were prepared to enhance biocompatibility. PCL nanofiber meshes were produced via electrospinning and PCL membranes by solvent casting method. For the surface modi- fication in the first step, hexamethylenediamine (HMDA) was used to introduce amino groups onto the PCL surfaces. Histidine, and fetuin immobilization on amino groups of the surface carried out by using cyanamide and N-hydroxysuccinimide (NHS). Fourier Transform Infrared Spectroscopy (FTIR), X-ray Photoelectron Spectroscopy (XPS) and Scanning Electron Microscopy (SEM) were used for the characterization of modi- fications. The effects of surface modification on cell proliferation were studied by using L929 fibroblast-like cells. MTT assay and cell cultures studies have shown that histi- dine modified PCL nanofiber meshes have shown higher cell proliferation percentage than histidine modified PCL membranes and control groups within increasing histidine content. According to the results it was shown that PCL biocompatibility can be en- hanced with such simple amino acid histidine and it is possible to use these surfaces in many different tissue engineering applications.

Thesis No.: 365 Network Security Vulnerabilities and Pernonal Privacy Issues in Healthcare Information Systems: A Case Study İn A Private Hospital

Name: Nihan Namoğlu Cengiz, Year: 2014

Advisor(s): Yekta Ülgen

Abstract: Healthcare industry has become widely dependent on information technology and internet; as it moves from paper to electronic records. Despite the benefits of electronic system, good quality may not be totally achieved unless its risks to security are mitigated. Working in collaboration with a 150 bed private hospital in Turkey; this study aims to present a secure healthcare network infrastructure while presenting the security vulnerabilities in the current hospital information systems. The regula- tion criteria in Turkey and counterparts in USA and EU are compared according to their privacy approach and a list of items for common security controls from different industries is proposed as a best practice. The study shows that the hospital is not compliant with known healthcare standards like HIPAA or ISO 80001. Managements attitude against privacy and security shows that the responsibility is totally to IT and Biomedical Engineering Departments. Since explaining the threats and corresponding vulnerabilities in the system may cause the hospital be prone to cyber-attacks, the name of the hospital is secluded. As hospitals are adopting electronic transactions, consideration must be given to protect public electronic health records in terms of personal privacy aspects. Healthcare industry in Turkey should benefit from best prac- tices in other industries and applications in other countries. This study can lead the pathway for policy makers in healthcare organizations and regulation authorities to implement a more secure environment for every citizen.

Thesis No.: 364 Evalution of Lifht and Concentration Dose on Cell Viability at Photodynamic Therapy in vitro

Name: Nuray Aysan, Year: 2014

Advisor(s): Murat Gülsoy

Abstract: Photodynamic Therapy is a promising and safe antimicrobial treatment that includes in a chemical agent, called a photosensitizer, which is activated by appropriate light energy and it results in production of reactive oxygen species (ROS) which have an important role in destroying the target cells. PDT dosimetry (light dose, photosen- sitizer dose and concentration of produced ROS) is very critical in the photoactivation process. Low concentration of oxygen radicals or low level light may cause cell pro- liferation with some biochemical pathways instead of the killing effect of antibacterial PDT. For this reason, there is a biostimulation risk during antibacterial PDT and op- timization of PDT dose properly is very important to overcome the multidrug resistant bacteria problem on wounds. The main purpose of this study was to investigate the PDT safe region for bactericidal application and to demonstrate the importance of PDT dosimetry. In this study, PDT with different concentrations of indocyanine green (ICG) (20, 50, 100, 125, 150, 200 and 250 μg/ml) and different doses of 809-nm diode laser (84, 168 and 252J/cm2) was investigated on Pseudomonas aeruginosa ATCC 27853 in vitro for PDT safe region. In this study, the cell proliferation of P. aeruginosa strain was observed instead of the PDT killing effect, when 84 J/cm2 of energy dose (809-nm diode laser) was applied with 20, 50, 100, 125 and 150 μg/ml of ICG concentrations. When we increase the energy doses with the same concentrations, at optimum higher concentrations, the PDT killing effect was significantly observed (150 μg/ml ICG with 168J/cm2 and 125 μg/ml ICG with 252 J/cm2). The results of experiments show that there could be biostimulation on pathogens if PDT dosimetry is not optimized properly.

Thesis No.: 363 In Vitro Investigation of The Potential of 1940nm Thulium Fibre Laser as A Surgical Tool For Oral Soft Tissue

Name: Melike Güney, Year: 2014

Advisor(s): Murat Gülsoy

Abstract: Lasers of different wavelengths are being used in oral surgery for making inci- sions and excisions with minimal bleeding and pain. Thulium fibre laser, with its 1940 nm emission, is well absorbed by water, making it a promising tool for oral soft tissue surgery. This study was conducted to investigate the potential of Tm: fibre laser as an incisional and excisional oral surgical tool.Both 1940 nm Tm: fibre and 980 nm diode laser were used on ovine tongues in this study for comparative purposes. Both lasers were applied in contact to the tissue, which was completely submerged in saline solution, via a 600 μmm fibre. The incisions were made by moving the fibre tip manually at different speeds (0.5, 0.75 and 1 mm/s) and with making single, three or five passes, using three different power settings (2.5,3 and 3.5W for Tm:fibre and 12,14 and 16W for diode laser). The samples were stained with H&E for microscopic evaluation of depth of ablation and extent of coagulation, and ablation effciencies were calculated.Deeper ablations, as well as larger coagulations were obtained with both lasers by using higher power settings. However, making more passes at constant power yielded deeper ablations without significantly larger coagulation zones. Furthermore, increas- ing the speed caused shallower ablation and narrowed coagulation zones. Microscopi- cally, a narrow vacuolization and a large coagulation zone were observed for 1940 nm Tm: fibre laser, whereas the coagulation zone produced by 980 nm diode laser was larger and no vacuolization was evident.

Thesis No.: 362 Effect of Self Movement on Absolute and Masked Thresholds in the Pacinian Channel

Name: Fatma Büşra Özkan, Year: 2014

Advisor(s): Burak Güçlü

Abstract: In this thesis, we simulated active touch by measuring absolute and masked thresholds in the Pacinian channel during cyclic self-movement. Based on previous work we hypothesized improvement in the absolute thresholds and increase of mask- ing effciency compared to passive touch condition. An aluminum contactor (r=0.685 cm) was used for the stimulation of the left middle fingertip of the subjects. The measurements of the psychophysical thresholds were repeated for three conditions: no movement, slow self-movement (0.1-0.2 m/s), and fast self-movement (0.5-0.6 m/s). The slow movement condition (-20.8 dB) and the fast movement condition (-21.8 dB) yielded on average lower thresholds than the passive condition (-17.9 dB). Paired t-tests showed that the differences between the movement conditions and the passive condition were signifiant (p=0.023 for passive vs. slow; p=0.024 passive vs. fast). Interestingly the threshold shift due to masking increased with self-movement (2.9 dB for passive; 7.9 dB for slow; 9.2 dB for fast). The differences between the threshold shift due to masking for passive and individual movement conditions were significant. According to these results, self-movement significantly enhanced sensation in the Pacinian channel. However the speed of the self-movement did not matter. Forward- masking effciency also increased due to self-movement. Therefore this enhancement seems to operate at both threshold and suprathreshold levels. Since self-movement involves both proprio- ceptive and motor signals, the exact source of this enhancement currently cannot be identified.

Thesis No.: 361 Analyzing The Efficiency of The Colorimetric Tezhnique in Determining The Degree of Hemolysis of Stored Blood

Name: Osman Melih Can, Year: 2014

Advisor(s): Yekta Ülgen

Abstract: Transfusion has risks of adverse outcomes on patients due to the storage lesions of blood products. Measuring quality of the blood prior to usage can minimize the transfusion related reactions. For controlling the quality of units, experts visually assess the degree of hemolysis by comparing color of blood with graded color charts. Since results are subjective and depend on the spectral energy distribution of the illuminant, the method is inaccurate. Instead of using color charts, color of the stored blood can quantitatively be measured by analyzing the spectrum of the light reflected from the sample with a spectrometer. The color of blood can be defined as a set of tristimulus values or color coordinates in the color space. In this study daily changes in the colorimetric parameters of stored blood were monitored and correlated with the changes in the degree of hemolysis. Red blood cell (RBC) suspensions collected from 7 male volunteers were used for the study. On each day of storage, 24 colorimetric parameters in various color spaces were measured with a reflection probe that transmits both the incident light from the light source to the blood bag; and the reflected light from the blood bag to the spectrometer. Standard hemolysis measurements with Harboe technique were performed on weekly basis, by taking blood samples from blood bags. Colorimetric parameters: tristimulus X, u', u-v saturation, Hunter a, CIE a*, CIELAB chroma and the correlated color temperature (CCT) changed significantly ($p<0.05$) for each sample after the 3rd week of storage. Except CCT, hemolysis showed good correlation ($r>0.65$) with the parameters that mostly correspond to red contents of the color stimuli. Hunter a apparently is the most suitable parameter for determining the degree of hemolysis with ($r=0.71$) ($p<0.005$).

Thesis No.: 360 Bone Surface Mimicked Biodegradble Polymeric Scaffolds

Name: Öznur Demir, Year: 2014

Advisor(s): Bora Garipcan

Abstract: In this thesis, bone surface topography was mimicked by a using biodegradable polymer. In the first part, bone surface topography was mimicked and transferred to the polydimethylsiloxane (PDMS) surface using soft lithography technique. Bone surface mimicked Polylactic acid (BSM-PLA) prepared by solvent casting using the PDMS as a mold. The effect of PLA concentration (2.5-10% (w/v) in chloroform) and casting time (as evaporated- 24 h) were investigated to obtain best mimicking conditions. After characterization of BSM-PLA scaffolds by scanning electron microscopy (SEM), the best mimicked scaffolds were obtained at 10% PLA concentration and 24 h casting time. The effectiveness of bone mimicking procedure was also investigated by SEM. As a result, same bone and PDMS surface could be used several times to fabricate BSM-PLA scaffolds. The fabricated BSM-PLA scaffolds' surface characterization results showed that the fabricated BSM-PLA surface hydrophobicity and roughness were improved to guide cells attachment. In second part, in-vitro degradation in terms of weight loss and morphology, and cumulative drug release tests were performed. Compared with the BSM-PLA, plain PLA scaffolds degraded more rapidly in phosphate buffer solution (PBS). The result was the same for the rate of drug release profile in PBS as well. For the last part of the thesis, the effect of surface topography on human bone marrow mesenchymal stem cells (hBM MSCs) viability and differentiation were investigated using BSM-PLA scaffolds. According to these results, stem cell incorporation onto BSM scaffolds as a future trend is addressed shortly highlighting the immense potential for osteogenic stem cell differentiation that features high adaptiveness to the biological environment. Consequently, the developed BSM-PLA scaffolds are predicted to have a great potential on the surface 3D scaffolds fabrication and guidance of stem cells that are provided for bone tissue engineering applications.

Thesis No.: 359 Preparation And Characterization of Cartilage Mimicked Structures

Name: Meftune Özgen Öztürk, Year: 2014

Advisor(s): Bora Garipcan

Abstract: In this thesis, micro-environment of cartilage tissue was mimicked by adjusting the surface topography, stiffness and chemistry of polydimethylsiloxane (PDMS) which is a biocompatible synthetic elastomeric polymer. PDMS substrates were synthesized with different stiffness between 2.13±0.150 MPa and 0.56±0.06 MPa which were in the range of healthy human articular cartilage's stiffness (0.45-0.80 MPa) and measured by nanoindendation. A template mimicking the collagen type II bundle alignment, geom- etry and size of healthy human cartilage tissue were prepared (A= 100, 150, 200 µm; B= 30, 40, 50 µm; C= 30, 40, 50 µm) by photolithography. PDMS substrates with desired patterns were prepared by soft lithography. In order to mimic the chemistry of the cartilage tissue micro-environment, PDMS substrates were modified with amino acid conjugated self-assembled molecules (Histidine, Leucine and Tryptophan) and also with type II collagen. Stiffness of PDMS substrates were analyzed with nanoindenta- tion measurements and chemical modifications of substrates were confirmed by using X-ray Photoelectron Spectroscopy and contact angle measurements. According to the characterization results, prepared substrates with cartilage like stiffness, chemistry and topography are possible cell substrates for cartilage tissue engineering

Thesis No.: 358 Development of a Novel Fiber Laser Based Backward-Mode Photoacoustic Microscopy System and Image Characterization

Name: Mustafa Ümit Arabul, Year: 2013

Advisor(s): Cengizhan Öztürk/Burçin Ünlü

Abstract: Among all other imaging modalities, optical methods using non-ionizing ra- diation became popular due to safety concerns. However, pure optical methods have severe limitations for deep tissue imaging. On the other hand, photoacoustic imaging is a promising imaging modality for in vivo tissue monitoring due to its high optical contrast and high ultrasonic resolution. The parameters of the laser used in photoa- coustics, namely pulse duration, pulse repetition frequency, beamwidth and output power has a quantifiable impact on signal amplitude, imaging speed and resolution. In literature, Q-switched lasers, solid state lasers and fiber lasers are used for the micro- scopic scale of photoacoustic imaging. Most of the lasers used in photoacoustic studies has a fixed capacity and key parameters cannot be adjusted independently. In this study, we declare a novel all-fiber mode-locked laser with adjustable pulse duration between 1 - 3 ns and selectable pulse repetition frequency between 50 kHz and 3.1 MHz. All fiber integration makes our laser resistant to vibrational disturbances, yet increases its stability. Additionally, we utilized a photonic crystal fiber at the output stage of the laser to generate a supercontinuum of a wavelength range of 600 - 1100 nm. We analytically reveal laser parameter dependencies of photoacoustic signals. We test our microscopy system with a phantom made of horse hair, and present resultant images with point spread function of width 500 μm

Thesis No.: 357 Identifying Gene Interactions for Time Series Microarray Data Using Dynamic Bayesian Networks and External Biological Knowledge

Name: Umut Ağyüz, Year: 2013

Advisor(s): Ahmet Ademoğlu

Abstract: DNA hybridization arrays measure the expression levels for thousands of genes. These measurements provide us with a “snapshot” of transcription levels in the cell. A major challenge in computational biology is to identify the gene-gene, and protein-protein interactions using such measurements, as well as some biological features of celluar systems. In our study we aimed at building up our framework on the use of Bayesian networks. A Bayesian network is a graph-based model of joint multivariate probability distributions that captures properties of conditional independence between variables. Such models are deemed attractive for their ability to describe complex stochastic processes. They also provide a clear methodology for learning from observations, even for noisy ones. However, Bayesian Networks work only for stationary data, require prior information in model selection, and applies to acyclic directed graphs. Dynamic Bayesian network (DBN) is an improved to overcome the cyclicity and stationary limitations.

Thesis No.: 356 A Mobile Urine Analysis Systems for Homecare

Name: Büşra Kahraman, Year: 2013

Advisor(s): Mehmed Özkan

Abstract: Urinalysis is a remarkable diagnostic technique and an essential part of physical examination used frequently in kidney an urinary tract diseases. Urine reagent strips which are widely used in urinalysis are impregnated with a number of colored reagent blocks or pads separated from each other by narrow bands. The reagents in each block react with specific component is present, and the color change produced is proportional to the concentration of the component being tested for. Recent analysis of test strips is perfomed via refractometric devices of the corresponding test strips. In this thesis, a mobile urine strip analyzer called BUSA which can be controlled via both GUIs of MATLAB and Android operation system was designed by using Parallax' s color sensor, TCS3200- DB. The fundamental idea behind this desing was to form a database which incluced color data of control solutions of CombiScan 500, 40 patients analyzed by CombiScan 500 in Yeditepe University Hospital and prepared solutions of known pH and glucose amount. 15 patients analyzed by CombiScan 500 were compared to BUSA. Specificity of the results of the comparison for bilirubin, urobiliogen, pretein, blood, b-nitrite and leukocyte was 1 and for ketone was 0.933. Sensivity of the results of the comparison for glucose, protein and blood was 1, 0.2 and 1 respectively. pH and specific gravity were analyzed via Blant Altman method which means and standard deviations were 0.133, 0.5156 and 0.0017, 0.0059 respectively. In conclusion, BUSA is successful at measuring pH an specific gravity of urine and negativeness of bilirubin, urobilinogen, kotone, glucose, protein, blood, nitrite and leokocytes. In addition, BUSA is successful at detecting positiveness of glucose and blood, except protein.

Thesis No.: 355 Sensitivity and Speccifity of the Multi-Channel Cw-fnirs for Medical Purpose

Name: Alp Özdemir, Year: 2013

Advisor(s): Ata Akın

Abstract: In last decades, optical imaging technology has been rapidly developed and become much popular for scientific researches. Its safe, non-invasive and portable de- sign easily integrates fNIRS to different research areas and makes it much preferable especially for brain researchers. Since fNIRS sensitively scan neurobiological changes in the PFC during neurological and psychiatric disorders, many studies benefits from the convenience of fNIRS to extend the understanding about these disorders. This study aims to present reflections of different PFC related disorders which are schizophrenia, migraine and attention deficit & hyperactivity disorder (ADHD) on fNIRS measure- ments and to reveal their differences from control group via advanced signal processing application. For this purpose, collected fNIRS measurements during cognitive task were preprocessed to remove artifacts and prepared for further analysis. Pre-processed signal sets were used to create feature set for each subject with the assistance of inde- pendent component analysis. Then these feature sets were investigated by clustering algorithm to observe discrimination of experimental groups and performance of the system was reported. In some cases, proposed system presents success rates up to 82% for migraine group, 92% for schzophrenia group and 95% ADHD group.

Thesis No.: 354 Die Lectophoretic Force Stimulation for Bone Fracture Healing

Name: Erman Kibritoğlu, Year: 2013

Advisor(s): H.Özcan Gülçür

Abstract: On the average, a person has two bone fractures during a lifetime. The heal- ing time depends on the age, the health of the patient, the type and the severity of the fracture and can be quite long, especially if there is an infection. This is very frustrating for patients during this time, since they require help and are unable to work. Although a number of invasive and non-invasive techniques have been studied for shortening fracture healing times, including the application of direct current, elec- tromagnetic fields, pulsed electromagnetic fields, ultrasound and low-intensity x-ray. However none of these techniques are entirely satisfactory. In the present thesis we propose a novel technique based on the use of dielectrophoretic forces (DEPFs).
By applying a non-uniform electromagnetic field around a fracture site, red blood cells within the blood will be polarized, creating electrical dipoles. Due to the interaction of these dipoles and the electromagnetic field, the red blood cells will be subjected to dielectrophoretic forces that will accelerate them and thus the blood flow will be increased. This will, in turn, increase vascularization, transmembrane signalling, the supply of nutrients, necessary hormones and growth factors at the fracture site and thus help bone healing.
For the generation of non-uniform fields we considered three different coil de- signs (linear, parabolic and square root). Using Mathcad we numerically studied ex- tensively, the dielectrophoretic forces for a long bone fracture where the main arteries are vertically-oriented and the blood flow is downward. The gravitational force and the drag force on the red blood cells determine the steady state blood flow. The di- electrophoretic force added to the force balance is functional in increasing the blood flow.

Thesis No.: 353 Auditory Brain Response Detection Using a Portable EEG Headset

Name: Zeliha Koç Söker, Year: 2013

Advisor(s): Mehmed Özkan

Abstract: In general terms, evoked potentials are electrical signals generated by the ner- vous system in response to a stimulus. Auditory evoked potentials (AEPs) are gener- ated in response to an acoustic stimulus. Measuring the electrical response of auditory system gives many information about the status of individuals hearing. Auditory brain response (ABR) is an AEP and can be detected using EEG technology and signal pro- cessing techniques. In this thesis, an ABR detection system has been implemented. Experiment procedure was designed using auditory oddball paradigm. An acoustic stimulus has been sent to the subject and a marker about the stimulus has been sent to the recording software simultaneously while recording EEG. A low cost, wireless EEG headset was used to record EEG data under auditory stimulus from 13 subjects. Raw EEG data has been processed by using epoch extraction, event related potential (ERP) averaging, and independent component analysis (ICA) methods. Some features were extracted about the auditory stimulus. Then the extracted features were used to classify the data to understand if hearing has occurred or not under given stimulation. Results of the experiments showed that the implemented ABR detection system detected the sound and silence stimulation with 85% accuracy.

Thesis No.: 352 Similarity and Consistency Analysis of Functional Connectivity Maps

Name: Mehmet Ufuk Dalmış, Year: 2013

Advisor(s): Ata Akın

Abstract: Functional connectivity (FC) refers to statistical relations of activations of dis- tinct neuronal populations without any reference to causal or anatomic connections. One of the problems in FC studies is, to interpret the resultant FC matrix and only few studies in the literature have focused on consistency and temporal variability of FC networks. In this study functional near infrared spectroscopy (fNIRS) signals were recorded from prefrontal cortex (PFC) of 12 healthy subjects during a stroop test. Mutual information was used as a metric to determine functional connectivity between PFC regions. 2D correlation based similarity measure was used as a method to analyze within-subject and inter-subject consistency of FC maps, and how they change in time. How functional integration changes during to stroop test session was also investigated, using a graph-theoretical metric "global efficiency". It was found that within-subject consistency (0.61 ± 0.09) is significantly higher ($p < 0.001$) than inter-subject con- sistency (0.28 ± 0.13). Within-subject consistency was not found to be task-specific. Results also revealed that there is a gradual change in FC patterns during stroop ses- sion for congruent and neutral tasks, where there is no such trend in the presence of an interference effect (incongruent task). Finally it was found that, the changes in global efficiency of the FC networks during the stroop test session exhibit a parallel trend. One of the results of these findings is that it is feasible to study consistency, inter-subject variability and temporal changes in functional connectivity during a cognitive task with fNIRS.

Thesis No.: 351 Effects of Early and Delayed Laser Application on Regeneration

Name: Tüba Akgül, Year: 2012

Advisor(s): H.Özcan Gülçür

Abstract: Studies to understand the operating mechanism of the nervous system and to and new treatments for its diseases have been growing at an increased pace. To accelerate the rate of regeneration, the laser is used immediately after surgery and the protocols in literature are generally adapted to this method. After crushing or transection of nerve, the mononuclear cells invade the injured segment and remove injured nerve structure. This degenerative event takes place at the first week after injury. These two critical points gave rise to the question of this study; are there any differences between early and delayed application? In this regard, three experimen- tal groups underwent surgery (sciatic nerve was damaged by crushing for 10 minutes by applying a force of 50 N using dead-weight machine) and two of which were ad- ministrated 14-days of low dose laser irradiation. 650 nm, 25 mW laser irradiation in continuous mode was applied to the early group immediately after injury whereas the therapy started one week after in the delayed group. The healing process of the damaged sciatic nerve has been shown to be accelerated in the laser therapy groups by means of functional, electrophysiological and histological examinations. It was ob- served that the sciatic functional index (SFI) value of the laser groups approximately reached to the normal whereas the SFI of the control group did not in day 21. However, this finding was not significantly important ($p>0.05$). In addition, it was observed that the latency of the Compound Action Potential (CAP) decreased significantly ($p<0.05$) in the delayed group. Moreover, histological examinations showed that the number of mononuclear cells was lower ($p<0.05$) in the laser groups. Although further tests are needed to be more conclusive, these results indicate that the laser therapy accelerates the rate of recovery. Both laser groups had positive results. However, the delayed group showed better recovery. This result may be due to the degeneration during the first-week.

Thesis No.: 350 The Effects of Skin-Tissue Morphometry on the Mechanical Impedance of Rat Glabrous Skin

Name: Çağlar Gök, Year: 2012

Advisor(s): Burak Güçlü

Abstract: In this thesis, the mechanical impedance of rat glabrous skin was measured at two different locations: the digit and the sole in the hind paw, at two frequencies: 40 Hz and 250 Hz with amplitude of 61 μm. The force (F), the velocity (v) and the phase difference between them (φ) were measured to calculate the mechanical impedance components. Skin samples were also studied histologically from the same locations where the impedance measurements were obtained. On the microscope images, morphometrical measurements of the skin layers were performed. All mechanical impedance and morphometrical measurements were done in two different conditions: the normal and the epidermis-peeled condition. In the normal condition, two-way ANOVA showed that the effect of the location on the resistance was marginally significant ($p=0.056$), whereas the frequency had no effect ($p=0.376$). The effect of the frequency on the modulus was found to be significant ($p=0.018$); however, the effect of the location on the modulus was not significant ($p=0.684$). In the normal condition, there was a significant correlation between the resistance and the stratum corneum thickness at 40 Hz in the sole and marginally in the digit ($r=0.61$, $p=0.06$ for the digit; $r=0.94$, $p<0.0001$ for the sole). In the peeled condition, at 40 Hz, the remaining epidermis thickness in the digit was significantly correlated with the resistance, the reactance and the modulus ($r=0.91$, $p<0.001$ for the resistance; $r=0.80$, $p<0.01$ for the reactance; $r=0.90$, $p<0.001$ for the modulus). No correlations were found at 250 Hz either on normal and peeled conditions. According to these results, the impedance was found to be largely governed by resistance. The resistance of the skin was affected by the location and it was highly correlated with the stratum corneum thickness at 40 Hz. This suggests that stratum corneum may determine the mechanical properties of the skin at 40 Hz.

Thesis No.: 349 Functional Parcellation of Memory Related Brain Networks by Spectral Clustering of EEG Data

Name: Çağatay Aydın, Year: 2012

Advisor(s): Ahmet Ademoğlu/ R. Koryay Çiftçi

Abstract: The EEG signal and its oscillatory components may relate with temporal modulation of information processing of a sensory activation in a local electrical field and neural populations. In this study, we investigate the clustering information of alpha band brain networks during memory load task. For this purpose, short time memory experiment with a varying memory load combinations was designed. The functional coupling among EEG electrodes was quantified via mutual information in the time- frequency plane. A spectral clustering algorithm was used to parcellate memory related circuits in the brain in a load-dependent manner. The method was based on deter- mining the eigenspectrum of the adjacency matrix of a graph and assigning nodes to clusters with respect to this spectrum. To be able to circumvent the problem of choosing the number of clusters beforehand a soft clustering approach was implemented. It is a novel method which allows constructing significant clusters without fixing their number and increases the inside cluster significance by normalized-cut value decomposition at each clustering level. In the N- cut clustering, clustered nodes which are projected on occipital and bilateral regions increase in number with respect to the memory load. In soft clustering, inter-cluster connections between left lateral and occipital clusters are decreasing in the second time interval which can be linked to the enhancement of posterior region due to an increase in the memory demand.

Thesis No.: 348 Laser Etching of Enamel for Bonding Orthodontic Brackets

Name: Ayşegül Şen, Year: 2012

Advisor(s): Murat Gülsoy

Abstract: The aim of this study is to determine the optimum laser parameters to provide the maximum bonding strength with reference to conventional bonding technique for orthodontic braces. 1940 nm Thulium Fiber Laser was used in pulse mode and in two different parameters for enamel etching procedure. In addition, there is a control group, which had conventional acid etching technique. Laser etching procedure was carried out by two different approaches: Lasing without cooling and with cooling. For the first approach, according to the whitening of the enamel initiation, application time of laser irradiation was defined for each laser parameters. For the second approach, in order to prevent damage on alive tissue, water spray and air pressure cooling was applied during lasing to limit pulp temperature to maximum 5.5 ◦C , which is the critical temperature. After the bonding of ceramic braces, they were debonded from the enamel surface using mechanical test machine. When the bonding strength of the braces were analyzed, it was observed that the mean bonding strength of both the etching without cooling group and etching with cooling group are significantly different from acid etched group ($p<0.05$, student t-test). SEM evaluations of etched surface with laser showed that surface morphologies were not similar with acid etching group.

Thesis No.: 347 Implementation of Tomosynthesis in Dental X-Ray Imaging

Name: Arda Varılsüha, Year: 2012

Advisor(s): Cengizhan Öztürk

Abstract: Digital tomosynthesis is a method of reconstructing any number of to- mographic planes, by using a set of limited angle projections, acquired as the X-ray source moves around the object. The quality of the reconstructed planes is affected by structured artifacts, due to blur from planes other than the plane- of-interest. In this project a special multiple projection algorithm along with an out-of-plane blur removal method is implemented to improve the image quality. In-silico phantom experiments was employed to evaluate the parameters that affect the image quality in tomosynthesis. Different groups were created with varying arc lenghts and projection counts. A blur removal method was implemented during image reconstruction to increase image quality. Image quality was evaluated by both visual assessment and structural similarity analysis. The proposed noise removal algorithm resulted in images with less artifacts. Preliminary tests of the algorithm were also done in a physical dental phantom. The results showed that the tomosynthesis image reconstruction could be a promising and a low cost method to evaluate digital dental x-rays without excess radiation to the patient.

Thesis No.: 346 1940-nmThulium Fiber Laser Ceramic Bracket Debonding

Name: İrem Demirkan, Year: 2012

Advisor(s): Murat Gülsoy

Abstract: The aim of the study was to determine the proper laser parameters for 1940-nm Thulium Fiber Laser for ceramic bracket removing. In order to assess the effectiveness of 1940-nm Thulium Fiber Laser in orthodontic ceramic bracket debonding, poly- crystalline ceramic brackets were bonded to mandibular bovine teeth with adhesive agent. The samples were divided into 9 different groups due to applied laser power and laser duration, debonding method used. There was a control group that had no laser application. The efficiency of the laser was investigated together with the required debonding forces and intrapulpal temperature changes. In this study, keeping intrapulpal temperature changes below the threshold value that is accepted 5, 5 ◦C must be accepted as a must. In most of the lasing groups, the increases in intrapulpal temperature changes were observed almost below the threshold value 5,5◦C. The findings revealed that 1940-nm Thulium Fiber Laser irradiation could reduce the needed debonding force or SBS (shear bond strength) values significantly compared to control group. Irradiation of the specimens by 1940- nm Thulium Fiber Laser caused more than 50% reduction in the needed debonding force when compared to the control group. Different application methods: non-scanning and scanning were studied to assess the effects of the distinct configurations. Scanning method was tried to reduce the intrapulpal temperature rise during laser irradiation but in this study side effects of this method were faced. It was revealed that different application methods did not create any remarkable differences. In more than 50% of samples with energies 25 J or more, adhesive remnant hasn't been observed on enamel surfaces for the laser groups.

Thesis No.: 345 Development Of an Acqusition and Image Enhancement Platform for Digital Dental Imaging

Name: Abdülkadir Yazıcı, Year: 2012

Advisor(s): Cengizhan Öztürk

Abstract: With technologıcal developments in X-ray imaging, digital systems started to replace analog systems. Principle advantages of digital X-ray imaging are; it has lower cost (in the long run), is ready to be processed with a computer, could acquire 3D images and has better imaging quality even at low radiation doses. Usage of digital technology in dental imaging is also increasing rapidly. Although, dental dose levels are significantly less than other X-ray imaging techniques, its cumulative effects could be harmful in the long term. Main aim of this thesis is to set up a digital dental imaging system and to implement its image processing software. A digital dental X- ray system consists of three of the shelf components; a digital intraoral X-ray sensor, a portable X-ray tube and a computer. The new digital system and its acquisition software are tested on phantom and cadaver tests. Furthermore, effects of several image enhancement techniques on low dose dental radiographic images are examined.

Thesis No.: 344 Tactile Mental Rotation in Blindfolded and Congenitaly Blind Subjects

Name: Betül Polat, Year: 2012

Advisor(s): Burak Güçlü

Abstract: Mental rotation is the process of imagining an object rotated into a different orientation in space. This well-known visual phenomenon may be used to understand the cognitive processing by applying it to the tactile modality. Linear correlation between response times and angular orientations of the explored objects shows the mental rotation effect. Twelve sighted, 12 congenitally blind subjects participated in this study. All subjects were right handed. Gender and age were balanced. The sighted were blind- folded through the experiments. Two tactile L-shaped objects were glued on cardboards as pairs rotated at five orientations (0o, 45o, 90o, 135o, 180o). A passive touch method was developed, subjects' hands were steady on a platform and objects were placed and lifted with a lever. Subjects used their palms to passively touch the objects. The subjects were instructed to explore the objects tactually and decide if the pairs were same or different - different meaning mirror as known to the experimenter. Response times and accuracies were recorded. Correlation analysis and ANOVA were performed using Matlab. Results showed that both the blindfolded and congenitally blind subjects used mental rotation process during tactile exploration of the stimuli. The results support the idea that an analog representation is used in the cortex which totally lacked visual input. The data presented in this study, combined with the literature further supports the hypothesis that spatial properties of the objects are encoded similarly for touch and vision.

Thesis No.: 343 Volumetric MRI Analysis Of Thalamic Stroke Patients

Name: Pınar Özel, Year: 2012

Advisor(s): Ahmet Ademoğlu

Abstract: The thalamic pain syndrome is a weakly deduced phenomenon thet develops as a complication of asmall stroke in the thalamus. Because this syndrome results in many different physiologinal disturbances, it iscritical to understand its physiological basis to diagnose and to treat it. It is important to determine the whole volume of the lesion and to label it with reference to an anatomical atlas in order to identify the stroke region more accurately. In this thesis, we develop a software tool to help the neuroradiologists inperpret the stroke region more accurately by estimating its volume and identifying its anatomical label. To reduce the anatomical variability, the first step consists of spatial registration and normalization of brain images. This is achieved using the procedure implemented in the Statistical Parametric Mapping (SPM) package in Matlab. Normalized MR images are used to identify the lesions in the brain, to calculate its volume and to label it in a graphical user environment. Three types of neuropsychological tests i.e. are Mini – Mental State Examination (MMSE), Frontal Behavioral invertory (BDI) are evaluated in estimating their correlations with the total volume of selected regions. Neuroradiologists can potentially benefit from the sorfware to diagnose and to treat the thalamic stroke patients. Furthermore, such a platform may help the clinicans to interact with each other distantly by exchanging more objective information about the clinical neuroanatomical assessment of their patients. Additionally, correlation analysis of neuropsychological tests and stroke volume in the Talairach atlas plays a role for the neuropsyhologinal and neuroanatomical data fusion for better assessment.

Thesis No.: 342 Bayesian Modelling And Interference For Functional Magnetic Resonance Imaging OfThe Visual Cortex

Name: Meltem Sevgi, Year: 2011

Advisor(s): Cengizhan Öztürk

Abstract: For the most effective use of functional magnetic resonance imaging (fMRI), mapping the brain signals to a statistically valid map is crucial. The common approach to create a statistic at each voxel is applying the frequentist or the classical statistics. However, there are many challenges raised by the use of classical statistics to test the functional data such as the multiple comparison problem, and the limitation in the interpretation of the parameters. As an alternative, a Bayesian approach can be used to assess the data based on the posterior probability distributions of the parameters. In this study, the power of Bayesian inference was compared against classical inference in random effect analyses: A group data collected from visually stimulated volunteers was assessed following a simulation study. In order to assess the results of the statistical inference for the group level, the variation of the effect sizes with respect to stimulus frequency was used. A comparison was performed between the change in the effect sizes of lateral geniculate nuclei (LGN) and primary visual area (V1) during graded visual stimulation by using the posterior probability maps (PPMs) with an effect size threshold of zero. This comparison became possible with the fact that once we had the posterior probabilities the activity in LGN was able to be visualized by changing the effect size threshold and without decreasing the significance threshold, which is not possible to achieve with classical inference where the data is tested against the null hypothesis. Despite of the small magnitude of activation in LGN we could show the connectivity between V1 and LGN and the differences in response characteristics during graded visual stimulation.

Thesis No.: 341 Graph Theoretical Analysis Of Functional Human Brain Network

Name: Adem Umut Günebakan, Year: 2011

Advisor(s): Ahmet Ademoğlu

Abstract: Recent studies suggest that, human brain has a small-world behavior which is reflected by locally and globally efficient processing. To investigate this behavior a short term/working memory experiment was designed which had manipulation and retention conditions. Our goal was to be able to explore the differences between the organizations of the brain during the execution of these tasks within a graph theoretical context. The retention condition required the subject only to remember a visually applied stimulus whereas the manipulation condition to visually manipulate the stimulus before keeping it in mind. Brain activity information was recorded through the electroencephalography (EEG) device. After preprocessing, the collected EEG data was decomposed into classical frequency bands and phase locking values (PLV) between each pair of electrodes were computed with the help of the Hilbert Transform. After applying threshold to PLV matrices to build binary unweighted networks, the graph theoretical analysis was applied to determine and compare the main dynamics of functional coupling during manipulation and retention. This analysis was carried out in a time dependent manner to better monitor the variations of these dynamics. It was found that the brain exhibited a highly efficient behavior in the local and global sense both during manipulation and retention; and thus the brain had a small-world characteristic during the execution of these tasks. The statistical analysis revealed significant differences between the efficiency values of retention and manipulation. The analysis of node and edge centrality values of different frequency bands showed prominent effects in the upper alpha gamma bands. The finding of this thesis study supports the feasibility of the graph theoretical analysis for analyzing complex brain networks.

Thesis No.: 340 Effects Of Contactor Size And Stimulation Distance On The Response Properties Of Rapidly-Adapting Tactile Fibers Innervating The Rat Glabrous Skin

Name: İsmail Devecioğlu, Year: 2011

Advisor(s): Burak Güçlü

Abstract: Recent population models used space-invariant attenuation functions. But this assumption is not enough to construct realistic population models, because mechanical properties of the skin vary along the skin [1]. In this study, it is hypothesized that response profiles of mechanoreceptive Fibers are not symmetric along proximo-distal axis due to the varying mechanical properties of the skin. In this study, sinusoidal mechanical vibrations were applied perpendicular to the skin of adult rats. Single-unit responses were recorded from sciatic nerve. Five different stimulus locations (2 distal, 1 RF center, 2 proximal) and three different contactor sizes (area: 0.39 mm2, 1.63 mm2, 2.96 mm2) were used. Averages of absolute spike thresholds (a0) and entrainment thresholds (a1) of rapidly adapting fibers were plotted as a function of stimulation distance and contactor size. Also, mechanical impedance of the skin was measured at 5 different locations on distal phalanx of one rat. 2-way ANOVA showed that the effect of stimulus location on a0 and a1 was significant ($p<0.001$), whereas contactor size had no significant effects ($p=0.642$). Post- hoc Tukey test showed that thresholds for proximal stimulations were higher than those for distal stimulations. A mechanical model which explains the mechanical behavior of the skin and its effects on mechanoreceptive fibers' response is presented. According to these results rate-intensity functions of RA fibers shift asymmetrically along the proximodistal axis, which suggests that the mechanical stimulus is transmitted better towards the proximal direction. This may counterbalance the effects of innervation density and cause uniform psychophysical detection thresholds for the finger.

Thesis No.: 339 Endonenous Laser Ablation: Different Lasers And Delivery Techniques

Name: Meral Filiz Somunyudan, Year: 2011

Advisor(s): Murat Gülsoy

Abstract: Endovenous Laser Ablation (EVLA) has become a popular minimally invasive alternative to stripping in the treatment of saphenous vein reflux. Several wavelengths have been proposed; of which 810, 940 and 980- nm are the most commonly used. Ther- mal shrinkage of collagenous tissue during EVLA plays a significant role in the early and late results of the treatment. Longer wavelengths (>1000-nm) show greater water absorption than shorter wavelengths and may have some advantages for EVLA due to water molecules in the vein lumen cells. However, the most appropriate wavelength is still the subject of debate. The laser light delivery technique is another criteria that affect the success of EVLA. Bare fiber, which is generally used for medical application, delivers the laser light locally focused to application area. Radial fiber, which is a new technique for laser light delivery, emanates the laser energy homogenously circularly to vessel lumen. The aim of this study is to compare the efficacy of 980 and 1940- nm laser wavelengths in the treatment of varicose veins. In this study, 980 and 1940-nm lasers were used to irradiate stripped human veins. Different power settings (8/10W for 980- nm, 2/3W for 1940-nm) and laser delivery techniques (radial and bare fiber) were used to compare their effects. As a conclusion, 1940-nm TM-fiber laser and radial fiber are promising methods in the treatment of varicose veins.

Thesis No.: 338 Calculating The Magnitude Of Transfer Functions For Hearing Aids By Insertion Gain Measurements

Name: Yunus Karamavuş, Year: 2011

Advisor(s): Mehmed Özkan

Abstract: While the hearing loss is one of the most common problem in our lives, it is also the most compensable disability. In general, hearing impairment can be fixed by a hearing aid which amplifies sound levels at different frequencies. A transfer function of a hearing aid determines how much the input signal will be amplified at certain frequencies. However, this function may vary depending on whether the hearing aid is worn or not. Therefore, when a hearing aid is in use, expected results are mostly not achieved if the calibration is done without wearing it. This phenomena is known as a fitting problem in literature and due to the altered transfer function artifacts a small incidence of people having hearing abnormalities prefer using a hearing aid. In this thesis, to compensate the fitting problem, we designed and developed a hearing aid analyzer which uses a Real Ear Measurement (REM) method. Determining the electroacustic performance of hearing aid in situ is essential for ideal fitting and it varies according to ear shape, ear canal, and hearing sensitivity. In REM, an insertion gain measurement is obtained by inserting a probe microphone into the ear canal and calculating the gain between input and output signals. Fine tuning is performed using the transfer function based on insertion gain measurement. REMs allow determining individual based, actual characteristics of hearing aids. The superiority of our system comes from the fact that it is capable of measuring the transfer function while the hearing aid is in situ. Moreover, our design is battery powered and small in diameter which makes it portable. Finally, our system complies with international standards.

Thesis No.: 337 Software Development for X-Ray Fluoroscopy And MR Image Fusion

Name: Emre Özdal, Year: 2011

Advisor(s): Cengizhan Öztürk

Abstract: In interventional radiology, treatment is routinely done under X-Ray Fluoroscopy (XF) using special catheters or needles. XF is a fast modality and allows one to follow the endovascular path with contrast injections and to track devices during the interventions. On the other hand, one of the most important problems in XF imaging is the lack of soft tissue contrast; besides the obvious problem of ionizing radiation. During the intervention, additional soft tissue information could decrease the risk by providing important extra guidance to the surgeon. For instance: in endovascular cardiac interventions, detailed anatomical positions of infarcted segments of the heart could highlight target or weak zones on the myocardial wall. Main goal of this study is to overcome the lack of soft tissue contrast of XF. To achieve this goal soft tissue information gathered from a priori imaging modality is used. MRI is the best candidate with excellent soft tissue contrast and ability to image any cross section in the scanned volume. On the other hand, MRI has deficient features in temporal resolution when compared to XF, instrument compatibility problems with high magnetic and RF fields and limited patient access because of the shape of the magnet bore. Therefore combination of these two modalities all deficient features could be avoided by complementing each other. Combined usage of XF and MRI requires registration of images from both modalities and a reliable software platform is needed for preclinical and clinical studies. In this work, a new implementation of XFM Suite in Extensible Imaging Platform (XIP) software provides all the tools for X-Ray fused with MRI (XFM) clinical studies performed in X-Ray-MRI suites (XMR) with real-time registration and fusion of images.

Thesis No.: 336 Intraoperative Measurement Of Human Spastic Gracilis Muscle Isometric Forces As A Function Of Knee Angle

Name: Fatma Oya Aytürk, Year: 2011

Advisor(s): Can Yücesoy

Abstract: Spasticity is a neuromuscular disease which is associated with increased muscle tone, stiffness and impaired motor control and consequently functional limitations. Improved understanding of spasticity requires the collection of substantial directly measured length-force characteristics of spastic muscles. Studies including direct measurement of human muscle force are very rare due to limited access to the muscle. With the method developed in this study, isometric length (knee-angle)-force characteristics of human spastic Gracilis muscle are measured intraoperatively for the first time in literature. Experimental data is collected during the surgical operations performed by Prof. Dr. Yener Temelli and his group in Istanbul University School of Medicine. In 7 subjects (average ager: 8±4.6), isometric muscle forces are measured by buckle force transducers at five different knee angles (of 120°, 90°, 60°, 30° and 0°). Mean peak Gracilis muscle force and mean optimal knee angles are measured to be 41.19±41.07 N and 30±31.6° respectively. Knee-angle force characteristics of 7 subjects showed inter-subject variability and peak Gracilis muscle forces were not correlated with the anthropometric data of subjects. Gracilis muscle exerted non-sero force in each condition indicating that functional joint range of motion is at least as wide as from full knee extension to 120° of knee flexion. A finding of major importance is that knee angle-force characteristics of spastic Gracilis muscle are found to be not representative of the pathological condition occuring at the joint and are comparable with the ones obtained from healthy subjects in a previous study of our research group. Moreover, length history of muscle was shown presently to affect muscle force in most of the subjects.

Thesis No.: 335 Design Of A 32" Colr TFT LCD Pacs Monitor And Its Clinical Evaluation Through ROC Analysis

Name: Sadık Hakan Kayabaşı, Year: 2011

Advisor(s): Albert Güveniş

Abstract: One of the most important stages in digital radiology process is the transfer of the image to the observer, as the variations in light and color from a physical display. The common practice in observing these visual results is to use a medical grade LCD monitor. The main problem with medical grade monitors is their high cost. First objective of the study was to design a 32" LCD PACS monitor to be as compatible as possible to a medical grade LCD monitor with a remarkable cost advantage. The second was to test the hypothesis for a significant difference between a medical grade LCD monitor and the designed one in terms of diagnostic image quality. After the design's validation, 60 digital radiographs with definite findings were obtained in cooperation with the authors of a previous study. Three experienced radiologists from Acıbadem Hospital examined these radiographs both on a medical grade Reference branded LCD monitor and on the 32" design. To check observers' performance, the receiver operating characteristic (ROC) curves for all monitor-reader cases were statistically compared by using the same content and observers. The area under curve (AUC) of each ROC curve was used as a metric for detecting lung modules in the radiographs. With 95% confidence interval, the hypothesis was tested for a significant statistical difference between the related monitors. AUC for Reference monitor for observer 1, 2 and 3 were calculated as 0.634, 0.703 and 0.755 respectively. AUC for 32" design were 0.811, 0.746 and 0.811 For observer 1, the 32"design showed superior performance. For observer 2 and 3, Though AUC was far better on behalf of the new design; no significant statistical difference could be proven. As a result, it is possible to implement the new 32" design as a PACS monitor for medical diagnosis purposes without sacrificing any diagnostic value.

Thesis No.: 334 Autostreoscopic Displays In Computer Assisted Surgery

Name: Caner Gümüş, Year: 2011

Advisor(s): Mehmed Özkan

Abstract: Using images for diagnosis, therapy and surgery is a widely used option as evidenced by many articles in the literature. In conventional systems standard two-dimensional (2D) displays are used to view the images even though the images are three-dimensional (3D) reconstructed. In this study, we used a computerized surgical assistant whose core functionalities are provided by an open source software package called Slicer. Slicer uniquely integrates several facets of image quided therapy into a single environment and has capabilities for visualization, surgical planning and guidance. We performed basic tasks of computer assisted surgery such as registration, segmentation, surface model generation and 3D visualization on medical images and displayed the reconstructed images on an autostereoscopic display so that the images with depth can be viewed without the need to wear any special eyeglasses or headgear.

Thesis No.: 333 Comparion Of Particle Counting And Microbiological Sampling Methods At Rest And During Surgery

Name: Ahmet Emir Kavak, Year: 2010

Advisor(s): Yekta Ülgen

Abstract: Air quality monitoring in operating rooms is of prime importance because particles that carry microbiological contamination generate serious risks during surgical operations. Air quality monitoring is executed by two separate methods: Microbiological sampling and particle counting. The aim in this project is to investigate statistical correlation between these two methods. If so, particle-counting technique could replace frequent microbiological sampling. Microbiological sampling and particle counting techniques are applied in five operating rooms located at three different hospitals with a total number of 360 measurements taken before (at rest) and during surgery. Spearman's correlation coefficient is used for measuring the level of correlation between two methods. The bacteria counts are classified after their sizes and tested for size-by-size correlation. Then, the bacterial counts measured at the same site are cumulatively added together and correlated with the particle counts at each particle size-range. No correlation is found when size-by-size correlation is performed. When cumulative bacteria counts are considered in 'at-rest' conditions, the number of particles in 5.0-10.0 μm and 10.0-25.0 μm size ranges correlated with bacteria counts. Particles of 1.0-5.0 μm size ranges and particles larger than 25.0 μm correlated with bacteria counts during surgery.

Thesis No.: 332 Cole Parameters Of Human Blood With Different Anticoagulants

Name: Fatma Gülden Şimşek, Year: 2010

Advisor(s): Yekta Ülgen

Abstract: Impedance spectroscopy of blood samples with Acid Citrate Dextrose, Ethylene Diamine Tetra-acetic Acid, Lithium Heparin and Sodium Citrate anticoagulants are performed in the frequency range 20Hz-1MHz, using the two probe method, at room temperature. The measurement cell is a cylindrical-like plastic tube of 1.45 cm diameter and 14 ml volume with two stainless-steel electrodes. Blood samples of 5 ml are drawn from 9 healthy male donors between ages 22 to 28, and centrifuged at 5500 rpm for 8 minutes to constitute different hematocrit values in the range from 29% to 60%. Multifrequency impedance measurements are fitted to Cole-Cole diagrams using the Matlab algorithm; Cole parameters R0, R_∞, fc and alpha (α) are then used to model the equivalent electrical circuit of blood. Only high frequency data (100 kHz-1MHz) are used in fitting the Cole circle where effects of electrode polarization are negligible. It is later shown that this is acceptable since the characteristic frequency of the blood samples occurs around few MHz. Resistivities of plasma alone are measured as 70±1.3 Ω.cm : 79.2±1.3 Ω.cm: 72±3.4 Ω.cm and 78.3±1.2 Ω.cm for EDTA, LH, SC and ACD respectively. At 100% hematocrit when the extracellular conductivity is zero the intracellular resistivities are 200 Ω.cm for EDTA; 214 Ω.cm for LH; 261 Ω.cm for SC and 176 Ω.cm for ACD. The rate of increase in extracellular resistance with Ht is measured higher with LH and EDTA. In the physiological range of hematocrits, Re is the highest with LH and lowest with SC; at h=0.6 LH samples are 34% higher than SC samples. The characteristic frequency fc changes with the type of anticoagulant; the frequency span at Ht=50% is from 0.8 MHz (LH) to 1.1 MHz (ACD). The angle of depression is the highest with LH.

Thesis No.: 331 Analysis Of Effects Of Manual Therapy On Muscular Mechanics Using Finite Element Modelling

Name: Selen Ersoy, Year: 2010

Advisor(s): Can Yücesoy

Abstract: In this present study, the specific goal was to evaluate the mechanical effects of manual therapy quantitatively. Physiotherapists primarily aim for increasing the range of motion of restricted joints during treatment, therefore lengthening of the target muscle was highly important for this study. Simulation of therapeutic loading was applied at three different locations (Location P, I, and D) for single loading cases and at two different locations (Location P, I and Location I-D) for multiple loading cases on EDL muscle model of rat with extramuscular connections. Nodal strain percentage changes of Case P, Case I, and Case D and Case P, Case P-I and Case I-D loading cases were compared. Loading the muscle at a proximal location yields more pronounced percentage changes for both fiber and cross-fiber direction nodal strain and for strain distributions. These effects were shown to be more substantial for compressive loading compared to loading in tension. Our results also suggest that increasing the number of loading locations does not provide any notable improvement in the intended effects of manual therapy. Our results should be tested in clinical environment to have a scientific basis of the effects of therapeutic loading of muscles.

Thesis No.: 330 Effects Of Preconditioning Over History Effects In Skeletal Muscles Of Rat

Name: Yusuf Turgay Ertugay, Year: 2010

Advisor(s): Can Yücesoy

Abstract: It has been already known that activity at high lengths, leads at least, to major decreases of active force at low lengths, whereas forces at high length are hardly changed. This impact on muscle force is named as length- history effects. And it has been experienced that such effects can be minimized by a method called preconditioning in which alternating contractions are done at high and low lengths until no further decreases of active force at low lengths are seen. However, whether preconditioning does minimize the history effects or not, has not been investigated systematically in any studies so far. One of the goals of this study is to be able to observe the effects of history effects in repeated measurements by taking control measurements. Another aim of this work is to assess the effects of preconditioning over history effects in rat muscles. In order to achieve this goal, length force graph was obtained on the extensor digitorium longus (EDL) as well as to that of its synergistic muscles i.e., TA+EHL complex. Then preconditioning was performed. After that, three more length force graphs were obtained again to quantify the changes to the forces produced by these muscles. In this study, it was found that preconditioning helps to minimize the history effects in EDL distal tendon. In contrast to EDL distal, control measurement shows that preconditioning performed by EDL lengthening distally is not a solution for force decreases in EDL proximal although after preconditioning EDL muscle seems history-free. On the basis of results obtained from TA+EHL complex, the measurements taken from neighboring muscle is reliable for analysis. As a result, it can be said that any studies involving control measurement should perform preconditioning to minimize history effects. Our results therefore provide a better way to minimize the history effects for the scientists designing muscular mechanics experiments involving rat muscles.

Thesis No.: 329 Mechanıcal Effects Of Botulınum Toxın Treatment On Isolated Muscle:Assesment Of Theoretıcal Paralyzatıon Patterns Vıa Fınıte Element Modelıng

Name: Ahu Nur Türkoğlu, Year: 2010

Advisor(s): Can Yücesoy

Abstract: The specific goal of the present study was to take an initial step in explaining the effects of Botulinum toxin treatment used fort he muscle pathologies such as spasticity on muscle mechanics via myofascial force transmission, which we believe is a major determinant. For this purpose an isolated EDL muscle model generated using the finite element method was used. In order to determine the effect of paralyzation location three cases were studied: Proximal half passive, middle half passive and distal half passive. Strain and stress distributions and length- force relationships of these cases were compared. Length-force relationship showed about 0.5 foce drop at optimum length for all three cases whereas at low lengths, distal half paralyzed case showed up to 0.15 more force reduction than other two cases. This result may be significant for spastic muscles since they are reported to operate at low

muscle lengths. Also range of active force exertion decreased up to 0.23. A significant result obtained from strain distributions is that the mechanically operational parts, i.e. parts that are not affected by Botulinum toxin showed less shortening compared to their counterparts in the non-paralyzed muscle. It is evident that this effect arises from the interaction between mechanically operational and paralyzed muscle portions. Such effect is a clear indication of intramuscular myofascial force transmission pathways.

Thesis No.: 328 Investıgatıng The Effects Of Ceramıde And Sphıngomyelınase On The Nmda Receptör Of Hıppocampal Cell

Name: Fatma Tuğba Köker, Year: 2010

Advisor(s): Hale Saybaşılı

Abstract: Ceramide is a structural membrane component which plays important roles in carrying the message about the fate of cell such as apoptosis, differentiation or cell growth. Also, hippocampus is a very important region for transferring the information in central nervous system and NMDA receptors are related with learning and memory. Various pathological conditions occur as a result of differences in neuronal activities in hippocampus. Therefore, in this study, the effects of C2-ceramide (10 μM), C2- dihydroceramide (10 μM) and sphingomyelinase (30 mU/ml, 50 mU/ml) on NMDA receptors of hippocampal CA1 pyramidal neurons were investigated by using the patch clamp technique. It was observed that C2-ceramide had a depression effect on NMDA currents. C2-dihydroceramide, which is the inactive form of C2-ceramide, depressed the amplitude of NMDA currents, as well. In addition to that, sphingomyelinase which activates the formation of ceramide applied at two different concentrations. Both of them decreased the amplitude of NMDA current, so they had the same effect as C2-ceramide. Besides being a second messenger in the cell, C2-ceramide and also C2- dihydroceramide may have some modulatory effects on the cell membrane. Therefore, it is possible that sphingomyelinase interacts with the cell membrane directly to form ceramides. In conclusion, ceramide molecule plays an important role in the regulation of glutamate mediated NMDA currents which plays important roles in hippocampal plasticity, where clarification of its role requires further investigations.

Thesis No.: 327 Acorrelatıonal Study Between Serum Cytokıne Measures.Volumetric Mr Measures And Global Cognıtıve Changes In Alzheımer's Dısease

Name: Mehmet Tardu, Year: 2010

Advisor(s): Ahmet Ademoğlu

Abstract: Earlier detection and diagnosis of Alzheimer's disease (AD) would permit earlier intervention, which conceivably could delay progression of this dementing disorder. In order to accomplish this goal, reliable and specific biomarkers are needed. Unfortunately, there is no yet such a universally accepted biomarker. In this study, we aimed to analyze the association between volumetric MR measurements and possible AD related serum cytokine biomarkers and to determine biological and clinical predictors for patients at high risk to develop AD. 28 AD patients and 16 healthy controls were participated to the study. For this study biochemical markers (IL-1 , IL-1 , IL-10, TNF-) which were considered to play a pivotal role in the inflammation process during AD were chosen. Additionally, volumetric MR measurements were done to determine atrophic regions in the brain of AD patients. For this purpose, a fully automated software (FreeSurfer) was used. First of all, our ELISA measurements indicated that patients with AD produce increased quantities of pro-inflammatory cytokines (IL-1 and TNF-) than normal subjects and these results supporting the hypothesis that a pro-in ammatory phenotype contributes to AD. ROC curve analysis showed that IL-1 and TNF- serum levels could not be used as a diagnostic test tool. However, serum IL-1 level might be a better candidate to make a better diagnostic decision. Secondly, regression analysis revealed that serum IL-1 level had a significant linear relation with the volume changes of cerebral white matter and amygdala/hippocampus. Additionally, the Mini-Mental State Examination (MMSE) score was used as a scale of AD severity. Regression analysis emphasized that serum cytokine levels did not have a significant relation with the severity of cognitive impairment.

Thesis No.: 326 Mcdemas-Medical Devide Maıntenance Management System Via Remote Access

Name: Ülkü Doğan Balcı , Year: 2010

Advisor(s): Mehmed Özkan

Abstract: As the technology improves rapidly, diagnosis and treatment devices that directly affect human health increase in number and variety. Unfortunately, these devices carry their own risks. Any hazardous/defective device can harm user or patience; or miss-calibrated devices can give birth to wrong diagnosis and treatment. Thus, medical devices' proper selection, planned and in time periodic maintenance, repair and calibration processes become more of an issue. The aim of the study was to develop a medical device maintenance management software which would keep inventory of medical devices; their maintenance procedures and repair/maintenance histories; and would automate maintenance scheduling process, using the proper algorithm for maximum efficiency. Another aim was to make it possible to carry out and complete the maintenance process remotely, making use of proper maintenance procedures. In the proposed study, a medical device maintenance management system, MEDEMAS was designed and implemented which provides a data pool of medical devices, maintenance procedures and related information. The system also contains repair and maintenance history of devices. MEDEMAS creates optimal maintenance Schedule for devices and enables to carry out and report maintenance processes via remote access. The study aims to make the maintenance process more accurate, efficient, faster and easier to manage and organize; and much less confusing. Accumulated history of the devices and personnel helps in risk management and replacement planning.

Thesis No.: 325 Image Qualıty Evaluatıon Of Ultrasound Images Usıng Computer Sımulatıon

Name: A.Levent Kurtoğlu, Year: 2010

Advisor(s): Albert Güveniş

Abstract: Image quality, for scientific and medical purposes is defined as how well the desired information can be extracted from the image thus the principal research goal in medical imaging is the development of data acquisition and reconstruction procedures that can produce consistently good clinical images to be able to make precise and accurate diagnoses. Parallel to other imaging modalities, ultrasound imaging made also massive breakthroughs in the last decade in terms of its image quality and archiving modalities abnormalities in the body are better observed with a region specific ultrasound probe, which works within a certain frequency border and the images yielded are subjected to certain filters to remove the noise, blur or clock that arise because of reasons such as body fat, location of the lesion or minor malfunctions in the hardware etc. For diseases with long term follow-up, the images are compressed and stored, for being able to examine later on or some images obtained in a distant part of the world are transmitted via internet for telemedicine applications. This work intends to make an evaluation of medical images, using real and simulated ultrasound images compressed via lossy algorithms, to examine the feasibility of a simulation procedure for assessing compression algorithms, to investigate the performance of those and to make comparisons between the different sources of errors and the compression errors that effect the image quality.

Thesis No.: 324 A study On The Neuroendocrine Hormone Levels And Psychophysıological parameters In Excessıve Computer Game Playıng Young Male Adults

Name: Taliha Paşaoğlu, Year: 2010

Advisor(s): Burak Güçlü

Abstract: Excessive gaming may be considered a behavioral addiction similar to gambling. In order to test this hypothesis, the activity of the autonomic nervous system was recorded (heart rate and skin conductance) and neuroendocrine hormone levels were measured (cortisol, dopamine, -endorphin) in 16 subjects who played computer games excessively (>28 hrs/wk) and in 16 subjects who played infrequently (ages: 19-27). ANOVA was used to study the factor effects. The excessive players had significantly higher skin conductance uctuations than non-excessive players. Their mean heart rates were also marginally higher than the heart rates of non-excessive players. For both subject groups, heart rate fluctuations were lower in game sessions compared to control sessions. Cortisol levels were found to be decreased in both groups after each session compared to the beginning of the session. In excessive game players, skin conductance fluctuations and -endorphin levels were negatively correlated; heart rate mean and dopamine levels were positively correlated. In non-excessive players, skin conductance fluctuations and cortisol levels were positively correlated. These results show clear difierences of autonomic responses in excessive game players. Although we could not find a direct difference in excessive players regarding hormone levels, correlations show evidence of significant changes in their neuroendocrine systems.

Thesis No.: 323 Design Of A Brain Computer Interface Based On EEG

Name: Ozan Günaydın, Year: 2010

Advisor(s): Mehmed Özkan

Abstract: A Brain Computer Interface (BCI), sometimes called a Brain Machine Interface (BMI) is a communication device between the brain and an external device, usually a computer. The main purpose of BCI systems is repairing or assisting human motorsensory functions by asking the brain to control synthetic devices, computer cursors or robot arms. In order to extract information from the brain, physical source of information must be selected rst. Electroencephalography (EEG), Magnetoencephalography (MEG) and Functional Magnetic Resonance Imaging (fMRI) could be the sources of information. In this thesis, both acquisition hardware and software of a two channel EEG based brain computer interface was designed. EEG based BCI systems are usually implemented by analysis and classification of specific features or patterns in the spontaneous or event related EEG activity. After investigation of the components in EEG, motor imagery related mu and beta rhythms were selected for the information sources of the system. In order to discriminate left and right hand movement imagery, three different feature extraction methods were developed using: Discrete wavelet transform, power spectrum transform and band pass FIR alters for Mu and Beta rhythms. These features were used as inputs to a two layer feed forward back propagation neural network for classification. Designed system was trained and simulated with the data provided in BCI Competition II. With the direction of the results, a low power system with the TI MSP430 microcontroller using FIR alters and a neural network was implemented.

Thesis No.: 322 A Mathematical Model For Cerebrovascular Dynamics

Name: Melis Alptekin, Year: 2010

Advisor(s): Ata Akın

Abstract: Human brain goes through a number of physiological changes in daily life. Some of these changes can be observed with optical imaging methods at near infrared light range. The aim of this study is, by using functional near infrared spectroscopy (fNIRS), with a specific experimental protocol, estimating the venous compliance and resistance values of the brain by constructing a three-element Windkessel model and observing oxygenation and blood volume with respect to time. For this purpose, 10 healthy volunteers participated and measurements were taken from their prefrontal cortex during the experiment. When the subjects are in supine position, they were asked to move their heads down to their knees and they stayed in this position for 30 seconds. fNIRS signals were analyzed to represent right and left hemisphere. Therefore, in each hemisphere, maximum and minimum points of blood volume showed no significant difference for men and women. (left hemisphere: for Vmin; p=0.12, for Vmax; p=0.22; right hemisphere: for Vmin; p=0.073, for Vmax; p=0.074). Without taking sex difference into account, Vmin and Vmax values of right and left hemisphere are not significantly different (respectively p=0.22, p=0.069). For compliance values, there is not a meaningful difference between left and right hemisphere. (p= 0.38). For resistance values between right and left hemisphere, we found a significant difference (p=0.04). Therefore, this study implies that there is not a meaningful difference in a young subject group with respect to brain hemodynamics and parameters but only the resistance values. This model may be also used in an elderly or diseased group to observe brain hemodynamics.

Thesis No.: 321 Advanced Registration Tools For XFM

Name: Fevzi Aytaç Durmaz, Year: 2010

Advisor(s): Cengizhan Öztürk

Abstract: Minimally invasive therapies are very common in today's healthcare. Many procedures which require invasive surgery, with its associated long recovery times and high cost, can now be performed more effectively, with less trauma to the patient, by using smaller incisions and specialized surgical instruments. During interventional studies X-ray Angiography provides us with high resolution images at sufficient frame rate, but it doesn't have the desired soft tissue contrast. MR imaging on the other hand provide 3-D anatomic imaging with excellent soft tissue contrast. Our aim is to fuse 2-D X-ray images with a priori 3-D MR volumes during medical interventions to assist physicians. X-ray fused with MRI (XFM) is an approach which combines strengths of both image modalities to improve the quality of image-guidance during minimally invasive interventions. In XFM, pre-operative MR images are segmented, 3D structure of target area is reconstructed from these segments, and after registration its projection is overlapped on top of live images during X-ray fluoroscopy. Fusion of two modalities requires registration which could be achieved by using several algorithms. In this study we are using an intensity based 2D-3D registration algorithm rigid, multimodality intrasubject registration using mutual information between two modalities. The results of intensity based algorithm is compared with fiducial based registration results for the same datasets. Our preliminary results show that our method has the potential to locate the MR image on top of 2D X-ray image with high accuracy in fusing both modalities.

Thesis No.: 320 Computerized Bone Age Assessment For Zero-To –Seven Age Interval

Name: İsmail Enes Özkalay, Year: 2010

Advisor(s): Albert Güveniş

Abstract: The goal of this thesis is to study the use of neural networks for radiological bone age assessment from hand and wrist x-ray images is done. Carpal bones have been considered for bone age assessment. While the both semi-automatically and manually marked carpal bone features are given to our system as inputs, bone age is produced as an output. Additionally, chronological age, radiologist readings and sex information are used besides carpal bones and finally, the results are investigated. In this study, real data sets have been used. This study is important because a very simple and efficient method by using all 7 carpal bones is developed for assessing the bone age of children instead of the complicated methods in the literature. This semi-automated method also improves the time efficiency compared to the widely used manual methods such as GP, TW2. Inclusion of carpal bones for assessing bone age of children is mandatory. However, due to various factors including the uncertain number of bones appearing, non- uniformity of soft tissue, low contrast between the bony structure and soft tissue, automatic segmentation and identification of carpal bone boundaries is a hard endeavor. In this study, semi-automated carpal bone segmentation and age assessment software is developed and implemented. Also, neural network classification is used to assess the bone age depending on the selected features from carpal bones. In our application, 236 training images and 58 test images are used for 0 to 7 age group. After application, it is illustrated that results are considerably comparable with both chronological bone age and the two radiologist readings. We therefore conclude that the developed system may replace the manual methods for improved speed and comparable accuracy.

Thesis No.: 319 Automatic Postprocessing And Reporting Tools For Functional Neuroimaging

Name: Engin Demirel, Year: 2010

Advisor(s): Cengizhan Öztürk

Abstract: For advanced magnetic resonance imaging (MRI) applications, reporting and postprocessing tools have been designed. The software tools developed consist of DICOM structured report (DICOM SR) preparation, functional image overlay onto anatomical Standard atlases, lateralization calculations, maximum Z value and location analysis and mean Z value analysis for cortical and subcortical brain regions. Abstract Radiologists can view the functional image overlayed onto the anatomical ones, visualize the activated regions and edit DICOM SR accordingly with the image references. Lateralization calculation is automatically done and displayed on the user interface. Maximum Z value is found and shown on standard anatomical atlas in axial, sagittal and coronal planes with the waveform of the maxima through the time points of the data analyzed. The software finally provides the user with DICOM SR and rich text format (RTF) output including edited DICOM SR text fields, referenced images, lateralization or maximum Z value calculations.

Thesis No.: 318 Rotenone Interference With Neuronal Transmission In Hippocampus

Name: Fatih Akkentli, Year: 2010

Advisor(s): Hale Saybaşılı

Abstract: Rotenone is a pesticide and insecticide, which causes behavioral, biochemical, and neuropathologic changes in rats that closely resembles PD symptoms in humans. It is known that this pesticide inhibits mitochondrial complex-I, which has an important role in cellular energy production. The object of the current research is to investigate the effect of rotenone on synaptic transmission between neurons in hippocampus, especially its effect on the glutamergic transmission. For this purpose, CA1 pyramidal neuronal response upon low frequency stimulation of Schaffer collateral (0.1 Hz) was recorded by patch clamp tight-seal whole cell recording technique from CA1 pyramidal neuron of rat hippocampus. Different rotenone concentrations were tested on glutamate current; it was observed that rotenone effect on the amplitude of glutamergic currents is dependent on its concentration. To eliminate the rotenone induced cytoplasmic second messenger system effect, ATP was excluded from intra-cellular solution in experiments. Thus, observed effects of rotenone on glutamergic currents occur via its direct effect on cell membrane receptors rather than rotenone-induced intracellular enzymatic or mitochondrial activities.

Thesis No.: 317 Effect Of Diabets Meelitus On Gastric Motility: An AGG Study

Name: Aydın Duygu, Year: 2010

Advisor(s): Ata Akın

Abstract: Longstanding diabetes mellitus is associated with gastrointestinal symptoms and disturbances of gastrointestinal motility. Diabetic patients with a history of microvascular and macrovascular complications such as retinopathy, nephropathy, and neuropathy frequently have diabetic gastroparesis. Diabetic gastropathy includes a number of neuromuscular dysfunctions of the stomach, including abnormalities of gastric contractility, tone, and myoelectrical activity in patients with diabetes. The main pathogenetic factors in diabetic gastroparesis are vagal autonomic neuropathy and, interstitial cells of cajal pathology. Slow waves and spike activities are the well-known components of stomach myoelectricity. Electrogastrography, a technique using electrodes positioned on the abdominal skin records gastric myoelectrical activity, or the gastric electrical slow wave, which is responsible for controlling the maximal frequency and the propagation of distal gastric contractions. Electrogastrography is one of the many tests of gastrointestinal function which were proposed to evaluate patients with unexplained nausea, vomiting and other dyspeptic symptoms. Understanding of the gastric neuromuscular function in diabetic patients may be an important component to consider in therapy, selecting appropriate drugs to regulate gastric emptying, and designing therapy for individual patients. However EGG has not been used commonly in clinical practice in order to diagnose or screen diabetic gastropathy. Therefore the main objective of this study is to record gastric myoelectrical activity of diabetic patients and healthy person with EGG in order to evaluate the impact of diabetes mellitus on gastric myoelectrical activity. Another objective of this study is to detect gastric spike potentials by using surface electrodes. At present, recording of the spike potentials from human by using surface electrodes are not reported while it was reported that cutaneous recording from dogs was achieved. In this study with a different approach from conventional EGG, the power spectrum was further analyzed for its major two peaks in the slow wave (2-15 cpm) and spike activity (50-100 cpm) ranges in order to show that high frequency waves may reflect peristaltic contractions.

Thesis No.: 316 The Effects Of Irradiation On Bone Fracture Healing: Can It Promote Mineralization At Low Doses?

Name: Nurettin Heybeli, Year: 2010

Advisor(s): H.Özcan Gülçür

Abstract: Non-union, or delayed union of a bone fracture poses a major burden both to the individual and society. This experimental study investigated the hypothesis that low dose irradiation can enhance fracture healing and mineralization. Standardized transverse femur fractures were created and intramedullary fixed with an open technique to forty young adult, male Sprague-Dawley rats and randomized to RT (irradiation with 1 Gy) and C (controls, sham treatment) groups. At third and sixth week after fracture, high resolution Bone Mineral Density (BMD) analysis, bone scintigraphy and radiographic examination with a mammography device were performed to subgroups (RT3, C3, ve RT6, C6) and rats were sacrificed for histopathological examinations. Statistically significant differences were found at sixth week; as BMD index was found to be higher in RT group ($p = 0.006$) and BMD value was found lower in the non-fractured regions of the irradiated femurs ($p = 0.005$). No statistically significant differences were found between groups for other parameters. Lamellar bone formation was disorganized at group RT6 when compared with controls by histopathological examinations. The results showed increased mineralization at the fracture site only when compared with irradiated non-fractured bone region, which cannot be regarded as a basis for clinical practice. However, when applications like heterotopic ossification prophylaxis are considered, the issue remains to be solved by molecular techniques, specifically for doses between 1 and 5 Gy.

Thesis No.: 315 Hardware Interface For A 3-DOF Surgical Robot Arm And A 6-DOF End Effector

Name: Ahmet Atasoy, Year: 2010

Advisor(s): Mehmed Özkan

Abstract: Robotic surgery aims minimum soft tissue damage and minimum operator intervention by employing automated, precise electro mechanical devices. In this project the hardware components of a surgical robot are integrated for orthopedic surgery. For this purpose an existing robot arm prototype is modified to operate a surgical end-effector that is designed specifically for orthopedic surgery. The electronic control system for both the arm and the end-effector are designed in this study. In addition motor drive circuits of the end-effector were designed. Control interface of both units, the arm and the end-effector were implemented in hardware and also in software. While serially articulated robot arms are easy to handle, precision requirements of dynamically active robots in surgery are very demanding. To overcome the problem we integrated a serial robot arm with a parallel end-effector. The serial arm is responsible for handling the end-effector on the surgical site at a relatively static position. The end-effector on the other hand, applying a dynamically changing force while moving the surgical tool on the operation area. Parallel stewart platform is preferred for the end-effector design to increase the accuracy. Therefore the design includes two system structures; a stewart platform 6-DOF as the end effector, and a 3-DOF serial robot arm to hold the end effector.

Thesis No.: 314 Remote Quality Assessment And Research Support Systems For Advanced MRI Studies

Name: Ertuğrul Akbaş, Year: 2010

Advisor(s): Cengizhan Öztürk

Abstract: User interventions and quality assessments are usually necessary for diagnostic and experimental MRI studies. The main motivation of this study is to develop a software package which enables users to remotely control distant console, communicate with physician and/or technician via on-line messaging transfer system and control MRI scanner software when necessary. This platform consists of main console and sub-modules. Main console and sub-modules were programmed with Borland Delphi 7 which is object oriented programming language based on object Pascal. While current sub-modules were programmed with Delphi, it's possible to include future applications which are developed with different languages/compilers. Application is based on client-server architecture and connection protocol is TCP/IP. Remote control system and its sub-modules let users/researchers connect to distant computer systems (e.g. one at laboratory, one at hospital etc) and allow them to operate remotely which could improve productivity and optimize time and error management. The main idea is development of a remote control system for quality assessment and remote support system for MRI scanners.

Thesis No.: 313 Biomedical Design For Improving The Primary Stability Of Dental Implants In Poor Bone Quality

Name: Sarkis Sözkes, Year: 2010

Advisor(s): Sabri Altıntaş

Abstract: Like so many other discoveries, clinically reliable dental implants were preceded by a serendipitous observation, rather than a logical chain of experiments, leading to the final product. In an attempt to film the microcirculation of rabbit bones, Branemark noticed that the metallic cap at the end of a fiber optic cable embedded in the bone of an experimental animal had apparently become fused to the bone after remaining in situ for some days. This observation led him to postulate that the metal of the end cap, namely titanium, had properties that could be valuable in the construction of dental implants. In order to test his hypothesis, Branemark and his collaborators began a series of experiments, first in animals and later in humans, which led to the development of the first reliable dental implant. The development of new systems has been accelerated in last years and implants became a treatment modality in modern dentistry. Even though there are many types of implants available in the medical applications, some developments are required regarding the need of improving the success of surgical interventions. The research implemented to use titanium which is well documented to provide all necessary mechanical and bio-compatibility requirements. The focus is to propose a new implant design, not conical or cylindrical designs which are actual designs applied, but a new design which will resemble the tooth anatomy as with roots, thus increase the primary stability and open new indications to implant applications. The results of the study indicates promising positive future directions but further controlled clinical in vivo research is needed for better understanding the action mechanism of the developed implant design. After the modifications are applied by the data collected from controlled clinical in vivo research will be realized, developed implant design can open new treatment indications in implant dentistry.

Thesis No.: 312 Tracking The Quality Of A Biomedical/Clinical Engineering Unit Using Statistical Process Control

Name: Dilara Türegün, Year: 2009

Advisor(s): Albert Güveniş

Abstract: Since, healthcare is an ever-changing environment, it is vital for each institution to be prepared to face and consequently conquer technological future advancements in medicine. This can be accomplished by careful selection of appropriate indicators which are essential to measure the performance and quality of processes and their improvements. Statistical process control (SPC) is a key approach to quality improvement. Control charts, central to SPC, are used to visualize and analyze the performance indicators over time. In this study, SPC principles were incorporated into. NET Framework on MS Windows to design and develop a control system for biomedical engineering departments in hospitals. With the use of the software developed, biomedical/clinical engineering departments' processes were analyzed using real time SPC techniques (X control chart and Cusum control chart), which permitted monitoring, controlling and improving the implementation of different quality and performance indicators through analysis. This expert system enables the user to be notified of any potential problems, just in time to implement various techniques for their improvement.

Thesis No.: 311 Ceramic Bracket Debonding With Infrared Lasers

Name: Ayşe Sena Sarp Kabaş, Year: 2009

Advisor(s): Murat Gülsoy

Abstract: Orthodontics is a specialized branch of dentistry aiming to produce a healthy, functional bite, creating greater resistance to disease and improving personal appearance. Orthodontic brackets are small attachments used in orthodontics to fasten an arch wire. One of the types that used is ceramic brackets provide higher strength, more resistance to wear and deformation, better color stability and preferred for cosmetic reasons. After treatment ceramic brackets needs to be debonded from the enamel surface. Debonding may be unnecessarily time consuming and damaging to the enamel if performed with improper techniques or carelessly. There are several methods for debonding orthodontic brackets. All these techniques have their own advantages and limitations. Since the early 1990s, lasers have been used experimentally for debonding ceramic brackets as a new and established method. Using Lasers in debonding procedure reduces required debonding force and risk of enamel damage but thermal effect during the laser radiation on dental tissues can cause undesirable results. The aim of this study is to develop a better technique for ceramic bracket debonding. A new fiber laser (1070-nm Ytterbium fiber Laser (IPG Laser, YLM-20- SC, GmbH)) was tested, debonding procedure was quantified with a universal testing machine and intrapulpal temperature was monitored for limiting the injury or pain in present study . Experiments were performed in two sections according to the type of lasing mode: Adjusted Laser power was applied in Continuous Wave (CW) and in Pulse Mode. Debonding force, debonding time and work done by universal testing machine was significantly decreased by irradiation in both sections. Lasing caused a 50 % of reduction in required load for debonding and showed a 3- fold decrease in time. Intrapulpal temperature changes are below the accepted threshold value (5.5 oC) until the level of 3.5 watts of laser power in continuous wave mode. Also applying more than 3.5 watts of laser power showed a rapid increase in total applied laser energy. It can be reported that a sensible striding is observed after 88.6 joules of total energy applied on the ceramic brackets in both modes. Moreover, during debonding, the work done by universal testing machine is diminished up to 5 times by irradiation. Most of the groups in CW Mode and all groups are below the threshold value in pulse mode. Laser applications in debonding require further improvement because Laser could mean very rapid and painless debonding without the risk of either enamel tear outs or bracket fractures. If debonding can be achieved with lasing alone, mechanical operations during bracket removal become unnecessary, alleviating patient discomfort at bracket removal.

Thesis No.: 310 Effects Of Epimuscular Myofasciaş Force Transmission On sensory Level Experimental Assessment By Afferent Signals Received From Frog Lower Leg Muscles

Name: Önder Emre Arıkan, Year: 2009

Advisor(s): Can Yücesoy

Abstract: It has shown that non-tendinous structures play a major role in force transmission: epimuscular myofascial force transmission. Such force transmission was shown to cause substantial stain distributions along muscle fibers indicating serial heterogeneity of sarcomere lengths. Recent studies showed evidence on sizable interantagonistic epimuscular myofascial force transmission. It is hypothesized in this study that epimuscular myofascial force transmission can play a role in afferent signals generated in muscle sensory organs. The goal of our present study was to test this hypothesis by measuring the afferent firing rates of antagonistic muscles of the lower leg. Gastronemius muscle of the frog (Rana ridibunda) was given 1-5 mm of ramp-and-hold stretch via a pulley mechanism connected to its distal tendon. Keeping the ankle and knee angles fixed (at 100 and 120 respectively), sensory unit recordings were taken from both tibial and peroneal branches of sciatic nerve simultaneously: afferent signals generated from both the lengthened gastrocnemius muscle and the restrained antagonistic muscles were recorded. Remarkably, imposing passive stretch resulted in a significant increase in the firing rates of the units of not only the lengthened muscle, but also of the restrained antagonists ($p<0,05$ $n=12$). This novel finding suggests that due to epimuscular myofascial force transmission, stretching of the target muscle causes local length changes sensed by the sensory organs within the fibers of the antagonistic muscles, despite being restrained. Our results therefore provide a preliminary support to our hypothesis and are likely to have major implications on our understanding of the functioning of muscular mechanoreceptors.

Thesis No.: 309 Evaluation Diagnostic Loss In Compressed Medical Images Using Computer Simulation

Name: Alpaslan Koç, Year: 2009

Advisor(s): Albert Güveniş

Abstract: The objective of this thesis is to evaluate the diagnostic loss in compressed medical images using computer simulation. Compressing medical images is a necessity due to the cost of the storage medium as well as the low bandwidth available for telemedicine procedures. Experimental studies conducted conventionally for this purpose use a set of real images for which a consensus is reached by a team of medical imaging specialists, on the presence or absence of a lesion. Then ROC (Receiver Operating Characteristic) curve analysis is carried out in order to determine the effect of compression at different ratios in terms of lesion detectability. The area under the curve (AUC) equals one when lesions can be detected perfectly well. If they can not be detected the area under the curve (AUC) equals 0.5 and this means that it is not better than arbitrary guessing. These experiments should be conducted by using many images and observers if it will be statistically significant. Therefore it is time consuming and expensive. Furthermore, this method has serious drawbacks since it does not include any analysis for small subtle lesions and is impossible to compare the errors due to other factors such as variation in equipment and data acquisition protocols. This thesis has the objective of eliminating these drawbacks by using a computer simulation of the entire imaging chain that includes the organ, the imaging equipment and the human observer. A Monte Carlo simulation package (SIMIND) has been used to simulate the image formation process for a gamma camera acquiring data from a breast containing a lesion. The obtained images are then compressed using the JPEG and JPEG 2000 algorithms at different compression ratios. Lesion detectability is then assessed by using a mathematical observer model named the channelized hotelling observer. Image quality is also assessed using quantitative image quality metrics. The results showed that diagnostic loss occurs at all compression ratios for subtle lesions but this loss may be comparable to other losses such as the ones due to variation in equipment and data acquisition protocols. Eventually, the decision of which compression rate to adopt will not be different than any other engineering tradeo decision made for balancing cost and performance. This is in contrast with experimental studies that determine the ideal compression ratio based on evident lesions only and therefore presents an alternative methodology.

Thesis No.: 308 The Effects Of Serotonin And Its Antagonists On Slowly Adapting Type I Mechanoreceptive Fibers In Frog Skin

Name: Sevinç Mutlu, Year: 2008

Advisor(s): Burak Güçlü

Abstract: It was intended to investigate serotonin as the neurotransmitter between Merkel cell and its nerve ending, through changes in SA-I response to exogenically applied serotonin and its antagonists. Single-unit electrophysiological responses were recorded from the dorsal cutaneous nerves of the common water frog's (Rana ridibunda) skin perfused in a tissue bath. Maintained mechanical stimulation was applied at suprathreshold levels by von Frey hairs calibrated at 0.16, 0.4, 1, 1.4, and 2 g-bending forces. The effect of serotonin was tested at concentrations: 10 μM (n=8), 100 μM (n=7), 1000 μM (n=6). The responses were analyzed as spike rates. Paired-t test was used to test the significance of the results. The spike rate increased as a linear function of the stimulus level at baseline and all tested concentrations. Additionally spike rate increased significantly at 10 μM ($p<0.05$) and at 100 μM ($p<0.05$), but decreased at 1000 μM ($p<0.05$) compared to the baseline. In order to find out which serotonin receptors are involved in the process, selective 5-HT3 (n=7) and 5-HT2 (n=6) receptor antagonists were applied at 100 μM concentrations. Both receptor antagonists decreased SA-I responses($p<0.05$). Recovery was obtained at each case other than 1000 μM serotonin application. Our results confirm the role of serotonin in the mechanoelectric transduction in Merkel cell-nerve ending complex and that at least two serotonin receptors are involved in the process in frog skin.

Thesis No.: 307 Pure Tone Audiometer Design

Name: Yusuf Arpat, Year: 2009

Advisor(s): Mehmed Özkan

Abstract: Audiometry is a technique which is used to measure where the hearing deficit stems from in aural way and what the degree of severity of deficit is. This thesis work basically focused on a prototype of pure tone audiometer generating pure tone, wide and narrow band noise and warble tone. Direct Digital Synthesis (DDS) and logarithmic shaping methods are utilized for sine wave generation. For noise, firstly wide band noise is generated and then it is filtered by switched capacitor filter for narrow band noise. Warble tone is frequency modulated signal. Frequency modulation is implemented by Voltage Controlled Oscillator. All the obtained signals are made suitable to output apparatus and opening (80 dB) level via Digitally Controlled Potentiometer (DCP). Desired signal is selected via the multiplexer for right or left channel. Sequentially in order to match the signal between the -10 dB and 100 dB, its volume is readjusted in a special functional unit. Ultimately to supply the desired current drive for the TDH39 and bone vibrator, a current feedback operational amplifier is used. All the functional units are managed with the microcontroller coded as MSP430FG439 and the status of the device is showed on Liquid Crystal Display (LCD). In Turkey, audiometer is not manufactured. Despite the fact that this prototype of audiometer is not appropriate to come on the market, it may give idea for production of more complex ones. Moreover, because of the fact that many hearing testing devices have analogous units with this protype, inspecting this work carefully may give useful ideas about implementation of those devices. This protype is tried to work out based on the standard of TS 9595-1-4 (EN60645-1-4) of Turkish Standards Institution.

Thesis No.: 306 A Device For Functional And Cosmetic Improvement Of Lagophtalmos Due To Facial Paralysis

Name: Mehmet Doğan Aşık, Year: 2009

Advisor(s): Burak Güçlü

Abstract: A new device for the correction of eyelid problems due to facial palsy was studied. Lagophthalmos is the condition of the paralyzed eyelids' to close totally. It may cause drying and irritation .In this thesis, 14 rabbits were injected with local anesthetics to induce temporary facial palsy and lagophtalmos. In order to provide functionality to the upper eyelids, ferromagnetic steel pieces were placed inside and outside of the eyelids of the rabbits. The device moves the eyelids by magnetically pulling the steel pieces. The control group (n=5) did not wear the device. The treatment group with external implant (n=4) and the treatment group with internal implant (n=5) made to wear device and tested. All animals were observed during the experiments and recorded to video tapes. The data collected from video records were analyzed to test the statistical difference between control and the treated groups. The results showed that treatment groups paralyzed eye and control groups paralyzed eye have significant differences. Furthermore, the treatment group with internal implant shows a noticeable similarity with the healthy (un-paralyzed) eye.

Thesis No.: 305 Somatosensory Brain Responses Evoked By Vibrotactile Stimulation Of The Distal Phalanx In Normal Subjects

Name: Duygu Torun, Year: 2009

Advisor(s): Burak Güçlü

Abstract: The sensory response upon vibrotactile stimuli is still not completely understood. Previously, the responses of single units from mechanoreceptive afferents and cortical neurons have been studied. On the other hand, there is a thorough psychophysical literature on judgements of the presence, magnitude, and frequency of vibrotactile stimuli. However, non-invasive recording of evoked somatosensory brain responses on the scalp was not explored adequately due to technical difficulties. Dependency of the evoked somatosensory response to vibrotactile stimuli, the frequency following response, is a phenomenon in which the human brain has a tendency to change its dominant EEG frequency towards the frequency of the external stimulus. This may arise from the synchronous ring of many cortical neurons. In this study, 40 and 230 Hz vibrotactile stimuli were applied to 10 adult subjects (5 females and 5 males) and psychophysical detection thresholds were measured at various frequencies using the two-interval forced choice paradigm. The psychophysical results were consistent with the literature. To measure the frequency following brain responses, stimulus amplitudes were determined based on the psychophysical sensation levels. Stimuli amplitudes were set at 10, 20 and 30 dB higher than the thresholds (SL=10, SL=20 and SL=30 dB respectively). EEG recordings were obtained over the primary somatosensory cortex with gold surface electrodes placed on the scalp at CPi-CPc. The results were examined by fourier transforms and wavelet transforms. Wavelet transform plots showed that, as the mechanical stimulus amplitude was increased, the background activity was suppressed and the frequency-following activity during the stimulus period increased. This finding was statistically significant. The origin of the frequency-following responses were discussed based on current results.

Thesis No.: 304 Multimodal Segmentation Of Brain MR Images Through Hidden Markov Random Fields

Name: Ufuk Mat, Year: 2009

Advisor(s): Mehmed Özkan

Abstract: Segmentation of brain MR images, especially into three main tissue types: CSF, GM and WM, is an essential task in clinical applications as it aids surgical planning, computer-aided neurosurgery and diagnosis. However, every single MR image contains degenerative components such as noise and RF inhomogeneity which dramatically reduces the accuracy of the results of automatic post-processing techniques. A number of methods are proposed in the literature for tissue segmentation of brain MR images. Among these, Otsu thresholding, ML estimation and MRF model based methods are the ones that widely used. Moreover, 2D segmentation of True-T1 and True-T2 images almost completely removes the artifacts mentioned above hence results in the best results ever reported. However, the required scan time of the method and the expense of the process makes this method inapplicable to clinical applications. In this study, three different segmentation schemes for brain MR images, namely Otsu thresholding, ML classi cation and MRF model based segmentation, are analyzed taking the segmentation results of 2D segmented true parameter images and a novel multivariate MRF segmentation method using T1 and T2-weighted images is proposed. As a result, the performance of the segmentation methods when two dimensional data were used increased. Moreover, multivariate HMRF model-based segmentation method achieved the best results.

Thesis No.: 303 Gui Driven Sigma-Delta Modulator Design And Measurement Tool With A View Of Medical Ultrasound Imaging Implementation

Name: Güneş Damla Altınok, Year: 2009

Advisor(s): Mehmed Özkan

Abstract: The widespread use of mixed-signal based systems in conjunction with the various benefits provided by digital techniques have significantly increased the need for high resolution analog-to-digital (A/D) and digital-to- analog (D/A) converters. The (A/D) converter based on the sigma-delta modulation sigma-delta is capable of providing a very high resolution for low-to-medium signal bandwidth applications. It utilizes oversampling and noise-shaping to trade-off operation speed for amplitude resolution. In this study the theory and advantages of sigma-delta converters are introduced. Low-pass and narrow-band band-pass sigma-delta modulators are designed, examined and analyzed. A variety of sigma-delta converter topologies are modeled in Simulink and MATLAB routines are written. Various Butterworth and inverse Chebyshev based (sigma-delta) modulators are designed and implemented at the behavioral-level to enhance SNRs. The system performance analysis and trade-offs are analyzed via various single-loop and multi-stage low-pass and resonator-based band-pass sigma-delta modulator simulations. A user-friendly software tool is developed to speed up the design, analysis, evaluation and measurement of single- loop and multistage sigma-delta modulators at the system-level. Using second-order low-pass sigma-delta modulator built in the design tool is used in the medical ultrasound beam forming implementation. For this aim, a comparison of ultrasound images constructed by beam former architectures that use 10-bit ADC's and single-bit sigma-delta modulators are performed. The benefits and trade-offs of using 1-bit sigma-delta modulators are examined.

Thesis No.: 302 Investigation Of Neurovascular Coupling By Synchronous EEG And fNIRS Measurements During Steady-State Visual Stimuli

Name: Müge Özker, Year: 2009

Advisor(s): Ata Akın

Abstract: In this thesis, the steady state human visual evoked potentials that are generated in response to visual stimulation and its corresponding hemodynamic response are investigated via electroencephalography (EEG) and functional near infrared spectroscopy (fNIRS). The ssVEPs are investigated for the frontal and the occipital cortex and the corresponding HBO2 changes are investigated for the frontal cortex. The left and the right hemispheres are compared as well as the frontal and the occipital cortices in terms of electrical activity and the hemodynamic response. The stimulus locked ssVEPs are time averaged in order to increase the signal to noise ratio and the power of the resulting averaged signals are calculated. On the other hand the mean values of the band passed altered HBO2 signal for the stimulation intervals are calculated. The responses obtained from the frontal electrodes and fNIRS channels are averaged as well as the responses obtained from the occipital electrodes in order to see the overall electrophysiological and hemodynamic responses of the frontal and the occipital regions since the lateral response differences turned out to be statistically insignificant. The overall average calculated between the 13 subjects revealed that the ssVEP power observed for the frontal electrodes peak at the upper alpha band (10-13 Hz), and the ssVEP power peaks at 9 Hz frequency for the occipital electrodes, whereas the maximum hemodynamic response is observed at 24 Hz stimulation frequency. The correlation of the ssVEP and the hemodynamic responses obtained from the frontal cortex are analyzed. At 9, 12 and 20 Hz stimulation frequencies, the linear relationship between the ssVEP and the hemodynamic responses is determined to be positive and moderate. At 28 and 30 Hz stimulation frequencies a negative, moderate correlation is found between the ssVEP and the hemodynamic responses. Since, the maximal frontal ssVEP power and a moderate correlation between the ssVEP and the hemodynamic responses are both observed during 12 Hz visual stimulation, 12 Hz is assumed to elicit a strong neurovascular coupling in the frontal cortex.

Thesis No.: 301 The Side Effects Of Different Antiembolic Agents On The Fracture Healing And Micro-Mechanical Behavior Of The Fractured Bone

Name: Burcu Tunç, Year: 2009

Advisor(s): Hikmet Üçışık / Metin Usta

Abstract: Fracture of bone is always expected when the stress exposed to body is enough for initiation and propagation of the crack. Due to social lives, increase of life expectancy, wars and accidents the number of bone fracture has increased. One of the problem during healing of the fractured bone is hematoma formation. In order to eliminate hematoma formation, antiembolic agents injection into the body is generally imperative. In this thesis, we deal with the inorganic portion of the bone, treated with and without antiembolic agents. 16 Wistar-Albino male rats were used for the study. Scanning electron microscopy and X-ray diffraction technique were applied in order to reveal the effect of antiembolic agents on the bone fractured followed by healing. It is observed that antiembolic agents helped healing of the fractured bone without defect and crystalline nature of the inorganic part of bone showed phase transitions.

Thesis No.: 300 Clasification Of ECG Arryhtmia Beats With Artificial Neural Networks

Name: Seçil Zeybekoğlu, Year: 2009

Advisor(s): Mehmed Özkan

Abstract: Electrocardiography (ECG) is very useful noninvasive imaging method of the heart's electrical activity. Based on these recordings, a wide range or heart conditions can be diagnosed. These conditions may vary from minor to life threatening ones. Therefore, the scientists started to work on automatic systems that would detect any kind of abnormalities in the heart's electrical activity. These automated systems are expected to help patients monitor themselves or the clinicians monitor their patients for any kind of abnormalities. With the help of these automated systems, there is a big contribution to early, quick and efficient diagnose of the heart diseases. Based on this need, this thesis presents an automated arrhythmia detection system. The classification of beats is performed in a Graphical User Interface, namely Patient Monitoring GUI. Based on the user's selection, the GUI displays the type of beats that flow on the screen. In the background, the GUI uses an Artificial Neural Network (ANN) trained to classify the 7 different types of arrhythmias. During the training process of ANN's the ECG recordings from MIT BIH Arrhythmia database are used as references. The arrhythmia samples are extracted from the database and preprocessed to create input sets to rain ANNs. The Fourier Transforms of a predefined window of signals were taken as a feature extraction method. The training was performed in multiple steps in order to obtain best performing
ANN that will be finally used by the Patient Monitoring GUI. The training of the ANNs was performed by using the Neural Network Toolbox in Matlab 2008b and the results were recorded to track the difference between the training attempts. The overall success rate of the best performing ANN was measured as 80%.

Thesis No.: 299 Investigating Brain Hemodynamics Of Schizoprenic Patients by Functional Near Infrared Spectroscopy

Name: Sinem Serap, Year: 2009

Advisor(s): Ata Akın

Abstract: People can easily stop talking, walking, singing and so on, in response to changes in internal or environmental states. The ability to respond to a specific dimension of a stimulus while suppressing simultaneous inappropriate or no longer required competing stimulus is known as interference effect. This ability to inhibit inappropriate or irrelevant responses is a hallmark of executive control and is subserved by prefrontal cortex of the brain in healthy subjects. Damage to these prefrontal regions, results in response inhibition deficits and also have been linked to several neurological disorders like schizophrenia and autism. Schizophrenia is a psychiatric disorder that associated with general cognitive impairments in addition to inhibitory deficits. Onset of these symptoms typically occurs in young adulthood, with approximately 1% of the population affected. In this study, attentional processes in schizophrenia spectrum have been examined using Stroop task and fNIRS.

Thesis No.: 298 Implementation And Statistical Evaluation Of Computer Assisted TW2 Method For Bone Age Assessment

Name: Esra Güven, Year: 2009

Advisor(s): Albert Güveniş

Abstract: The most commonly used method for bone age assessment is based on a single x-ray of the hand and wrist. The bones in the x-ray are compared to the bones of a standard atlas, usually "Greulich and Pyle (G&P)". A more complex method also based on hand x-rays is the "Tanner-Whitehouse (TW2)" method, which relies on the systematic evaluation of the maturity of all the bones in the hand and wrist. In this study, first we implemented the computer assisted TW2 method, then we compared this method with reference to widely used method of G&P using the criteria of accuracy and speed, and lastly we studied how learning and practice affects speed of bone age assessment. We used 50 "bone age" radiographs of the left hand and wrist performed in a large hospital. data were analyzed using the "method comparison" statistical technique. 20% of the radiographs were then re-analyzed to assess intra-observer variation. The 95% confidence interval for the difference between the two methods was -1.84 to 1.32 years. Intra-observer variation was greater for the G&P method than for the TW2 method (95% confidence limits, -0.77 to 0.97 vs. -0.45 to 0.37). The speed of computer based TW2 was close to G&p (1.7 min vs. 0.7 min) and increased with practice. Since both methods take reasonable amount of time, computerized TW2 method should be preferred for higher performance in bone age assessment.

Thesis No.: 297 Hemodynamic Correlates Of Mental Aritmetic Task in Migraine

Name: Ebru Ünlü, Year: 2009

Advisor(s): Ata Akın

Abstract: : Investigating the relationship between the hemodynamic changes and cognitive activity (known as the neurovascular coupling) provides a basis of the underlying physiology of the brain energy mechanisms. The aim of this study was to investigate the differences in the hemodynamic response caused by the mental arithmetic (MA) task between migraineurs and healthy subjects by using functional near infrared spectroscopy (fNIRS). 16 healthy subjects (5 male, 11 female) and 16 migraine patients (4 male, 12 female) participated in the study. Subjects were asked to perform mental subtraction and answer verbally to 3 sets of questions with increasing complexity. Performance, work load, FNIRS data and laterality (LI) index were analyzed. The difference in the oxyhemoglobin levels across different complexity levels were calculated. As the MA task got harder, work load increased, performance decreased and the change in [HbO2] increased for both groups but showing a lower incremental in oxyHb concentration in migraine patients for varying complexity levels. Control group showed a right dominant PFC activity, whereas migraine patients showed a left dominant PFC activity. Our results support the hypothesis that migraine is a neurovascular coupling dysfunction causing unregulated activation in PFC than controls.

Thesis No.: 296 Simulation of Optical And Thermal Responses of Laser Irradiated Tissue

Name: Bahar Kurt, Year: 2009

Advisor(s): Murat Gülsoy

Abstract: A Java Simulation Application was developed to simulate optical and thermal response of laser irradiated tissue by using Monte Carlo and Finite Difference Methods. For light propagation Monte Carlo was preferred according to its high accuracy because a number of photon packets can be launched to increase efficiency. Also Finite Difference Method was used for heat diffusion because of its simplicity. The results taken from Monte Carlo Model are used as a source term in heat conduction equation. Thus, in small time steps by doing iterations of Finite Difference Method thermal gradients are measured inside a tissue. At 1064 nm fluence and thermal contours of brain and liver tissues are obtained with same laser parameters. Also at different wavelengths, 1064 nm and 630 nm, fluence and thermal contours of liver tissue are calculated in the same conditions. Moreover, fluence and thermal contours of liver tissue are measured for different power densities and exposure times. The thermal gradients of laser irradiated tissue were plotted with 2D colored surface plotting.

Thesis No.: 295 Infrared Lasers For Corneal Tissue Welding

Name: Rifat Rasier, Year: 2009

Advisor(s): Murat Gülsoy

Abstract: Objective of this study is to investigate the potential of infrared lasers for cornea welding in order to seal corneal cuts done during cataract surgery. Infrared lasers can be used to weld soft tissues. Water molecules and also protein molecules such as collagen absorb the infrared energy and a temperature gradient can be created at the application site. Corneal welding is rather a new application area in laser medicine, and few studies reported successful welding dose for different infrared wavelengths. Different laser wavelengths were studied comparatively in the present research. Diode lasers (809-nm and 980-nm), a fiber laser (1070-nm) and a Tm: YAP lasers (1985- nm) were used in a power range of 200mW-3W. In vitro experiments were performed on a total of 60 freshly enucleated bovine eyes. Full thickness, one-plane 3.2 mm long clear corneal cuts were done using a pre-calibrated knife. Laser power, irradiation duration, energy density and spot size were the parameters used and histological indicators of photothermal effect were observed. According to preliminary results; 1070-nm YLF laser and 1985- nm Tm:YAP laser were selected for further investigation. Histological examination of hematoxylin-eosin stained samples revealed that 1070-nm and 1985-nm laser wavelengths have a great potential for corneal welding.

Thesis No.: 294 Optical Probe Design For Continuous Wave Near-Infrared Spectroscopy

Name: Kadir Evcil, Year: 2009

Advisor(s): Ata Akın

Abstract: The modern medicine is using optical methods more and more every day, among optical methods Nearinfrared Spectroscopy is one of the most appealing techniques. Near-infrared spectroscopy is a noninvasive, safe, reliable technique. With near-infrared spectroscopy even three dimensional images can be produced and functional information can be achieved. Near infrared spectroscopy uses light at the infrared portion of the electromagnetic spectrum and measures the changes in the intensity of the light. This M.S. thesis is focused on the development of a prototype Near Infrared Spectroscopy instrument. This instrument is based on the Continuous Wave Near- Infrared Spectroscopy. This system is designed by using leds that emit near-infrared light, photodiode detectors that are sensitive to near-infrared light, and operational amplifiers. The instrument's circuit design is based on the analog circuit design. The ability and e activeness of the system is tested on phantom and human subjects with several experiments

Thesis No.: 293 Evaluation Of Force velocity Characteristics Of Quadriceps Muscles By Means Of Peak Torque Angular Velocity Relationship During Knee Extension And Flexion

Name: Abdülaziz Akkılık, Year: 2008

Advisor(s): Burak Güçlü

Abstract: In this thesis, an experiment, which shows that there is a relationship between theoretical force-velocity characteristics of a muscle fiber and experimental peak torqueangular velocity characteristics of quadriceps muscle contraction using CYBEX NORM isokinetic dynamometer, is presented. First, the equations of force-velocity relationship for muscle fiber contraction were derived using a special cross-bridge theory. Then, during the experiments, the subject performed knee extension and flexion movements with different angular velocities. In this way, peak torque values at different angular velocities were obtained during eccentric, isometric and concentric contraction of quadriceps muscles. Finally, it was observed that the theoretical curve of force-velocity for muscle fiber contraction could fit the experimental data showing the relationship of peak torque-angular velocity for quadriceps muscles quite well. As a result, although many parameters were not controlled during the experiments, force-velocity curve of the muscles was applicable for different conditions

Thesis No.: 292 Differantial Effects Of Short Light Pulses in The Dark Phase of An L/D Cycle On Behavioral Despair in Male Wistar Rats

Name: Elif Aydın, Year: 2008

Advisor(s): Burak Güçlü

Abstract: The present study investigated the effect of a 10-min light pulse either early or late in the dark phase of the L/D cycle on behavioral despair in male Wistar rats. Independent groups of rats (n=8 each) maintained on a 12L/12D cycle (lights on at 06:00 h) received a 10-min light pulse (either 900 or 1350 lux provided by an incandescent lamp) 3 or 9 h after dark onset. A control group (n=8) was treated similarly except for light exposure. All animals then underwent a 15-min Forced Swim Test (FST) starting at 14:00 in the next light phase of the L/D cycle, followed by a 5-min FST 24 h later. Analysis of variance indicated that exposure to either intensity of light delivered in the late but not the early part of the dark phase of the L/D cycle has protective effect in behavioral despair as indicated by shortened durations of immobility in the second swim test compared to controls. The fact that light pulses in the early part of the dark phase had no ameliorative effect on durations of immobility suggests that the antidepressant property of the late pulses may be due to their differential effect in phase shifting the circadian rhythm. Analysis of c-Fos expression reported a significant difference between the control and light exposure groups. Light exposure at ZT21 and ZT15 induces dense c- Fos immunoreactivity in the core region of the SCN which indicates phase shifting. Slight spontaneous c-Fos immunoreactivity was detected in the shell region of the SCN of the control rats. These results suggest that light may exert its antidepressant effect via circadian phase shifting.

Thesis No.: 291 An Internet Based System For Monitoring Patients And Relatives Satisfaction Raates in Health Services

Name: Ufuk Demirci, Year: 2008

Advisor(s): Albert Güveniş

Abstract: The aim of the study is to develop an internet based dashboard system for monitoring health key performance indicators (KPI) to improve medical services quality with a benchmarking framework. The study implements "patients and patient relatives' satisfaction rates" of organizations and institutions as a sample KPI. Enterprise Digital Dashboard (EDD) is an effective tool for executives to get a top level view of their corporate. Dashboard systems gather and display KPIs in a centralized system for supporting quality improvement processes. The Ministry of Health of Turkey collects and measures several KPI's in order to improve quality and performance in health-care services. 'Patients and patients relatives' satisfaction rate is one of these KPI's. In this study, we implemented an internet based system for replacing the currently applied paper-based patient satisfaction survey. The collected answers can be measured, benchmarked between hospitals or different departments of the same hospital, and monitored in various dimensions. Our solution has three sub-systems; first system collects survey answers through web forms, second system publishes the survey result as web services, and the last system displays the received KPI values from web services in a dashboard. The new system performs monitoring in various dimensions and benchmarking because the information is stored in a relational database. In current system, only the average satisfaction rate of a hospital is calculated and there is no benchmarking performed on the results. The benchmarking capability of the new solution provides the effective use of the KPI's in quality and performance improvement.

Thesis No.: 290 A Microcontroller Based 100kHz-1MHz Multifrequency Bio-impedance Measurement Device

Name: Hakan Solmaz, Year: 2008

Advisor(s): Yekta Ülgen

Abstract: Complex impedance measurement of biological systems is gaining wide popularity in determining the pathological and physiological status of biological tissues in research applications such as; skin hydration, dental decay, body fat content, tissue ischemia, food freshness, blood freshness and etc. The device presented in this study is a four-probe, multi frequency, portable bio-impedance measurement device based on the principles of magnituderatio and phase-difference detection. The system is built with a DDS frequency generator, a voltage controlled current source, two high frequency instrumentation amplifiers, a phase-gain detector and a microcontroller unit. The software for the microcontroller is written and compiled on CodeVisionAVR C Compiler and the microcontroller is programmed on AVRStudio 4. The accuracy and precision of the prototype device are checked against the HP 4284A LCR meter using different RC test loads. The results show that the overall percentage error averages of the real and imaginary parts of the complex impedance are 0.80 % and 1.78 % respectively. The Cole-Cole diagrams are generated to obtain the Cole parameters, R0, R1, fc and ® that give valuable information about the physiological status of biological tissues. Those parameters are also checked against the LCR meter. The percentage errors of R are found to be high due to relatively high phase-difference detection errors.

Thesis No.: 289 The Effect of The Dialysis Environment and Reprocessing Procedure on the Mechanical and Structural Stability of High Flux Polysulfone Membrane

Name: Bengi Yılmaz, Year: 2008

Advisor(s): Hikmet Üçışık

Abstract: Although there are many clinical researches in the open literature, biocompatibility and performance of reprocessed hemodialysis membranes are not still well defined. This thesis aims to fulfill the deficiency in the experimental studies performed from an engineering point of view. In line with this aim, Fresenius FX80 polysulfone hemodialyzer membrane was exposed to formaldehyde and bleach after a dialysis session. The mechanical stabilities of virgin and user-processed fibers were investigated by tensile tests consisting of monotonic and cyclic loading. The surface features and morphology changes were examined by SEM and AFM. The crystallinity of the mechanically tested virgin and used-processed fibers was determined by XRD. The experiments showed that the ductility, toughness and strength of the used-processed fibers decrease. The microscopic studies depicted some morphological changes such as increase in pore size and deformation in pore shapes. The X-ray diffraction method demonstrated the increase in the crystallinity of monotonically loaded used-processed or virgin fibers. However, it is seen that the cyclically loaded fibers undergo some structural changes, although the crystalline portion in their structure does not increase. This result can be related with the loading cycles in the elastic region and further studies are needed to determine the behavior of polymeric material. In conclusion, reprocessing and dialysis structurally changes the hemodialyzer membrane, which may result in some complications during hemodialysis reuse.

Thesis No.: 288 The Effect of Reuse Solution of The High Flux Polyamide Hollow Fiber Membranes in Hemodialysis

Name: Neslihan Sarıca, Year: 2008

Advisor(s): Hikmet Üçışık

Abstract: In order to question the safety of reuse of high flux polyamide hollow membranes used for hemodialysis, it is imperative to perform several experiments on both virgin high flux polyamide membranes and used fibers left in re-use solutions. SEM and AFM studies performed on virgin and used-processed fiber visualized the morphological changes. Rough wavy structure with defects was seen in used-processed fiber, whereas a smoother surface morphology was seen in virgin fibers. Big deep holes due to pore merging, more elliptical pores and defects were visualized in used-processed fibers. Thus, easy crack initiation and propagation is expected in used-processed fibers. Tensile tests also revealed the difference in mechanical properties of virgin and used-processed fibers and confirmed what was obtained from the SEM and AFM studies. Drop in ductility and toughness was observed in used processed fibers. This study showed that dialysis environment caused structural changes on membranes which may cause clinical complications.

Thesis No.: 287 Asynchronous Processing of Luminance Difference and Motion in Visual Perception

Name: Onur İşcan, Year: 2008

Advisor(s): Burak Güçlü

Abstract: This study is related with the perception of first-order motion. The processing of visual information in the human brain is accomplished by numerous visual streams. Each stream is specialized to process different attributes of the visual scene. It was already demonstrated that times-to-consciousness of form, color, luminance and motion differ. In the present study, it was investigated whether luminance difference and motion are perceived synchronously. The hypothesis was tested by modifying a particular task in the literature. The stimuli were filled squares presented on a mid-gray background. The luminance of the stimulus was continuously incremented or decremented and the subjects performed a lightness matching task based on the perceived luminance at motion instant. It was hypothesized that if the subjects perceived motion first, they would report luminance values back in time from the instant the motion had occurred. When the luminance-change direction was from dim to bright, the matching errors decreased as a function of luminance at motion instant. When the luminance-change direction was from bright to dim, the matching errors increased as the luminance at motion instant increased. In both cases the reported luminance values at motion instant were biased towards the luminance-change direction. This suggested that motion was perceived later than luminance difference. A computational model was used to predict the results of the current experiment. However, experimental results were not consistent with either the model prediction or the experimental results reported in the literature.

Thesis No.: 286 Evaluation of The Effects of Aging on Brain Assymetry With Functional Near Infrared Spectroscopy

Name: Elif Kubat, Year: 2008

Advisor(s): Ata Akın

Abstract: Cognitive aging is a natural and lifelong process which may lead to the neurological diseases as dementia and Alzheimer's. Investigation of the aging process on the cerebral hemodynamics of subjects would lead to the prevention of neurological diseases which are the last stages of cognitive aging process. The aim of this study was to investigate the prefrontal cortex (PFC) oxygenation increase as working memory load is increased, to determine the effect of cognitive aging on PFC hemoglobin oxygenation and to analyze the lateralization index of young and middle aged adults. The study included measurement of hemodynamic changes with Functional Near-Infrared Spectroscopy (fNIRS) during a mental arithmetic task. The study demonstrated that during the mental arithmetic study, prefrontal cortex (PFC) hemoglobin oxygenation increased with the increasing working memory load for both groups; there was no significant hemoglobin oxygenation difference between both groups; young subjects used right PFC regions, while the middle aged subjects used left PFC regions during the mental arithmetic task and lastly the lateralization index of two groups increased with the increasing memory load.

Thesis No.: 285 Acute Effect of Aponeurotomyperformed at multiple locattions of muscular mechanics: assessment bu Finite Element Modelling

Name: Zeynep Şeref, Year: 2008

Advisor(s): Can Yücesoy

Abstract: The specific goal of the present study is to assess the effects of the number of interventions on the acute effects of aponeurotomy by using finite element modeling. EDL muscle of rat with extramuscular connections was modeled with aponeurotomies at three different locations (Location P,I and D); four conditions including single (Case P), two double (Case P-I and Case P-D) and triple (Case P-I-D) interventions were studied. Muscle lengthforce characteristics, sarcomere length distributions and muscle geometry of multiple aponeurotomy cases were compared to the ones of single aponeurotomized muscle. It was shown that the intended acute mechanical properties of aponeurotomy were enhanced mostly by triple interventions, but even these enhancements were fairly limited: (1) In triple aponeurotomized muscle, further force reduction was small (e.g. distal optimal forces for Case P and PI-D are 68% and 64% of that of intact muscle). (2) The distal length range of active force exertion was increased by only 0.025% by two additive interventions, whereas single intervention (Case P) increased this length range by 44% of that of intact muscle. The proximal length range was even narrowed with additional interventions. (3) The sarcomere length distributions were not altered with multiple aponeurotomies. Our results indicate that the multiple interventions in the aponeurotomy should be questioned in terms of their limited enhancements in acute mechanical effects. Nevertheless, the geometrical changes might have clinical importance and this effect should be studied.

Thesis No.: 284 Cerebrovascular Reactivitiy of Free Divers Measured with fNIRS.

Name: Turan Deniz Nevşehirli, Year: 2008

Advisor(s): Ata Akın

Abstract: Although breath-hold diving is nowadays practiced as a competitive sports discipline, its underlying physiological mechanisms enabling divers to tolerate great dive depths and durations are still not fully understood. Effect of consecutive maximal dry breath-holds was compared between two groups of free divers with different experience levels and a control group. Hemoglobin concentration (by functional near infrared spectroscopy, fNIRS), heart rate and systemic oxygen saturation (by pulse oxymetry) measurements were performed during four consecutive maximal dry breath-holds. Breath-hold durations increased with consecutive trials in all the groups while the experienced free divers outperformed both the beginner free divers and the control group. Change in hemoglobin concentration from fNIRS measurements increased in parallel with increasing breath-hold durations in free divers but remained almost constant in the control group. Systemic oxygen saturation decreased with increasing breathhold durations for all the groups with a greater decrease for experienced free divers due to longer breath-hold durations. Breath-hold indices calculated using change in hemoglobin concentration and independently using change in Systemic oxygen saturation normalized to hold durations showed significant differences between groups ($p<0.00005$ for both indices). Free diver groups exhibited a higher slope of increase of the indices among consecutive breath holds compared to the control group elucidating an enhanced reactivity to hypoxia. Our results indicate that cerebrovascular reactivity to hypercapnia can be learned and trained and the level of reactivity can be reliably quantified by fNIRS.

Thesis No.: 283 Nonlinear Time Series Analysis Of Monkey Vocalizations

Name: Esin Yavuz, Year: 2008

Advisor(s): Burak Güçlü

Abstract: Primate vocalizations are produced as a result of interactions between and within the simple vocal system and the complex signal coming from the nervous system. As a consequence of the nature of this organization, the resulting voice signal is of nonlinear nature. Moreover, in contrast to humans, in many examples of nonhuman primate vocalizations, the vocal folds do not synchronize. Consequently, produced signal is rather complex. Nonlinear techniques were shown to be useful in analyzing nonhuman primate vocalizations. Deterministic versus stochastic (DVS) prediction technique is one of these methods which can be used to determine the amount of nonlinearity measure (LNM), which indicates the presence of a low-dimensional attractor. By using this method, it was demonstrated that while the nonlinearity measure is useful in voice signals with harmonic component, in highly irregular signals like screams and barks, the detectable amount of nonlinearity was comparatively small. In this study, The amount of nonlinearity in rhesus monkey voices was calculated by using DVS analysis and this measure was used to distinguish different call types and individual properties of the monkeys. Voice signals with harmonic components showed relatively high SNR and low-dimensional nonlinearity, while these phenomena could not be detected in irregular vices. The signals were analyzed and compared among different callers, different call types and also among call subtypes.

Thesis No.: 282 Calculation Of True T1, T2 and Proportion Density Images For The Elimination Of Signal Intensity Artifacts Segmentation Of Brain Tissue In Magnetic Resonance Imaging

Name: Onur Ağuş, Year: 2008

Advisor(s): Mehmed Özkan

Abstract: Segmentation of tissues in medical imaging is an essential subject because it helps the radiologists to be able to identify diseases, tumors and follow the degenerative diseases. In Magnetic Resonance Imaging (MRI) one factor that causes a problem during segmentation is the inhomogeneity in the magnetic field. Mainly the RF coil inhomogeneity effect causes intensity inhomogeneity through the image. This intensity inhomogeneity may cause segmentation algorithms to fail for a specific imager system. In case an algorithm that can be used in many imagers is needed the difference in the tissue intensities and the RF coil inhomogeneity change may cause greater failures. To overcome this problem a method which uses calculated T1, T2 and proton density parameters is proposed. These parameters are calculated from MRI images using four sampling points (four sets of images of the same region with different parameters) and using Levenberg-Marquardt Method. Then maximum likelihood classification is applied to distinguish the tissues and the segmented images were constructed. Gray Matter, White Matter and Cerebrospinal Fluid were segmented in MR brain images of seven volunteers. The subject heads were scanned with three different MR imagers. Tissue segmentation was performed with the weighted T1, T2 and Proton Density images along with the computed true T1, T2 and PD. Comparisons across image slices; across imagers and across subjects indicated that significant improvement can be achieved if the computed T1, T2 and PD images are used for the segmentation of brain tissue.

Thesis No.: 281 Working Memory Performance Assesment While Monitoring The Prefrontal Cortex Hemodynamics by Means Of Functional Near Infrared Spectroscopy

Name: Ceyhun Ekrem Kırımlı, Year: 2008

Advisor(s): Ata Akın

Abstract: One of the popular experimental paradigms for functional neuroimaging studies of working memory (WM) has been the n-back task, in which subjects were asked to monitor the identity or location of a series of verbal or nonverbal stimuli and to indicate when the currently presented stimulus is the same as the one presented n trials previously. It is known that dorsolateral and ventrolateral prefrontal cortex (PFC) is especially active during cognitive task requiring working memory performance. Functional near-infrared spectroscopy (fNIRS) is an optical imaging method, which allows non-invasive in vivo measurements of changes in the concentration of oxygenated (HbO2) and deoxygenated (DeoxyHb) hemoglobin in cortical tissue. In this thesis fNIRS was used to determine the activity on PFC of 9 graduate student subjects, who were asked to take an n-back test involving WM load. A gamma function variate was used to model the hemodynamic response behavior during the task and statistical analysis was applied to determine parameters from the near infrared spectroscopic signals that are in correlation with the WM load. A correlation between the working memory load and hemodynamic response function parameters determined form NIRS signal, was observed on left and right channels on the forehead probe. Model applied in this thesis enabled a quantification of the WM load solely by using fNIRS as a neuroimaging device.

Thesis No.: 280 Realtime Temperature Measurement Using Gradient Echo Magnetic Resonance Imaging

Name: Volkan Büyükgüngör, Year: 2008

Advisor(s): Cengizhan Öztürk

Abstract: Heat induced local therapies play a significant role in several medical procedures, a major one being tumor ablation. Regardless of the temperature range and the heat application method of these different hyperthermia applications, they all require the solution of the following problem: Determination of spatial and temporal distribution of temperature (thus the effects and side effects of treatment) within the applied region. A targeted temperature monitoring system with sufficient capabilities would enable focusing, localization, thermal dose planning, collateral damage prevention and validation of treatment. First four of the above inherently need to be interactive, thus require real time monitoring. For a real-time application, underlying goal is to provide a relative or absolute temperature measurement, fast enough to use the temperature data to intervene with the medical procedure. MRTI (Magnetic Resonance Temperature Imaging) with PRF shift method is first proposed as a way to provide fast temperature maps during thermal therapies by Ishihara in 1992. It provides a way to use the phase images from GRE sequences to extract temperature difference information between successive acquisitions. In this thesis, an attempt is made to implement all parts of an MR-based temperature measurement system, which consists of an appropriate GRE sequence, post processing, and visualization code. The system will have the potential of being adapted to an MRI console in order to create an interactive real-time temperature monitoring application.

Thesis No.: 279 Effects Of Aponeurotomy On Mechanics Of Muscle With Intact Neighboring Muscular and Nonmuscular Structures

Name: Bora Yaman, Year: 2008

Advisor(s): Can Yücesoy

Abstract: Aponeurotomy (AT) is a surgical technique used to lengthen spastic and/or short muscles. In previous studies, the biomechanical effects of AT were studied both experimentally and by finite element modeling in isolated muscle. In this study, the aim is to determine the effects of AT on mechanics of muscle with intact neighboring muscular and non-muscular structures. In order to achieve this goal AT was performed on the proximal aponeurosis of extensor digitorum longus (EDL) muscle of rat. Length–isometric force characteristics of EDL distally and proximally as well as the tibialis anterior (TA) and extensor hallucis longus (EHL) muscle complex distally were determined in (1) the intact condition, (2) the acute AT condition (after partial fasciotomy and proximal aponeurotomy), (3) the post AT condition (i.e. repeating the second step), (4) the fasciotomy condition and (5) TA+EHL removal condition. EDL distal and proximal length-force characteristics were altered significantly after all surgical interventions. EDL distal forces at optimum muscle length were decreased by 34.8 % in post AT, 41 % in fasciotomy and 52 % in TA+EHL removal conditions compared to intact condition. Also muscle optimum length shifted to higher lengths by 0.53 mm in post AT, 0.66 mm in fasciotomy and 0.28 mm in TA+EHL removal conditions. EDL proximal forces at optimum muscle length were decreased by 42.2 % in post AT, 43.4 % in fasciotomy and 48 % in TA+EHL removal conditions compared to intact condition. For short lengths drop of muscle force after AT was more pronounced and muscle force decreased by 73 % in post AT condition. TA+EHL forces decreased gradually as EDL was lengthened distally. Besides this after each intervention overall TA+EHL force decreased. It is concluded that the presence of epimuscular connections limits the effects of aponeurotomy and it should be noted that before planning a surgery to restore the motion of a joint, the possible effects on the other end of the muscle and the synergetic muscles should be taken into account.

Thesis No.: 278 A Fiducial-Based Automatic Registration Method For X-Ray Imaging Fused With MRI

Name: Merdim Sönmez, Year: 2008

Advisor(s): Cengizhan Öztürk

Abstract: X-ray fluoroscopy is widely used in image-guided interventions especially in catheter-based interventions. X-ray fluoroscopy provides high temporal and spacial resolution, but it suffers from low soft tissue contrast. On the other hand, magnetic resonance imaging (MRI) offers excellent soft tissue contrast and 3D anatomical information. X-ray fused with MRI (XFM) is a system which combines strengths of both image modalities to improve the quality of imageguidance and to achieve minimally invasive interventions. In XFM, pre-operative MR images are segmented, 3D structure of target area is reconstructed from these segments, its 2D projection is overlapped on top of live images during x-ray fluoroscopy. Fusion of two images requires registration of two images which could be archived using external fiducial markers attached to skin of patient. In this approach, first markers are detected and located in both image sets, then least square minimization algorithm is applied to complete the registration. The purpose of our study is to extend the currently practiced XFM systems and to allow its translation into a practical clinical setting by making it easier to use. We developed a fully automatic registration system for XFM. This includes automatic segmentation and localization of fiducial markers in both images and finding the correspondence between two point sets, also designing a marker localization system and development of user interface for technical user. In vivo validation of our method was performed in 10 animal experiments. Results show that our method locates markers in high accuracy, finds correspondence between two point sets and completes the registration process.

Thesis No.: 277 Partial Fasciotomy Has Major Effects On Muscular Mechanics Due Altered Epimuscular Myofascial Force Transmission

Name: Gülay Hocaoğlu, Year: 2008

Advisor(s): Can Yücesoy

Abstract: In remedial orthopedic surgery (e.g., aponeurotomy), partial fasciotomy is widely applied; however, is seen as a preliminary step to the main operation only. It is aimed at studying the effects of partial fasciotomy on muscular mechanics on the basis of epimuscular myofascial force transmission. Before (intact condition) and after proximal partial fasciotomy, isometric muscle forces of the rat were measured at proximal and distal tendons of extensor digitorum longus (EDL) muscle as well as at the tied distal tendons of tibialis anterior (TA) and extensor hallucis longus (EHL) muscles in two different conditions: after distal lengthening of (1) EDL exclusively and (2) EDL and TA+EHL muscles simultaneously. Secondary goal was to test the role of increased recovery time on history effects. For EDL lengthening exclusively (1) at lower muscle lengths, partial fasciotomy removed distally directed net epimuscular loads acting on EDL (2) at intermediate and higher lengths, proximally directed epimuscular loads measured in intact condition decreased; however, remained after partial fasciotomy. Moreover, partial fasciotomy caused major changes in EDL length-force characteristics: EDL active forces decreased substantially and muscle optimum length shifted to a higher muscle length distally. Simultaneous muscle lengthening changed intact EDL forces substantially: net epimuscular loads as well as most active and passive forces decreased, optimum length shifted to a lower length and optimal force changed Added partial fasciotomy caused further force decreases and additional shift of optimum force to a lower length. Increase in recovery time increased the differences between control and actual forces i.e., history effects. Yet, history effects themselves were affected by epimuscular myofascial force transmission: partial fasciotomy reduced the force difference between control and actual forces. We conclude that partial fasciotomy alone has major effects on muscular mechanics which may be highly important for a full control over the outcome of the actual operation.

Thesis No.: 276 Magnetic Resonance Imaging of Cerebral Perfusion Using DSC and ASL Techniques

Name: Onur Özyurt, Year: 2008

Advisor(s): Cengizhan Öztürk

Abstract: Magnetic resonance imaging (MRI) of cerebral perfusion is used as a complementary procedure in diagnosis of cerebral lesions. In this work, cerebral perfusion and perfusion related parameters are measured in terms of arterial spin labeling (ASL) and dynamic susceptibility contrast (DSC) techniques using MRI. All scans were performed at 3T in two healthy volunteers and two patients with cerebral lesions. In DSC, contrast agent concentration- time curves were obtained from the measurements. Then, singular value decomposition (SVD) method with constant threshold is used on the arterial and tissue pixels. As a result, relative quantitative values of cerebral blood flow (CBF), cerebral blood volume (CBV) and mean transit time (MTT) were calculated. In ASL, both the single and multiple subtraction methods are used in the subjects. Quantitative CBF maps are obtained as a result of both methods; additionally, transit delay of blood was quantified using multiple-subtraction method. For the patient and volunteer scans, perfusion values obtained by ASL were observed to be in good agreement with relative DSC results or with quantitative PET results in literature which are used as the gold standard. Comparisons were based on the mean CBF values in various tissue kinds of brain.

Thesis No.: 275 Fiber Optik Based Continuous Wave Functional Near Infrared Spectroscopy System

Name: Barış Özkerim, Year: 2008

Advisor(s): Ata Akın

Abstract: In the last decade, functional near-infrared spectroscopy (fNIRS) has been introduced as a new neuroimaging modality with which to conduct functional brain studies that require data collection from vision center or motor cortex. The main problem to get data from these regions is the presence of hair on the scalp. Furthermore, animal imaging requires miniaturized source and detectors to be placed on animal surface but there are no such components manufactured. Whereas, the use of fiber-coupled sources and detectors have allowed the investigation of cortical hemodynamics that lie underneath places covered with hair and also allowed the examination of the hemodynamic changes on the animal muscles. The study is involved with driving and modulating two near infrared lasers as well as coupling the resulting coherent and collimated lights to the optical fibers via the optical converters. In addition, fiber optic cables with large core diameters are used to transmit the scattered light from the tissue to the photodetectors. The main goal of the study is to develop a portable and robust fNIRS system for the detection of cortical hemodynamic changes occurring during motor and visual tasks as well as for the study of animal hemodynamics. The ability and effectiveness of the system is tested by several experiments based on the phantom, human and animal studies. Although the system can successfully operate up to one and a half centimeter source detector distance which is enough to examine the hemodynamic changes in the muscle and to work on the animal surface, it is not sufficient to examine the changes during the brain activity. This is mainly due to low signal to noise ratio (SNR) that can be increased with more powerful and fiber-pigtailed lasers.

Thesis No.: 274 Subband Filtering of fNIRS Data From Schizophrenic Subjects

Name: Ercan Kara, Year: 2008

Advisor(s): Ata Akın

Abstract: Schizophrenia is a neurological disorder and typically persists for a life. Investigation of the cerebral hemodynamics of schizophrenic patients with a rapid, non-invasive and precise technique is required to improve the prognosis and guide therapeutic interventions. Functional Near-Infrared Spectroscopy (fNIRS) is a non-invasive brain imaging technique measuring the changes in oxy-hemoglobin and deoxy-hemoglobin particularly in prefrontal cortex. In this study, fNIRS was used during a Stroop task to investigate the differences in oscillatory dynamics between schizophrenic patients and control subjects. Spectral analysis and dyadic wavelet transform were employed to quantify the degree of loss of cerebral activation and to localize the major areas of loss of activation in the prefrontal cortex. In this study, it was found that specific brain areas are responsible for generating specific oscillatory patterns and energies of these patterns are significantly reduced in schizophrenic patients.

Thesis No.: 273 Three-Dimensional Finite Elemt Modelling of Pacinian Corpuscle

Name: Serkan Yelke, Year: 2008

Advisor(s): Can Yücesoy+Burak Güçlü

Abstract: Understanding the mechanics of Pacinian corpuscle (PC) is a fundamental necessity in order to contribute to tactile sense studies. It is proposed that the geometry of PC may have impact on its mechanics. A threedimensional ovoid shape PC model was developed using the finite element method. The viscoelastic coefficients were included to involve time dependent material properties and to observe whether the band-pass filtering characteristics of PC obtained from neurophysiological data may be observed in the finite element model of PC or not. Static and dynamic stimulations were given to the model as inputs to mimic experiments. Data from both model and experiments were compared and it was concluded that geometry has no determining effect on the mechanics of PC. Besides, viscoelastic property, alone, was not enough to comprehend the underlying reason of band-pass filtering characteristics of PC. Homogeneous structure may not be the only answer to the mismatch of the results since the filtering property was not observed in experimental studies. If the homogeneous structure of the model is developed to a multilayered structure, more reliable results would have been obtained which needs to be tested in new studies.

Thesis No.: 272 Stimulus Frequency Dependancy of Post Stimulus Undershoot of the BOLD fMRI Signal

Name: Ahmet Sabri Alper , Year: 2008

Advisor(s): Cengizhan Öztürk

Abstract: The aim of this study is to investigate the effects of different stimulation frequencies on post stimulus undershoot of the blood oxygen level dependent functional magnetic resonance imaging signal. A fiber optic light delivery system connected to a black opaque sunglass is constructed to deliver visual stimuli to subjects during fMRI scans. One static visual stimulus and eleven flashing stimuli with frequencies ranging from 4 to14Hz and 30 to 46Hz are applied one subject in one fMRI scan session. The acquired data is analyzed to obtain the BOLD fMRI parameters. Positive blood oxygen level dependent and post stimulus undershoot signal changes in the primary visual cortex are determined for each frequency. The results suggest that the post stimulus undershoot has a frequency dependency independent of cerebral blood volume changes. Requirement of more data and additional measures for following possibly related phenomena such as cerebral blood flow are discussed which might be investigated in further studies.

Thesis No.: 271 Design of a Medical Equipment Managment Software

Name: Evrim Ece Yardımcı, Year: 2007

Advisor(s): Yekta Ülgen

Abstract: In this thesis, a medical equipment management system is developed for online access to the medical assets in a healthcare facility to control, plan, schedule and manage the medical equipment preventive maintenance and calibration processes. The system consists of hospital equipment inventory management, personnel information in charge of medical equipment, equipment failure and maintenance record registration, preventive maintenance and calibration management, analysis and graphical representations. A password protected, user friendly web interface is provided for easy, universal and secure access to the system. The system is built over a workstation and controlled from an online web site. Microsoft SQL database and .NET platform is used for the preparation of the system. All codes of the system were written with C++ programming language.

Thesis No.: 270 Examinition of Tissue Temperature Profile DuringPhotothermal Interaction of Laser Irradiation

Name: Muhammed Hakan Köseoğlu, Year: 2007

Advisor(s): Murat Gülsoy

Abstract: During laser surgery, temperature measurement is critical in order to know the photothermal effect of laser irradiation on tissue. Depending on the duration and peak value of the temperature achieved, different tissue responses take place such as coagulation, vaporization, melting and carbonization. There are extensive studies about photothermal effects of laser tissue interaction. In all these studies, measuring temperature accurately is the essential part. Different methods are available for measuring tissue temperature resulting from absorption of laser energy. For deep measurement, temperature sensing probes are the most commonly used devices in biomedical applications. In this study, the temperature values at different radial and axial distances were measured during laser (980nm diode laser) irradiation from different types of tissues (lamb kidney, heart and brain). Moreover, the effects of different power levels (2W, 3W, 4W) and different distances from target point on tissue temperature changes were compared. Thermocouple was used as temperature measuring device during laser irradiation. The deviations in the measurement of direct absorption of laser energy by thermocouple needles were taken into account. As a result of the experiments, it was observed that temperature increases are linearly positively correlated with the laser power levels and, the temperature decreases exponentially as the distance from the target point of laser light increases.

Thesis No.: 269 Importance of Hyoid Region in Voice Quality

Name: Volkan Adem Bilgin, Year: 2007

Advisor(s): H.Özcan Gülçür

Abstract: Speech is a combined form of phonation and articulation in human beings. Both phonation and articulation implies the acoustic formation, which is the result of mechanical and aerodynamic forces. The acoustic system as a tube analogy is shaped with constrictions and regularities, which represents the vowels in the phonetic system. The effects of the anatomic sites such as mouth, tongue, and pharynx have been well studied in acoustic science. However, the deeper structures in the hypopharynx below the hyoid constriction have not been well defined in the quality and the vowel production. This study aims to identify the effect of hyoid level and below on voice quality. 20 normal subjects, 7 females and 13 males are included in the present study. The mean age of the males is 30.8 and the mean age for females is 32.8. During data acquisitions, the subjects are instructed to produce Turkish phonetic vowels and the resulting sounds are recorded at a sampling rate of 44100 Hz. The recordings are repeated by applying backward pressure on the main corpus of the hyoid bone at its center. The data of pre and post constriction is analyzed by wide band spectrograms with a bandwidth of 100 Hz to obtain the formants F1-F4. The frequencies of the peak formantic levels which form the main data are compared using paired samples T-test. Although no significant changes were observed within the sex groups and the whole samples, voice changes are perceived by the listeners in all vocal tasks. As a conclusion, the hyoid region does have profound effect on the resonance system and thus on voice quality, but no considerable influence in the acoustic structure of vowels, i.e., articulation.

Thesis No.: 268 Low Level Laser Therapy on Human Adipose Tissue Derived Mesenchymal Stem Cells

Name: Perihan Selcan Güngör, Year: 2007

Advisor(s): Murat Gülsoy

Abstract: Recent in vitro studies on cell cultures provided that low level lasers have various biostimulatory effects on several tissues. Biostimulation of tissues and cells is an important issue in Tissue Engineering Applications like regeneration from stem cells. Therapeutic potential of mesenchymal stem cells (MSCs) from bone marrow or umbilical cord are now being tested for many lethal and chronic disorders worldwide; however the clinical use of these MSCs has presented problems. Current results indicate that adipose tissue can be a novel and abundant source for adult MSCs. In this study, the effects of 650 nm and 635 nm diode laser on proliferation of human adipose tissue derived mesenchymal stem cells were examined. Two different dosages (1,6 J/cm2 and 3,2 J/cm2) were applied for both two wavelengths. 24 h after seeding, irradiation was started. Cells were exposed to laser irradiation for three consecutive days. Cells were counted at 5th, 9th, 14th and 21st days after seeding. It was observed that the extent of enhancement of the cell proliferation by 650 nm diode laser was significantly higher relative to control group at 14th day. 635 nm diode laser application results showed significantly higher growing enhancement relative to control group on 5th day.

Thesis No.: 267 Design Of A Software Platform For The Quality Control Of Main Blood Products

Name: Sıtkı Akyon, Year: 2007

Advisor(s): Yekta Ülgen

Abstract: In modern blood banking services, blood banks and transfusion services, follow a standard operation procedure during preparation and the quality control of blood components. The Quality Management involves identification and selection of prospective blood donors, adequate collection of blood, preparation of blood components, quality laboratory testing and ensuring the safest and most appropriate use of blood/blood components: the objective is to ensure availability of high quality blood components for transfusion. A management model and a managing software is developed for the quality control procedures of main blood products: erythrocyte suspensions, thrombocyte suspensions, and fresh frozen plasma with reference to the Guide by European Council. The user can access detailed data for each of the prepared blood component; to prepare annual summations, and to manage QC processes effectively. It reduces the risk of producing defective components, by giving alarms to the QC Specialist. Unified Modeling Language is used as the Object-Oriented Modeling Design Platform and the software is developed on Eclips SDK, on a Java platform. Since data size is limited a simple memory save function is used to a Java HashMap.

Thesis No.: 266 Optical Tactile Array Sensor For Lump Detection In Soft Tissue

Name: Mustafa Zahid Yıldız, Year: 2007

Advisor(s): Burak Güçlü

Abstract: Tactile information has great importance in many areas. Receiving tactile information from a slave-robot is a necessary component of tele-detection with tactile display. Surgeons highly depend on tactile feedback in minimally invasive surgery to locate arteries and tumors hidden in tissue. Additionally physicians use palpation for a variety of medical procedures to find tumors and arteries, as well as to assess the health of soft tissue. For these applications, tactile sensors can provide objective, quantitative, and consistent measurements. The tactile feedback may restore the lost tactile sensation as well. Determining a palpable suspicious abnormality needs continued monitoring and requires maintaining a record of the examination results, but at present verbal notes are used and they are limited to subjective information about the position, size, and hardness of the lump. Because it is difficult to verbalize tactile sensations, tactile sensors should be used for quantitative measurements. In this study, an optical tactile array sensor has been developed. It has advantages over pre-existing discrete tactile sensors in terms of pattern recognition and sensing a pressure distribution over an area. The deformation of elastic silicon-rubber surface was measured optically. It can be used in breast tumor identification which has been conventionally done by hand palpation. The tactile probe can detect lumps in soft tissues and can also draw a map of the sample. This map can be fused on a real picture of the tissue to determine the probable location. The sensor consisted of 5x5 phototransistor array, 4x4 infra-red light sources, and silicon-rubber elastic surface. Each sensor output was selected by using a 16- bit multiplexer and the output signal was detected by a data-acquisition card. The software was developed in MATLAB. The sensor produces an image which shows the contact surface and quantitative and visual results are presented to the user. The sensor has a wide dynamic range (1 to 750 g), and high linearity ($R2=0.927$). The tactile sensor was tested with two phantoms, 7 different Von Frey Hairs and fingertip contact experiments

Thesis No.: 265 Evaluation Of Local Oxygen Consumption In Human Flexor Digitorum Superficialis Muscle by Near Infrared Spectroscopy

Name: Sinem Burcu Erdoğan Erdoğan, Year: 2007

Advisor(s): Ata Akın

Abstract: A strong relationship between mechanical and physiological conditions of skeletal muscle determines the force generated by that muscle. The aim of this study was to evaluate the relationship between local oxygen consumption and local force produced during isometric contractions at varying biomechanical conditions. Another aim of the study was to investigate the effect of relative position and absolute length changes on local energy consumption of flexor digitorum superficialis (FDS) muscle during isometric contractions performed at various muscle length and force levels. Nine healthy male subjects performed sustained isometric handgrip exercise by continuously pressing on a hand dynamometer. The handgrip exercise was performed while the wrist is (i) maximally flexed, (ii) maximally extended and (iii) in neutral position. Local oxygen consumption (mVO2) and time course of recovery (trec) of FDS muscle were measured by functional near infrared spectroscopy (fNIRS). mVO2 and trec were linearly related with force level up to 40% of maximal voluntary contraction force (MVC) at all wrist positions ($p<0.05$). At each force level, mVO2 was observed to be lowest when the wrist was maximally extended ($p=0.0004$). Both parameters presented a decrease as the wrist was extended. The results imply that local energy consumption has a dependence on muscle relative position and length. It is suggested that myotendinious force transmission between a muscle and its surrounding structures might be a determinant of local of energy consumption.

Thesis No.: 264 Investigation Of The Effect Of Crystal Thickness On The Spatial Resolution and Linearity Of A PEM Detector Using An Articial Neural Network Based Positioning Algorithm

Name: Didar Talat, Year: 2007

Advisor(s): Albert Güveniş

Abstract: The objective of this thesis is to improve the resolution and linearity of a continuous detector for positron emission mammography (PEM) imaging, by using an algorithm based on artificial neural networks. Another aim of this work is to investigate the effect of crystal thickness on the resolution and bias of the detector. A continuous scintillation detector is chosen, in order to overcome the difficulties observed in light collection and manufacturing of pixilated crystals and to reduce the cost. In this study, the detector is composed of 49 mm x 49 mm continuous LSO crystal where its thickness changes from 3 mm to 24 mm with increments of 3 mm. The photosensor chosen is Hamamatsu H8500 flat panel multi-anode photomultiplier consisting of 8 x 8 anodes. The interactions of narrow beams of 511 keV photons impacting the detector surface and the photosensor output are simulated using DETECT2000 simulation platform. The 64 outputs of the PMT is reduced to 4 and these outputs are used as the input vectors of the multilayer perceptron network for each interaction. Two sets of simulations are performed for each thickness of the scintillation crystal. One set to generate the training set and another set to create the test set. By fixing the parameters of the network and the number of iterations, the effect of crystal thickness and energy threshold on the intrinsic spatial resolution and bias are investigated. Our simulations confirmed the bias problem of the Anger algorithm and the necessity of using a biasfree positioning algorithm for scintillation coordinate estimation. Using artificial network based positioning algorithm better results are observed when compared to Anger algorithm. Results obtained show an intrinsic resolution of 0.329 mm and 0.690 mm for a crystal thickness of 3 mm and 24 mm in the center of the crystal, respectively. The systematic errors calculated are better than those obtained with Anger algorithm.

Thesis No.: 263 The Effects Of Methylphenidate On Brain Hemodynamics Of Attention Deficity/Hyperactivity Disorder Measured By Functional Near Infrared Spectroscopy

Name: Nermin Topaloğlu, Year: 2007

Advisor(s): Ata Akın

Abstract: Attention-deficit/hyperactivity disorder (ADHD) is a very common neurodevelopmental disorder. Approximately 30% 60% of individuals diagnosed with ADHD in youth have symptoms that persist into adulthood. This neurobehavioral disorder results in significant functional impairment. It decreases the life quality of the patients. Therefore, the need for recognition and treatment of patients with ADHD is necessary. Methylphenidate (MPH) is known to reduce hyperactivity in individuals with ADHD. Yet little is known about how it alters neural activity and how this relates to its clinical effects. Functional Near-Infrared Spectroscopy (fNIRS) is a portable, non-invasive brain imaging method measuring the changes in oxygenated hemoglobin [HbO2] and deoxyhemoglobin [HbH] levels particularly in prefrontal cortex. In this study, 15 adult, right handed cases with DSM-IV diagnosis of Attention deficit hyperactivity disorder (ADHD) were evaluated with fNIRS during a cognitive task which is Stroop test. The goal of this study is to examine MPH-induced hemodynamic changes during a cognitive activity, and to examine how these changes correlate with measures of behavioral response to the drug during Stroop task. It is found that MPH effectively decreased HbO levels. The reason of the decreased level of HbO after medication is vasoconstriction. MPH normalized the behavior during an executive function test. MPH has a great effect on the response time of the subjects to NS, CS, and IS. MPH always shortens the durations of the reaction times.

Thesis No.: 262 Correlation Between fMRI and Source Reconstructed EEG Of Steady State Visual Evoked Potentials

Name: Hüseyin Hamdi Eryılmaz, Year: 2007

Advisor(s): Ahmet Ademoğlu

Abstract: Electroencephalography (EEG) is a common technique for studying and understanding the functioning of the brain. In addition, functional Magnetic Resonance Imaging (fMRI), in the recent years has been a very conventional method for neuroimaging. The most important property of the EEG, which makes it superior to other neuroimaging modalities is its very high temporal resolution. EEG reflects functional activities in the range of milliseconds. However, due to limited number of electrode measurements and some modeling failures, it can provide limited spatial resolution. fMRI provides satisfactory spatial resolution for imaging of these processes but it lacks good temporal resolution. In this thesis, the steady state human visual evoked potentials and their corresponding fMRI scans are processed using EEG source reconstruction and fMRI statistical parametric mapping methods. The visual stimulations are ranging from 2 to 10 Hz. The fMRI voxels which proved significantly active were correlated with their associated EEG neuroelectric power which was determined on the same geometric head with Low Resolution Electromagnetic Tomography (LORETA). Spatially averaged positive BOLD, post-stimulus undershoot and LORETA amplitudes are determined across the frequencies as well as the spatial correlations between the positive BOLD and LORETA amplitudes over an activation mask. Finally, the correlation between the standardized regression parameter due to the steady state visual effect and the LORETA amplitudes were also computed over the frequencies. The most consistent observation for all these analyses is the significant activation increase at 8 Hz together with a strong correlation between the two imaging modalities.

Thesis No.: 261 An Autoregresive With Exogenous Model Approach To Functional Near Infrared Spectroscopy Data Acquired From Migraine and Healthy Subjects

Name: Esin Karahan, Year: 2007

Advisor(s): Ata Akın

Abstract: This study is focused on investigating the cerebrovascular dynamics of migraine by analyzing data acquired from healthy and migraine subjects with a noninvasive measurement technique, fNIRS during a breath holding task. Brain hemodynamic responses of subjects are modeled via a parametric identification technique, Autoregressive with Exogenous input (ARX) model. Analysis of modeled signals for healthy and migraine subjects is performed both in frequency and time domains. In frequency domain analysis, frequency intervals in which power spectrum estimates of migraineurs significantly differ from healthy ones, are obtained as 0.01-0.03Hz, around 0.13 Hz and higher than 0.2 Hz ($p<0.05$). The energy of the estimated signals of migraineurs in 0.01-0.03 Hz is approximately ve folds smaller than the healthy ones, whereas in 0.13 Hz and 0.25 Hz this difference is approximately 1.5 folds. Time domain analysis has shown that the amplitude of peak response of migraineurs is ve folds smaller than the healthy ones during all breath holding procedure ($p<0.05$). Required model orders to full the dynamics of response are found higher in migraine case. Results obtained show that response of cerebrovascular system of migraine subjects to breath holding task is considerably different with respect to normal subjects.

Thesis No.: 260 Magnitude Estimation by The Non-Pacinian I Tactile Channel

Name: Şeref Mete Dinçer, Year: 2007

Advisor(s): Burak Güçlü

Abstract: Psychophysical responses to mechanical stimuli were measured to study the sense of touch. By using a forward-masking procedure on eight subjects, magnitude estimation was performed by activating the Non-Pacinian I tactile channel. For each subject, 40-Hz and 250-Hz absolute thresholds were found. Additionally, the 250-Hz masking stimuli that were required to mask the Pacinian channel for selectively activating the Non- Pacinian I channel were determined. The masking stimuli were applied before the test stimuli to find the masked thresholds at 40 Hz. In the final set of experiments, suprathreshold stimuli were used to find magnitude estimation values. These values fit power functions well. Experimental results were compared to neural simulated population responses to study the origins of the power law. The model simulations that used the total number of spikes as the intensity code predicted the experimental results better.

Thesis No.: 259 Robust Design of Breast Scintigraphy Collimator Using Monte Carlo Simulations and Response Surface Methodology

Name: Sinem Balta, Year: 2007

Advisor(s): Albert Güveniş

Abstract: Breast Scintigraphy, a nuclear medicine breast imaging technique, is a supplemental breast exam that is used in patients to investigate a breast abnormality. It is not a primary investigative tool for breast cancer but it is used as a complementary technique in cases where conventional x-ray mammography has some limitations in breast cancer diagnosis. However, studies show that breast scintigraphy does not give successful results when breast abnormality is less than 1cm. The collimator plays an important role in image construction. This study aims to make a robust design of the breast scintigraphy system collimator to obtain a better image quality in small breast lesions (<1cm) by the optimization of the collimator parameters such as hole length (collimator length), hole size and septal thickness while keeping the lesion detectability less susceptible to patient variations such as breast and lesion dimensions. The breast and the lesion were modeled as a cylinder and a sphere, respectively. Monte Carlo Simulation is utilized for simulating the imaging system and Response Surface Methodology is applied for robust optimization. The first part of the study deals with a typical case of breast and lesion dimensions whereas the second part inserts variance to the parameters. Our results show that a hole length of 1.74cm, a hole size of 0.14cm and a septal thickness of 0.02cm are the dimensions of a robust collimator.

Thesis No.: 258 Investigation of Lipid Signaling in Rat Hipocampal Slices with Patch-Clamp Tight Seal Whole Cell Technique

Name: Özgür Genç, Year: 2007

Advisor(s): Hale Saybaşılı

Abstract: Ceramide, besides its structural role in cell membrane as a sphingolipid, has essential roles in apoptosis, cell growth and differentiation. In this study, the effect of C2-ceramide (10 µM) application on whole cell currents recorded by patch-clamp technique from cell body of hippocampal CA1 pyramidal neurons was investigated. Evoked post-synaptic currents were recorded with low frequency (0.1 Hz) stimulation of Schaffer collateral. It was observed that ceramide application resulted with depression among the NMDA currents. On the other hand, there was not any significant influence on non-NMDA currents. The role of C2-ceramide which leads to the depression on the NMDA currents showed that sphingolipids have an effect directly on the cell membrane, besides their roles as secondary messengers inside the cell.

Thesis No.: 257 Building a Measurement Setup for the Investigation of Acoustic Cavitations for Medical Applications

Name: Şener Erdem, Year: 2007

Advisor(s): Burak Güçlü

Abstract: Various noninvasive medical treatments rely on high intensity ultrasound or shock waves. The externally generated pressure waves transfer a large amount of energy into the body. There is evidence that in all of these treatments cavitation provides the main contribution to the desired effects. Cavitation consists of the formation and violent collapse of gas bubbles with sudden gas release. Examples of medical treatments where cavitation plays an important role are the destruction of urinary calculi by application of extracorporeal shock waves, the noninvasive ablation of tumors, localized drug delivery, and improved drug uptake by tissues. Unfortunately, the energy transfer during cavitation is often poorly controlled, frequently leading to inefficient treatment, hemorrhage, and undesired cell damage. In this study a setup is designed, built and tested to investigate microbubble cavitation and its possible effects on kidney stone destruction in combination with high intensity focused ultrasound (HIFU). Optical cavitation detection is monitored during ultrasound excitation by means of a digital camera. Active and passive cavitation detection techniques are used to detect cavitation events. Micro bubbles with different shell types and size distributions are tested. Artificial kidney stones are tested to see whether the HIFU transducer is able to damage a kidney stone. Preliminary results do not show, however, a significant influence of microbubble infusion on kidney stone destruction by means of HIFU.

Thesis No.: 256 Design of a WI-FI Based Electrocardiography Monitoring System

Name: Mehmet Kocatürk, Year: 2007

Advisor(s): Mehmed Özkan

Abstract: The objective of this project is to design a wireless ECG monitoring system which enables the tracking of ambulatory patients' cardiac activities on a central server. A developed software run on a server and the client devices on patients yield providing support for nearly real-time traceability of patient ECG data. The software on the server, which is technically able to handle unlimited numbers of connections of client devices, appropriately communicates with the remote devices and provides plotting of electrocardiogram of a selected patient who is preregistered with the software. The client device, carried by the patient, includes an ECG amplifier circuit which also includes necessary alters to avoid undesired signals, and manages analog to digital conversion of amplified ECG signal as well as its transmission to the server. IEEE 802.11b, as the wireless communication protocol, opted and involved in this design for ensuring data transmission between client devices on patients and the server, has rapidly penetrated in applications in Machine to Machine (M2M) communicating product lines except medical ones. What is more, due to rapid penetration of 802.11x (Wi-Fi) which simplifies the adaptation of the client devices developed with this study to the currently established networks, the designed system, in the aim of wireless ECG monitoring, can be foreseen to supply high efficiency in the further products of several ECG monitoring applications.

Thesis No.: 255 Design of a Wide Range KVP - Meter

Name: Murat Tümer, Year: 2007

Advisor(s): Yekta Ülgen

Abstract: The kVp setting is one of the major factors affecting the image quality in X-ray imaging and should be annually measured and calibrated if necessary. In this thesis, a kVp-meter is designed and a prototype unit was built and the performance was tested in terms of accuracy and reliability. The design is based on the dependency of the attenuation coefficient of metals on the energy of the incident photons, which is related to kVp. The tests on the prototype showed that the accuracy and precision are both below 1% in the diagnostic range. As the same measuring principle applies for mammography unit, this device can be also used for kVp measurements of mammography units. The accuracy and precision in the mammography mode are below 1%, too.

Thesis No.: 254 Bayesian EEG Source Reconstruction Using Markov Chain Monte Carlo Methods

Name: Gökçen Yıldız, Year: 2007

Advisor(s): Ahmet Ademoğlu

Abstract: Electroencephalography (EEG), a non-invasive neuroimaging method measuring neural activity without any metabolic bias, has millisecond scale temporal resolution, the best among available functional imaging techniques with magnetoencephalography (MEG). However, its spatial resolution is severely limited by electrode number used in measurements and head volume conduction effect. Dipole source analysis, EEG forward and inverse problem, aims to compensate for the head volume conduction effect and enhance the spatial resolution of the EEG. Given the known electrical field and head volume conductor properties, the EEG inverse problem estimates the location and magnitude of the brain electrical sources. In this study, EEG inverse problem is formulated using Bayesian inference on a realistic head model. The posterior probability distribution of dipole parameters including the number of active dipoles are sampled by Markov chain Monte Carlo (MCMC) methods. Sampling algorithm is designed by combining Reversible Jump (RJ) which permits trans-dimensional iterations and Parallel Tempering (PT), a heuristic to escape from local optima. Two different approaches to EEG inverse problem, equivalent current dipole (ECD) and distributed imaging are combined in terms of probability. EEG inverse problem is solved with this probabilistic approach using simulated and empirical data. Localization errors are computed. Comparing to multiple signal classification algorithm (MUSIC) and low-resolution electromagnetic tomography (LORETA) methods, this study shows that using MCMC methods with a Bayesian approach is useful for solving the ill-posed EEG inverse problem.

Thesis No.: 253 Design of the Biomedical Calibration Laboratory Quality Manual for EN 17025:2005

Name: Hande Çakıroğlu Doğu, Year: 2007

Advisor(s): Yekta Ülgen

Abstract: According to the New Approach Directives, the CE Marking is obligatory for medical products: the manufacturer affixes this marking in order to be allowed to sell his product in the European market. CE marked devices can only be tested and controlled by accredited laboratories. It is the aim of this project to design the laboratory quality manual in compliance with the EN 17025 standard, for the Biomedical Calibration Laboratory of Boğaziçi University. By searching other related international standards, minimum documentation requirements are determined: besides a draft Laboratory Quality Manual, draft documents such as policies, procedures and instructions are prepared within the scope of this master thesis. In the Appendices, a simple strategy plan on how to implement the EN 17025 standard in BME Biomedical Calibration Laboratory is also presented.

Thesis No.: 252 Effects of Various Parameters on Binocular Rivalry

Name: Gamze Bölükbaşı, Year: 2007

Advisor(s): Burak Güçlü

Abstract: In daily life, the two eyes see similar images and there is no perceptual competition. The input from the eyes are compatible and the images are fused. On the other hand, binocular rivalry occurs when two eyes are presented with incompatible visual stimuli. In this condition, the perception alternates every few seconds from one monocular stimulus to the other or an unstable piecemeal mixture is seen. Binocular rivalry is affected by many parameters like contrast, form and motion velocity. In this study, effects of flickering frequency, duty factor, size and luminance of the monocular image on binocular rivalry were tested. It was expected that the rivalry percentage would be decreased when the stimuli is flickered compared to static stimuli and also it was expected that the rivalry percentage would be increased as the duty factor is increased, but would stay constant with respect to frequency. The visual rivaling stimuli used were a square and a disc. The results showed that the rivalry occurrence was reduced when stimuli were flickered, compared to static stimuli. However, the frequency or duty factor of the flicker did not have any effect on the rivalry time. Moreover, the location of monocular images were interchanged in order to test eye asymmetry effects. No such effects were found. Additionally, changes in the size and the luminance of the target did not cause any differences in the rivalry time. This type of stimuli can be used for binocular contrast experiments since the rivalry percentage is found to be reduced in flickering stimuli.

Thesis No.: 251 Classification of Tactile Units of Frogs using Von Frey Monofilaments

Name: Korcan Uçar, Year: 2007

Advisor(s): Burak Güçlü

Abstract: Twenty-four mechanoreceptor afferent units with fast conducting axons in the sciatic nerve innervating the hind foot were isolated for electrophysiological recording in pithed frogs. Ten rapidly adapting (RA) units and fourteen slowly adapting (SA) units were differentiated from each other mainly based on their discharge patterns. In the neural response to von Frey indentation, RA units had a rapid transient discharge with the maximal five sequential action potentials. SA units had longer and sustained activity during steady pressure on the receptive field. Two kinds of SA units were distinguished; one group of SA units (SA type I) generated irregular discharge pattern at a gradually decreasing rate when was applied ramp stimulus, while the other group (SA type II) generated fewer transient discharges followed by sustained regular discharges lasting longer. SA I and SA II units were differentiated on the basis of several features: i.e., spontaneous firing, transient response and interspike interval histograms. The property of regularity was determined quantitatively. SA units discharged with higher latencies than of RA units. RA units differed from SA units by their higher conduction speeds. The average latency of the first spike was recorded as 33 ms for RA units and 45 ms for SA units. There was a significant difference between the conduction speeds of RA and SA units (t-test; P=0.039). There was no significant difference between the conduction speeds of SA I and SA II units (t-test; P=0.082). Thresholds of indentation did not differ between three groups of units. Most of the units had 0.16 g indentation threshold. Spike counts for RA units did not change as a function of indentation level, but pooled SA spike counts increase as a function of indentation amplitude. Receptive field analysis was made quantitatively and no differences were seen between groups according to their receptive field structure. Except for the receptive field information, results indicate that tactile units on mammalian and frog skin are similar.

Thesis No.: 250 Evaluation of the Continious Detector Conceptor for Pet Systems Dedicated to Small Animals by Using the Monte Carlo Simulation Method

Name: Sakine Şebnem Ertürk, Year: 2007

Advisor(s): Albert Güveniş

Abstract: A detector design especially for small animal PET systems requires taking into account three main factors: these are high energy and spatial resolution and price. When examining the state-of-the-art PET detectors, it can be seen that many researchers have preferred to use continuous (monolithic), block or discrete crystals for small animal PET systems. Although, the discrete crystal detector designs have provided high spatial resolution, they also have caused many complications such as, reduced light collection (low packing fraction), labour-intensive use and increased costs. In this study, to overcome these limitations, the feasibility of using a continuous crystal instead of block or discrete designs has been explored for high resolution small animal PET applications. For this aim, a PET detector for small animals based on continuous block Lutetium oxyorthosilicate crystal (LSO) (16mm x 16mm) coupled to a PS-PMT (Hamamatsu H8711-03) has been designed. When working with continuous crystals, surface treatment and crystal thickness are important factors that strongly determine the main characteristics of the detector module. Therefore, for the development of this explored small animal PET detector, the effects of these factors on the detector module performances have been investigated, in order to optimize crystal configuration. In this study 4 different surface treatments (Polish + Black, Ground + Black, Ground + Methacrylate, Ground + Air), 3 different crystal thickness (3mm-6mm-9mm) and 41 different source coordinates were used. The obtained results for the energy resolution, spatial resolution and image compression have been presented when using different surface treatments and thicknesses in continuous LSO crystals. The simulation results have been carried out by using DETECT2000 package. The end word, high spatial resolution is the most important parameter for a PET detector. In our study, Ground + Air (GA) surface treatment gives the highest special resolution but, the image compression is poor. However, this poorness can be avoided by using certain statistics based positioning (SBP) algorithms.

Thesis No.: 249 Design Optimization of a Continious Detector for PEM Imaging with Resolution and DOI Capability

Name: Serkan Berk, Year: 2007

Advisor(s): Albert Güveniş

Abstract: The objective of this thesis is to improve the resolution of a continuous detector by using an algorithm other than Anger algorithm. Our aim is to obtain a reasonable resolution necessary for Positron Emission Mammography (PEM) imaging. Many research groups have been involved in developing different types of high resolution Positron emission tomography (PET) systems. Among those, most designs have consisted of detectors assembled using tiny discrete crystal elements identified by position sensitive or multichannel photomultiplier tubes. However using narrow, pixilated crystals for higher resolution causes several problems including inter crystal scatter, light collection difficulty, practical difficulties of crystal size, and high cost. In this work, the feasibility of using a continuous crystal detector for PEM imaging with high resolution has been investigated through simulations. We aim to reduce the system cost and to improve system performance. Simulations confirmed that Anger algorithm is not a feasible algorithm to use in a small size detector since it needs further processing to correct the linearity distortion problem and it does not provide any information about the depth of interaction. Simulations also showed that, when calculating the location of interaction with Anger algorithm, there can be a shift about 1 mm depending on the depth of interaction in a 10 mm thick NaI crystal. The nearest neighbor algorithm by using a lookup table gave better results than Anger algorithm and also provided information about depth of interaction. We adapted a second threshold, called Proximity value, to the algorithm to eliminate possible Compton scatterings. This improves the resolution while trading off the number of interactions used. An optimum proximity value has been suggested depending on the simulation results.

Thesis No.: 248 Quantification of the Effect of Warm Up and Stretching on the Oxygen Metabolism Using an Improved Version of a fNIRS Device

Name: Emir Alkaş, Year: 2007

Advisor(s): Ata Akın

Abstract: In the vastly improved field of exercise physiology, it is an imperative to exercise a warm up and stretching routine before training. The reasoning is closely associated with the oxygen (O2) metabolism in the blood. Warm up provides the necessary means to activate enzymatic reactions to accelerate oxy-hemoglobin (HbO2) break up by increasing the body temperature and slightly decreasing the pH of blood. Stretching, meanwhile, acts as a regime to educate the muscle by extending the sarcomere to its full length and lining up the extracellular matrix (predominantly, the collagen fibers) in the line of action. This M.Sc. thesis is involved with the analysis of the effect of warm up and stretching on the O2 metabolism. The device used in the quantification process is a fNIRS equipment, named NIROXCOPE 301. Niroxcope 301, an improved version of Niroxcope 2011, locally measures the deoxy-hemoglobin (Hb) and oxy-hemoglobin (HbO2) change with respect to time and relative to a baseline determined at the calibration stage. The Arterial Occlusion Protocol was applied by using Niroxcope 301 in an effort to compare the gastrocnemius of the subjects ready for exercise (i.e. with warm up and stretching) with the unprepared gastrocnemius in terms of the pre-determined three parameters of post occlusion. Hbmax data, due to its great difference compared to that of the control groups resulted in $p = 4.71$ e-5 in ANOVA analysis. 90% index provided the most sterile data as it is normalized by a maximal value. It resulted in $p = 0.0054$.trec was a more controversial data due to its dual nature (more recruitment vs. better recovery of a single unit) and displayed a mixed pattern.

Thesis No.: 247 Artificial Neural Network for Gait Disorder Classification

Name: Shavkat Kuchimov, Year: 2006

Advisor(s): Mehmed Özkan

Abstract: Developments in motion analysis systems are distinctive in last decades. Those systems became very important tools for diagnosis of various gait disorders. They evolved so much that clinicians nowadays dare to use them in critical decisions. Thanks to advances in computer and motion capture technology, several biomechanical joint trajectories of human gait are available. Examining all parameters is wearisome and time consuming. Recent inclinations are towards facilitation of neural networks in similar cases. An Artificial Neural Network could be trained and considered as a decision support system for gait analysis. In this study a neural network is trained for classification of four different gait patterns. Supervised learning method and Error Back-Propagation Algorithms are deployed for the training of the Multilayer Perceptron. Matlab programming language was exploited for writing the code of the algorithm. Overall 150 subjects were used in this thesis. Their age range was between six and twelve years. Samples are collected for normal gait, Right Hemiplegia, Left Hemiplegia and Diplegia from Istanbul University Istanbul Medical Faculty Motion Analysis Laboratory. Attained classification success for distinguishing normal and for three different abnormal gaits was on average 77%. Further increase in success was achieved after the implementation of cross validation and early stopping methods, reaching at 85%. For the classification of normal and abnormal gaits into two groups a better classification success rate was achieved, up to 96%.There is still space to build upon the current research for further progress. This neural classifier could help clinician to support his/her decisions.

Thesis No.: 246 The Effects of MS/VDB Lesions on Behavioral Despair and Learning and Memory

Name: Ayla Aksoy Aksel, Year: 2006

Advisor(s): Murat Gülsoy

Abstract: The present study aimed to investigate the consequences of hippocampal denervation in terms of irreversible medial septal area lesioning on behavioral despair and navigational learning. To that purpose medial septum / vertical diagonal band of Broca (MS/VDB) lesions were achieved electrolytically or with 980-nm diode laser application in the rat brain. The animals were tested in forced swim test followed a week later by Morris water maze to assess behavioral despair and navigational ability respectively. Histochemical evaluation revealed lower acetylcholinesterase (AChE) content in the hippocampus of some of the lesioned animals compared to shamoperated control animals as a functional outcome of MS/VDB lesions. Animals with low AChE content in the hippocampus showed aggravated behavioral despair determined by augmented duration of immobility in the second swim test. On the other hand, the temporal learning acquisition in Morris water maze rather than total learning capability is affected by medial septal area lesions. Behavioral findings in the present study appear, not to be due to possible sensory-motor impairments of the lesioned animals since the latter did not differ from the sham-operated controls in the visible platform version of MWM task and open field activity test. Electrolytic lesions appear to be more efficient than laser lesions in terms of AChE decrease in the hippocampus. In conclusion, reduction of hippocampal AChE content via irreversible lesions of MS/VDB area aggravates behavioral despair but fails to induce learning impairments in rats.

Thesis No.: 245 Embedded Software development for a GSM-Based Ambulatory EKG Device

Name: Onur Yıldırım, Year: 2006

Advisor(s): Ahmet Ademoğlu

Abstract: Acute myocardial infarction (AMI or MI) occurs when a part of the heart muscle dies because of sudden total interruption of blood flow to that area. It is a life-threatening medical emergency which demands immediate activation of the emergency medical services. This thesis proposes the development of an embedded communication framework designed to enable quick diagnosis of AMI and immediate activation of emergency medical services targeted to it. The system consists of an embedded communication software along with a TCP/IP based sever software for a GSM based ambulatory ECG device. Both, the software components running on the ECG device and the communication server enable the device to be remotely interfaced by the call center software and controlled by the cardiologists.

Thesis No.: 244 Design and Implementation of Software for on EKG Based Remote Emergency Diagnostic System

Name: Can Baran Dilber, Year: 2006

Advisor(s): Ahmet Ademoğlu

Abstract: This thesis aims for the design and implementation of a software system for distributed emergency diagnosis to be used in conjunction with ambulatory electrocardiography (ECG/EKG) devices. The software consists of a Digital Signal Processor (DSP) helper library for processing and conditioning the ECG signals, a database for central data storage, and an expert user interface for ECG data evaluation. The system primarily aims to reduce the gap between patients and experts (cardiologists) and allows for the rapid diagnosis of acute myocardial infarction (AMI), commonly known as heart attack. This will consequently decrease the time span between the onset of symptoms and treatment. However, this system can also be used for the diagnosis of other forms of cardiovascular diseases, as well as a means of routine monitoring of cardiac patients.

Thesis No.: 243 SMT: Split/merge fiber tractography for MR-DTI

Name: Emin Uğur Bozkaya, Year: 2006

Advisor(s): Burak Acar

Abstract: Magnetic Resonance Diffusion Tensor Imaging is a recent imaging modality which has shown promise as a non-invasive tool for estimating the orientation and quantity of white matter tracts in vivo. It has been shown that the estimated diffusion tensors principal diffusion direction coincides with the fiber orientations, given that the tensor in question is anisotropic. MR-DTI fiber tractography aims at following these principal diffusion directions to reconstruct fiber paths. The conventional approach is to use integration techniques, i.e. to follow the principal diffusion directions. The goal of this project is to introduce a new technique for estimation and visualization of fiber tracts. The proposed Split/Merge Tractography (SMT) tries to overcome the disadvantages of existing techniques. SMTs approach is to generate short (thus more reliable) fiber tracts by conventional techniques (Splitting step) and ' then group these short tracks according to an estimated distribution (Merging step).SMT allows branching and does not mask the inherent resolution limitation of the data. The aforementioned distribution is estimated via the Metropolis-Hastings Method.

Thesis No.: 242 Investigation of 980-nm Diode Laser Parameters for Soft Tissue Surgery

Name: Yusuf Korkmaz, Year: 2006

Advisor(s): Murat Gülsoy

Abstract: Within 800 - 1064 nm spectrum 980 nm diode laser is very important because of the local absorption peak around 980 nm. This work was carried out to find the irradiation e irradiated with 980 nm diode laser. Coagulations were quantified interms of diameter and depth measurements. Laser beam was applied in two different modes: Continuous wave and modulated in 250 ms on/off and 50 ms on/off cycles. Carbonization threshold for each mode (CW or modulated) were found. Maximum irradiances and maximum energy densities were recorded. For best proposed doses histological analyses performed and thermal alteration was observed. For modulated wave, the effect of the duration of the duty cycle was discussed. The comparison of tissue types was done and water content of each tissue was calculated by desiccation method. Maximum irradiances, maximum energy densities and water content were compared. The result of this research study is a step for understanding the characteristics of 980 nm diode laser for soft tissue surgery.

Thesis No.: 241 Generec Implementation of the Cortico-Hippocampal Model of Gluck and Myers in Hippocampal Region Atrophy

Name: İlim Çağıran, Year: 2006

Advisor(s): Halil Özcan Gülçür

Abstract: Hippocampal region dysfunction is suggested to have an important effect for the cognitive impairments observed in Alzheimer's disease. In some patients, hippocampus and nearby structures show atrophy while other brain structures appear intact. Hence, study of neural network models which can mimic biological and psychological findings is hoped to contribute to our understanding of the underlying reasons and possible consequences of hippocampal dysfunction. Therefore the main objective of this thesis work was to develop an artificial neural network model that in many ways behaved like the hippocampal region. For this purpose we have used the corticohippocampal model of Gluck and Myers as the basic model. The learning rule Gluck and Myers used in their original work was backpropagation. Hoping to get a more biologically plausible model, the learning rule was changed to generalized recirculation (GeneRec). Furthermore, instead of using negative weights, the network was externally inhibited by two alternate methods: the kWTA inhibition and via additional inhibitory interneurons. Also, a weight bounding function was applied to the weight update rules. Addition of external inhibition and weight bounding functions to the network reduced the convergence characteristics of the network. Particularly cortico-cerebellar side of the network could not converge with external inhibition. Therefore external inhibition was abandoned for the cortico-cerebellar side. Although the hippocampal network could converge with kWTA, inhibition and weight bounding, rapid changes of activations of hippocampal network hidden layer neurons during training caused huge oscillations on the cortico-cerebellar output. Hence, external inhibition was abandoned also for the hippocampal network. The results of several representational differentiation and compression cases were found comparable to the Gluck and Myers original work.

Thesis No.: 240 Active and Passive Processing of Sequential Tactile Inputs

Name: Ali Murat, Year: 2006

Advisor(s): Burak Güçlü

Abstract: In this thesis, a psychophysics experiment, which is designed to test the effect of active and passive touch on tactile temporal processing, is presented. Active and passive touch are terms that were defined first by J.J. Gibson, and there have been many experiments done where these two were compared. Most of these studies made the comparison in the dimension of tactile spatial processing. In this study however, the subject is asked to detect the tactile stimuli applied at certain time intervals. Therefore, tactile temporal processing was tested here. The tactile stimuli were applied both actively and passively, and the correct judgments of the subjects were recorded at both conditions. Besides active/passive touch, the effects of visual attention and scan velocity on tactile temporal processing were tested in this study.

Thesis No.: 239 Mental Rotation & Mirror Image Recognition in Blinds, Blindfolded and Sighted

Name: Serkan Çelik, Year: 2006

Advisor(s): Burak Güçlü

Abstract: How the spatial information is coded and processed is one of the frequently researched subjects in cognitive science. For a rather long time there has been a hard debate about whether the object representation is analogue or propositional. One of the well-known experiments measuring how the spatial information is recognized is the mental rotation experiment. Mental rotation is based on the idea that if a shape is presented in some orientation other than its canonical one, the observer might compensate by an act of mental rotation. The viewpoint dependence in visual and haptic object recognition were studied analyzing whether the correct response times are changing with the orientation angles of the rotated objects. The experiment was performed on subjects who were sighted, blindfolded and the congenitally blinds. Thus, the tactile mental rotation concept and whether visual information is required in mirror image recognition and in mental rotation process were investigated. The subjects were asked which on was the mirror image of the standard object among three simultaneous presented stimuli. All three groupsof subjects, sighted, blindfolded, and blinds, were recognized the mirror image of the objects well regardless of its orientations. However, while the sighted and blindfolded subjects did not use mental rotation strategy, the blind subjects reflected mental rotation like process when they tried to find the mirror image of the standard object. Accuracy, speed of the response times, congruency effect, linearity effect, and uprighting process were analyzed in the present study in order to discover the common and differential structural mechanism underlying tactile and visual object recognition.

Thesis No.: 238 Production of Orbital (Eye) Implant from Hydroxyapatite

Name: Buğra Bayraktar, Year: 2006

Advisor(s): Sabri Altuntaş

Abstract: When an eye was lost due to trauma or in the events that require to remove eye globe from the orbit, spherically shaped orbital implants were used in order to fill the cavity, to protect the area from infection and to preserve the structure of orbit. In recent years, hydroxyapatite has gained wide acceptance as an orbital implant material due to its biocompatibility and its porous structure allowing tissue in growth. In this study, it is intended to manufacture porous orbital implant by a novel and simple process. The amount of porosity and pore size of implant is tried to be controlled through varying amount of naphthalene addition. Here, it is proposed to make the implant slight in weight as well as suitable for rapid vascularization after implantation. Characterization of the implants with respect to phase purity was performed by X-ray diffraction (XRD) and infra-red spectrometer (IR) so as to compare this characteristic of the final product to that of starting material. Based on these investigations, no sign of decomposition phases, impurities and the trace of naphthalene were detected in the sintered samples. The pore morphology and pore size distribution of the samples were investigated by scanning electron microscope (SEM) and the results were compared with respect to variables. Besides, weight, bulk density, rate of contraction and porosity of implants were measured. As a mechanical test, compressive strength of the specimens prepared for this purpose was investigated. All results were evaluated and compared to each other. As far as the mechanical strength, weight, pore size distribution in terms of micro macropores and interconnectivity concerned, the best results were achieved from %45 naphthalene added implant specimen.

Thesis No.: 237 Sub-Components of Event Related Potentials (ERP) Associated with Polymorphisms in Glutamate Gaba and Dopamine Neurotransmitter Receptors

Name: Çağrı Oğur (Beyazyürek), Year: 2006

Advisor(s): Ahmet Ademoğlu/Tamer Demiralp

Abstract: Event related potentials (ERPs) reflect perceptual and cognitive processes and therefore provide an electrophysiological window onto brain function during cognition. P300 component as well as spectral components of ERPs are highly heritable. Potential candidates for the genetic determinants of ERPs are genes encoding several most important neurotransmitter receptors. In this study, we aimed to identify associations of functional polymorphisms of genes encoding glutamate receptor 2A subunit, (NMDAR2A), GAB receptor gamma-2 subunit (GABRG2) and dopamine receptor D2 subunit (DRD2) with auditory ERPs. EEG recordings and genetic analysis of 72 Turkish male healthy volunteers were performed in this study. Groups were formed according to their polymorphism types for each of the three neurotransmitter receptors. Three cognitive paradigms were designed to generate auditory ERPs. ERP recordings of each polymorphic group were analyzed in the time domain by measuring P300 amplitude and latency, and furthermore, in the time frequency domain by decomposition of ERP signals via using wavelet transform with analysis of variance (ANOVA). Results provide evidence of strong effect of GABRG2polymorphism with ERP characteristics both in time domain and in time-frequency domain. The effects of NMDAR2A and DRD2 polymorphisms are less significant on P300wave. However, time-frequency decomposition of ERP data showed other effects could be observed in specific frequency bands of all three polymorphisms that were not reflected in the time-domain representation of the data. The results of this study show that extended analyses on the correlations of genetic differences among normal population on electrophysiological parameters may extend our view on the genetic basis of cognitive activities.

Thesis No.: 236 Biomechanical Analysis of Sit-to-Stand Motion in Children with Backpack Load

Name: Yasin Barış Seven, Year: 2006

Advisor(s): Can Yücesoy

Abstract: Sit-to-stand (STS) motion is a highly coordinated and energy demanding task of daily activities. The primary objective of this study was to investigate the effects of backload on the sagittal plane kinematics and kinetics of STS motion in healthy children. The secondary objectives were to determine the limbs which may be more prone to damage and to suggest a critical value of back load relative to the body weight. Fifteen healthy children (8 males, 7 females, mean age 9.6 ñ 1.2) participated in the study to perform STSmotion in three conditions: (1) with no back load (2) with a back load of 10% of the body weight (BW) and (3) with a back load of 20% of the BW. The motion was performed using a fixed bench height at a self-selected speed. Kinematic and kinetic data were collected via a 6-camera motion analysis system and 2 force plates. The present results led us to four major conclusions reflecting the effects of back load on the STS motion: (1) The neuromuscular system is concluded to adjust the durations of the individual phases rather than that of total STS in order to adapt the motion to the new mechanical conditions. (2) Subjects followed a "trunk flexion strategy" in the loaded cases by shifting the new center-of-mass both forward and downward presumably to ease the control of the motion and to reduce the risk of falling. (3) Different back load levels affect different joints. Increasing the load to 20% BW caused significantly higher ankle moment. On the other hand, even 10% BW load produced significantly higher knee moment. However, no major effect of back load was shown on hip moment and power. (4). Back loading causes higher forces and increases the range of eccentric activity of gastrocnemius and soleus muscles by leading to much higher angles of ankle dorsiflexion. Therefore, the calf muscles and the achilles tendon, were concluded to be the most prone elements of the muscle-tendon complexes of the lower extremity to damage while performing STS motion with back load.

Thesis No.: 235 Wavelet Transform Based Electrocardiogram Compression and Comparison with DCT/DST Methods

Name: Mustafa Namdar, Year: 2006

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis we investigate wavelet transform based ECG compression techniques and compare them with conventional approaches. A major issue addressed how to guarantee a user-specified error limit measured by the percent root mean square difference (PRD) for the reconstructed ECG signal to be controlled at every segment while keeping the compression ratio (CR) as large as possible with reasonable implementation complexity. Two wavelet transform based compression methods, one based on discrete orthonormal wavelet transform (DOWT) and the other based on wavelet packet transforms are studied in detail. Decomposition, uniform quantization, and entropycoding are applied successively to compress the digital ECG signal while entropy decoding, and inverse transformation are applied to reconstruct the original signal. Different types of wavelet families are used to analyze the effect on CR and PRD. More conventional discrete sine / cosine transform based methods are also studied for comparison purposes. Two numerical metrics PRD and CR are used as the major performance evaluation parameters to quantitatively compare one method to another. The CR is a measure of compression efficiency; the PRD gives information about the performance of the compression scheme and the distortion measured. Using the techniques developed, two different types of ECG signals (normal and an arrhythmic) are compressed analyzed and the results are reported. In each technique, while the PRD increases, the CR also increases. In general, the highest CR values are obtained with the wavelet transform; the lowest PRD values are obtained with the wavelet packet transform.

Thesis No.: 234 An Investigation on Lighy Intensity Variation with Composite Resin Depth in Dental Curing Devices

Name: Ahmet Bahadır Otaran, Year: 2006

Advisor(s): Murat Gülsoy

Abstract: In this thesis whether a new generation LED light source based Light Curing Unit can cure a new generation Dental Restoration Composite in a deep cavity situation, by a single application, without adverse effects and save time both for the doctor and the patient, is investigated. An experimental setup, including a made-to specification LCU using the highest intensity single LED available is prepared to find the light intensity change through a new generation Dental Composite, from 0 to 8 mm, in 1 mm increments, It is observed that the light intensity falls by exponentially in the composite, leaving only 15% of the light entering at the top surface in 4th mm and 5% in the 5th mm. With a given exposure duration of 20s, this proves not enough to polymerize the composite at lower levels. As the composite polymerizes its opacity decreases to result in an increase in light intensity on the other side of the material by 4%. This phenomenon stabilizes in 40s at 1 mm, 72s in 2 mm, 84s in 3 mm. This may be an indication of full polymerization. When longer cure duration of 90s and 180s is applied composite polymerizes up to a depth of 5.50 mm, while increase in light intensity trend behind 6 mm composite thickness continues (482% increase in 180 s). Results indicate that, if a LCU with enough power to compensate the loss in the material is used, it may be possible to cure deep restorations in a single application at shorter total duration.

Thesis No.: 233 Effects of Repetitive Retinotopic Stimulus on Viual Cortex fMRI Signal

Name: Andaç Hamamcı, Year: 2006

Advisor(s): Cengizhan Öztürk

Abstract: The aim of this study is to investigate the effects of the repetitive stimulus on the retinotopic functional magnetic resonance imaging results obtained. Screen projector system is constructed to show visual stimulus to subjects during fMRI scans. Retinotopic stimulus are applied to 5 healthy subjects, everyday during 3 weeks. fMRI scans of subjects are done one at the beginning and once after each week. The data acquired is analyzed to obtain the retinotopic fMRI parameters. Visual areas, BOLD signal changes and cortical magnification in primary visual cortex are determined for each week. The results obtained are quite stable. Observed changes are discussed which might be investigated in further studies.

Thesis No.: 232 A Fes Device developed for Treating Drop Foot

Name: Aykut Yavuz, Year: 2006

Advisor(s): Halil Özcan Gülçür

Abstract: Multiple sclerosis, stroke and peripheral neural disorders affect the central nervous system and cause various nervous and muscular disabilities. One of these disabilities is called drop foot, which prevents the patient from raising the foot at the ankle and effectively swinging the leg when walking. This situation can be corrected by using muscle stimulators and synchronizing functional electrical stimulation of the common peroneal nerve to the swing phase of the gait cycle. This thesis presents a portable, two channels, functional electrical stimulator that was designed and developed to assist drop foot patients during walking. The device has two independently programmable constant current outputs, which can produce biphasic pulses having pulse with up to 350 us and amplitude up to 100 mA. A microcontroller core controls all of the parameters. A new program code has been written for controlling stimulation parameters and storing them for a future application. The system can be programmed using push buttons and an LCD display. A foot switch worn by the patient, under the heel, is used for getting feedback control for stimulation timing during the gait cycle. This foot switch triggers the output channels to stimulate the related muscles through electrodes that are placed over the nerves. Various tests have shown that our system is reliable and the performance of the design is satisfactory enough.

Thesis No.: 231 Supra-Threshold Contrast Perception in Glaumatous and Normal Human Subjects

Name: Canan Aslı Ütine, Year: 2006

Advisor(s): Burak Güçlü

Abstract: The lateral inhibition mechanism of the sensorineural retina provides our visual system with a mean to sharpen the boundary between different luminances. Contrast is defined as the ratio of the difference in the luminance of two adjacent areas to the summation these luminance values. Contrast sensitivity is a measure of the ability of an individual to detect a difference in the luminance between two areas. Especially in the early stages of the chronic open angle glaucoma, contrast sensitivity changes are seen earlier that visual field and optic nerve head changes. The usefulness and benefit of contrast-sensitivity testing include uncovering the hidden loss of vision not apparent through other visual evaluations, providing a visual method to monitor the impact of treatment intervention, and providing insights into the extent of patients' visual disability and functional performance problems. The simultaneous lightness contrast (SLC) effect demonstrates that the lightness of an object depends on its immediate surround. A region seen against a dark background looks lighter than an identical region seen against a light background. A modified SLC test was used to uncover the changes in the normal enhancement of contrast increments and decrements, due to deleterious effects of the glaucoma on neurosensorial retina. Both normal and glaucomatous subjects were found to overestimate contrast decrements in a similar manner. However, glaucomatous subjects failed to demonstrate enhancement of the contrast increments, except for the largest increment. The test seem to detect the supra-threshold contrast sensitivity changes that occur before the visual field defects appear and classical threshold contrast sensitivity tests appear abnormal. It can be the first-line test in early stage and suspected glaucoma cases. Additionally, other subjective visual assessment tests performed on glaucomatous patients should be revised based on this concept.

Thesis No.: 230 Effect of Incident Light Intensity and Source-Detector Separation on Photon Migration Depth in Turbid Media

Name: Betül Şahin, Year: 2006

Advisor(s): Ata Akın

Abstract: Diffuse optical tomography (DOT) and near-infrared spectroscopy (NIRS) are techniques that suffer from an uncertainty of photon migration path length which is important for information of the tissue depth that is probed. We have investigated the hypothesis that probing depth is a function of the incident light power and source-detector distance. The hypothesis is tested both numerically by Photon Migration Imaging (PMI)Toolbox (finite-element model diffusion approximation to the radiative transfer equation) and experimentally using continuous wave coherent light. Increasing the light power simultaneously increases the measured photon fluence, more importantly its effects on distribution of photon density can be seen by forming perturbations in the media. Simulations and experiments showed that it is possible to detect the presence of a layer with a higher absorption coefficient than the upper layer and its depth using the fact that different source-detector pairs' diffuse photons have different depths of most probable path of migration. We also showed that a change in the photon distribution with increasing intensity of incident light has no virtual contribution to this derivation.

Thesis No.: 229 Measurement of Vibrotactile Thresholds of Normal Children

Name: Çiğdem Öztek, Year: 2006

Advisor(s): Burak Güçlü

Abstract: In this study, the vibrotactile thresholds of children (ages between 8 and 11) were measured at several frequencies, and compared to the vibrotactile thresholds of adults (ages between 21 and 27) at 40 Hz and 250 Hz. Also, the thresholds of Non-Pacinian I (NPI) channel of children were measured at 40 Hz. Since Pacinian (P) channel and NPI channel have similar thresholds at 40 Hz, a forward-masking procedure was used to elevate the threshold of P channel. Results were compared to NPI channel thresholds of adults at 40 Hz. To enable comparison with population models of mechanoreceptive fibers in the literature, the studies were performed using the terminal phalanx of middle finger and no contactor surround was used. Thresholds were measured using a two-interval forcedchoice paradigm, in order to ensure that the measurements were independent of the subject's criterion. No statistically significant differences were found between the absolute thresholds of children and adults at 40 Hz and 250 Hz. For NPI channel thresholds, children and adults' data were found to be marginally different. However, more data are needed to reach a firm conclusion. Moreover, the masking functions of children at 250 Hz were obtained. The threshold shifts increased as masking stimulus levels were increased. The results were discussed in relation to previous studies in literature.

Thesis No.: 228 Minimization of Inhomogeneties in Magnetic Resonance Mammography

Name: Orkun Serdar Doğruluk, Year: 2006

Advisor(s): Halil Özcan Gülçür

Abstract: Magnetic Resonance Mammography (MRM), accepted by for use as a supplemental tool to mammography in 1991, provides detailed information about very small lesions that X-ray mammography and ultrasound often cannot detect. Women who are at increased risk for developing cancer, or those who have completed breast conserving "lumpectomy", young women with dense breasts or those with a great amount of DCIS (ductal carcinoma in situ) are good candidates for MRM. Resolution of the breast imaging is important for improving differentiation between benign and malignant lesions and for refining treatment strategy. Inhomogeneity of the static magnetic field or secondary magnetic field and nonuniformity of the receiver coil have adverse effects on resolution. A number of methods have been proposed to minimize these effects. In this thesis work we present a novel improved homomorphic filtering method to minimize artifacts caused by these inhomogeneities. Unlike other homomorphic filtering methods, we apply a tissue mask to eliminate filter artifacts, and then apply low-pass filtering to estimate the bias field. Restored image is obtained by the difference of the original image and the estimated bias field. A frequency range is defined and a number of bias fields and restored images are estimated for each image. Entropy minimization is used to define an optimum cutoff frequency of the low-pass filter. This results in a fast, user independent, nonparametric algorithm. The method is demonstrated on various breast images from different patients. A performance evaluation method is also defined for quantitative measurement.

Thesis No.: 227 Optimal Collimator Design Using Monte Carlo Simulation and RSM Breast Scintigraphy

Name: Barış Bilgin, Year: 2006

Advisor(s): Albert Güveniş

Abstract: Scintimammography can be a useful adjunct to physical examination and mammography for the detection and characterization of breast tumors, especially for patients with dense breast tissue, architectural distortion of the breast, breast implant or with equivocal mammography. However, one major limitation of scintimammography is its poor sensitivity and image quality for small lesions (<1.5cm). The aim of this work is to optimize the collimator parameters of a scintimammography system to achieve better image quality by using Monte Carlo Simulation and the Response Surface Method. Two software packages have been used for this purpose: SIMIND is a Monte Carlo Simulation program developed by Dr. Michael Ljungberg. NCSS is a statistical analysis software package used for the Response Surface Method (RSM). Monte Carlo has a wide usage in nuclear medicine imaging, however RSM has not been used much in this area. RSM stems from science disciplines in which experiments are performed to study the unknown relation between a set of variables and the system output, or response. We ran SIMIND to simulate a planar gamma camera system and carry out the experiments. NCSS was used for the optimization process. The SNR (signal-to-noise ratio) is selected as the detectability index. A MATLAB program was written to compute SNR values from the outputs of SIMIND. The breast was modeled as a cylinder full of water and a spherical lesion with a diameter of 0.3 cm. Our results show that for a constant septa size of 0.02 cm, we can obtain optimum detectability when the diameter is 0.132 cm and collimator length is 1.449.

Thesis No.: 226 Measurement Changes in Cerebral Oxygenation and Hemodynamics During Obstructive Sleep Apnea by Functional Near Infrared Spectroscopy

Name: Zeynep Alptekin, Year: 2006

Advisor(s): Ata Akın

Abstract: One of the most important integral part of human existence is sleep. It has been thought that sleep has a recovery function for brain. This importance opens a new area of research about sleep disorders. Obstructive sleep apnea occurs with the absence of airflow for more than ten seconds despite continuing ventilatory efforts, several times during sleep with a reduction of arterial oxygen saturation (SaO2).Sleep apnea can clinically be detected by overnight polysomnography studies, but these studies do not give information about brain hemodynamics and tissue oxygenation. Functional imaging of brain by near infrared spectroscopy (fNIRS), gives chance to measure specific biochemical markers. It is also possible to continuously and noninvasively measure cerebral oxygenation by NIRS. In this study, by using functional near infrared spectroscopy synchronously with polysomnography; cerebral tissue oxygenation and hemodynamics of six obstructive sleep apnea (OSA) patients were measured with the certain polysomnography parameters, like SaO2 and respiratory signal. During apneic events, cerebral tissue deoxygenation was not as significant as deoxygenation in peripheral tissues. In this study, during apneic events, increase in deoxyhemoglobin and total hemoglobin were observed in combination with a lesser increase in oxy-hemoglobin in cerebral tissue. Phase differences between breathing, arterial oxygen saturation and cerebral tissue hemodynamics were also observed during this study.

Thesis No.: 225 Measurement of Oxidative Metabolism of the Working Human Muscles by Near Infrared Spectroscopy

Name: Akın Yücetaş, Year: 2005

Advisor(s): Ata Akın

Abstract: Near Infrared Spectroscopy (NIRS) is an optical method for the measurement of tissue O2 consumption and delivery. In the past couple of years, NIRS has become a more accepted technique for the non-invasive determination of local oxygen consumption and blood flow in human skeletal muscle. The advantage of such measurement in skeletal muscle is the ability to obtain local information about muscle oxygenation, with the possibility of calculating quantitative values for O2 consumption and blood flow using simple physiological interventions such as arterial or venous occlusions. This M.Sc. thesis is involved in analyzing the temporal relation of O2 consumption with Hb (deoxy-hemoglobin) signals generated during moderate isotonic forearm exercise under ischemic conditions. A model with a mono exponential equation with delay is developed. 6 men and 4 women subjects performed isotonic forearm finger joint flexion exercise with two different loads. It is shown that under the same load, men and women subjects generate similar time constants and time delays. However, apparent change in time constants and time delays were observed when exercise was performed under differing loads.

Thesis No.: 224 Unsupervised Detection of Tissue Differences in Contrast Enhanced Breast MRI

Name: Erkin Öksel, Year: 2005

Advisor(s): Cengizhan Öztürk

Abstract: This work aims to develop an unsupervised tissue differentiation technique for contrast breast MRI using widely accepted clustering algorithms. For image acqusition standard contrast enhanced Flash MRI technique is used Benign (n=1) and 10 malignant (n=10) region containing patient that assess are utilized in this preliminary analysis. Initially, LVQ, PCA and K-means analysis are applied to selected image data sets. As a result of these experiments trials K-means is chosen since it provided the best performance and reasonable computational load. The results from automatic analysis using K-means is compared with the expert segmentation results (done manually by an experienced radiologist) using a newly proposed segmentation correlation index (SCI). When the results acquired from doctor drawings and the tool (in 22 slices) compared the mean SCI was fun to be 61,8% with the standard deviation of 16%. All the region were identified by the automatic analysis. (SCI is a scale showing overlap of objects. If two binary images are copy paste images SCI is 100% and in the case of non-overlap the SCI is 0). The results are promising for this study which uses a complete the unsupervised approach.

Thesis No.: 223 Cross Calibration of Dexa by Using European Spine Phantom

Name: Serkan Uğur Bayraktar, Year: 2005

Advisor(s): Yekta Ülgen

Abstract: Osteoporosis is a disease characterized by low bone mass and micro-architectural degradation of bone tissue, leading to enhanced bone fragility and a consequent increase infracture risk. Among many risk factors for osteoporosis, bone mineral density (BMD) measured by dual energy X-ray absorptiometry (DEXA) scanners is the most accepted predictor of osteoporotic fractures. The World Health Organization (WHO) also uses BMD to define osteoporosis. As a result, BMD is an important risk factor, and among other things, has been used in the diagnosis of the disease, selection of treatment strategy, and evaluation of treatment efficacy. Since DXA technology has become widely acceptable and available as a screening tool for osteoporosis, standardization of BMD values and calibration among scanners are important objectives for the osteoporosis community. In this study we scanned 28 densitometers with one ESP (s.n. 03-208) and calculated the accuracy of each densitometer and observed the variation among different models and manufacturers. We calculated cross-calibration formulas by linear regression analysis for different models of 4 main manufacturers. When we calculate the MSE (Mean Squared Error) between the original values measured on the densitometers and the calculated with cross calibration formulas we found maximum error of 0.0042. With the BMD measurements obtained by each densitometer the reproducibility of the device are observed. And as a high lightening result, 27.74% of the total BMD values obtained from the device are out of reproducibility acceptance range of ±1.5% of the mean.

Thesis No.: 222 Optical Properties of Native and Coagulated Lambs Brain Tissues in vitro in the Visible and Near-Infrared Spectral Range

Name: Korhan Özer, Year: 2005

Advisor(s): Murat Gülsoy

Abstract: The aim of this study was to estimate optical properties of native and coagulated lamb brain tissues at three different temperatures (45ºC, 60ºC, 80ºC) by means of measured data which formed due to light-tissue interactions in visible and near-infrared spectral range in vitro. For dosimetry planning and accurate surgery, information about optical properties of brain tissue is required. Since optical properties of brain tissue may change due to thermal effects during laser therapy, knowledge of optical properties of brain tissue coagulated at different temperatures should also be known for surgery. During this experimental study, optical properties of cerebellum, brainstem, cortical (grey matter), and sub-cortical regions (white matter) of frontal lobe tissues of lamb brain were estimated. For estimation, optical measurement data were determined for either native or coagulated tissues. These measurement data were diffused transmittance, diffused reflectance, total reflectance and total transmittance. In order to measure these data, an optical system was designed; light coming from a light source was focused on the monochromator which can emit light at desired single wavelength. Incoming light from exit slit of monochromator was focused on integrating sphere by means of optic lenses in order to get measured data from lock-in amplifier. Afterwards, data obtained from experiments were used to estimate optical properties of tissues by means of a software (CAL-g3) written in Biophotonics Laboratory of Boğazici University. As a conclusion, it was stated that both and values of tissues increased as temperature increases. Also scattering coefficients decreased with the wavelength for all tissue types due to increase in Mie scattering.

Thesis No.: 221 Microcontroller Based High Power 809-nm Diode Laser Design for Biophotonics Applications.

Name: Cem Geldi, Year: 2005

Advisor(s): Murat Gülsoy

Abstract: High power diode lasers irradiating near infrared light (800-980-nm) have a wide range of applications in many branches of medicine due to the developments in the laser technology for the last 20 years. The ability of having high penetration property in soft tissues and enhancing indocyanine green (ICG) dye induced approaches in biophotonics applications provides possible usage of 809-nm diode laser for diagnostic and therapeutic purposes. In this thesis, a high power 809-nm diode laser system was designed and manufactured. System was consisting of 809- nm high power diode laser module with 10 W output power, current source unit, current sensor, switch mode power supply unit, microcontroller based controller unit, and fiber coupling. Diode laser driver system provides current to 809-nm diode laser module from voltage controlled current source in order to generate continuous wave 809-nm laser light. A current sensor was used to sense the operating current of laser diode for current feedback process of controller unit. Microcontroller based controller unit provided the control of whole system and it facilitated the user to access all the functionalities of the system. The user interface program was developed in C programming language to set diode current in amperes and duration in seconds via a PC. During laser operation, values of the diode current and diode temperature were controlled simultaneously and monitored by the interface program. The output power of the laser light was measured by using a powermeter and it was seen that the microcontroller based diode laser system was working accurately and efficiently.

Thesis No.: 220 Design of a Respiratory Monitor for the Teaching Laboratory.

Name: Can Kemal Ertan, Year: 2005

Advisor(s): Yekta Ülgen

Abstract: The goal of this thesis was to develop a cost-effective, portable and user-friendly respiratory monitor that gives the opportunity to observe pressure, flow and volume waveforms as well as time based ventilation data. An electronic hardware system has been built up in order to acquire analog pressure signals from the ventilator and transmit them to a PC properly. A software system has been developed in order to process the input pressure signals; obtain flow, volume and time based ventilation data; and to display both of the measured data at the user interface window. Also a mechanical adult lung simulation system has been adapted in order to give the occasion of evaluation at standard and realistic conditions. Analog pressure signals have been acquired by a differential pressure sensor and digitalized through a standard analog to digital converter after being amplified for precise measurements. Interface between the hardware and software systems has been achieved by standard parallel port communication. Data registers of the parallel port have been used for 8-bit differential pressure signal transmission. The software system of the respiratory monitor has been created by using LabVIEW program.

Thesis No.: 219 Computer Assisted Bone Age Assessment.

Name: Mahmut Haktan, Year: 2005

Advisor(s): Albert Güveniş

Abstract: Bone age assessment based on the radiological examination of the left hand and wrist is a procedure frequently performed to evaluate the growth of pediatric patients. In this thesis we examined studies conducted on the skeletal age analysis and we developed a computerized system for automatic bone age analysis. Firstly we examined two different clinical methods; The Greulich and Pyle method and the Tanner and Whitehouse (TW2) method. We chose the TW2 method to develop a computerized bone age system because it is more suitable for the computer analysis than the Greulich and Pyle method. We developed the web-based TW2 skeletal age calculation software. We then introduced steps that are necessary to transform this manual clinical method into a fully automated system. We explained preprocessing methods that are needed to make a radiograph fit for analysis and steps to find regions of interest and assign them TW2 stages. Finally we developed a computer program that assigns TW2 stages to a certain region of interest (the middle phalanx of the third finger) in the left hand. In this method we trained all TW2 stage groups for middle phalanx of the third finger and produced mean images for each TW2 stage. These mean images are used to determine the TW2 stage of queried image. We use the correlation between a mean image and a target image as an indicator of which stage should be assigned to the target. Our results show that 70% of all test images of the middle phalanx of the third finger have been assigned the correct TW2 stage by our method. We believe that the same method could be used to assign TW2 stages to other regions of interest in the hand.

Thesis No.: 218 Intraoperative Coronary Blood Flow and Myocardial Perfusion Imaging Method by Means of Thermal Image Processing.

Name: Mehmet Susam, Year: 2005

Advisor(s): Cengizhan Öztürk

Abstract: One of the most popular surgical operations is coronary artery by-pass grafting (CABG) operation, since coronary arterial disease is one of the leading causes of death and the main surgical treatment modality for this disease is the CABG operation. The main complication of the CABG operation is graft failure in either an early or late manner. While late graft failure is usually due to progression of the underlying disease, early graft failure can be caused by technical mistakes during manipulation of the heart and at the level of anastomoses. The evaluation of the graft flow and perfusion by means of thermal image processing may be a method to detect the graft failures during the operation. The method is based on the small temperature gradient that is produced by the inflow of blood into the graft and can be detected using an infrared scanner. This method is a non-invasive method that requires no catheter insertion, ionizing radiation or contrast material usage. It allows demonstrate graft patency of venous and arterial grafts and allows evaluation of perfusion after revascularization. It is also helpful detect distal stenoses in native coronary arteries. In summary, this method may be a valuable tool for intraoperative quality control in coronary artery bypass graft procedures and helps to minimize the risk of postoperative complications following myocardial revascularization.

Thesis No.: 217 Tissue Welding with 980-nm Diode Laser System.

Name: Zeynep Dereli Korkut, Year: 2005

Advisor(s): Murat Gülsoy

Abstract: In this study, tissue welding with 980 nm laser system which is first-time in the literature, was performed. Effects of 980-nm diode laser on tissue welding are not studied before. Hence, a preliminary study was done to determine optimal parameters for further studies. 1 cm long incisions which were done on the Wistar rat's dorsal skin were welded. Tissue welding with 980-nm wavelength depends on the degree of photothermal interaction. Thus different power levels and exposure schedule were investigated. Dorsal sides of all animals were photographed from the date of surgery until they were sacrificed. The clinical examination - opening of wound and presence of infection - was noted. Wounds were welded successfully at the end of the study. The rats did not show any abnormality on their health, behavior and nutrition manner. Thus, 980-nm diode laser was said to be a good candidate for tissue welding applications.

Thesis No.: 216 Cancer Diagnosis Via Elastic Scattering Spectroscopy.

Name: Filiz Ateş, Year: 2005

Advisor(s): Murat Gülsoy

Abstract: The goals of this study were to test the reliability of Cancer Scanner system whether it can detect the optical alteration of tissue dependent on temperature and to test the system on human tissues in which system can detect the cancerous lesions and examine the efficiency of this system. Cancerous tissue shows morphological alterations in the cellular level. Such changes may be detected by using the spectrum of the light scattered back from the tissue. Cell nuclei may be modeled as Mie particles that are larger than the wavelength of illuminating light. Cancer Scanner system is based on Mie theory and it uses elastic scattering spectroscopy method to differentiate cancerous tissue. This system delivers and detects white light with single optical fiber. The scattered light from tissue is detected by a spectrometer and spectrum is analyzed in PC with software. In this thesis work firstly Cancer Scanner system reliability was tested on lamb brain tissues in vitro. Tissues were coagulated at different temperatures and elastic scattering spectroscopy (ESS) spectra were taken from native and coagulated tissues. It was observed that as the coagulation temperature was increased, the slope of the elastic scattering spectra decreased. This showed that the slopes of ESS spectra taken with Cancer Scanner system in the visible range give valuable information about alterations of tissue optical properties. Secondly, the system was tested on human tissues in situ. The diagnostic efficiency of Cancer Scanner system was 86.6% for lung tissues and paratracheal lymph nodes, and 80% for brain tissues in differentiating cancerous and normal tissues. The system could not differentiate fat from tumor therefore; it was not successful on detecting breast tumors.

Thesis No.: 215 Cerebrovascular Dynamics in Migraine Measured with fNIRS.

Name: Didem Bilensoy, Year: 2005

Advisor(s): Ata Akın

Abstract: Migraine is a neurovascular pain syndrome affecting nearly 12 percent of world's population. Migraine decreases the life quality and work efficiency of patients drastically, and causes billions of dollars of economical loss to countries. Therefore, accurate diagnosis and treatment of migraine is important which is only possible by understanding its dynamics. This study aims to observe the differences cerebrovascular dynamics of migraine patients and healthy subjects by measuring their cerebrovascular responses during breath hold task by using functional near infrared spectroscopy. The subjects' responses are modeled using Gaussian functions and the obtained model parameters of migraineurs and healthy subjects are compared. All amplitude parameters of migraineurs were found to be approximately half of those for healthy subjects supporting that migraineurs' responses are suppressed for not only Hb dynamics but also HbO2 dynamics. Moreover, migraineous responses were found to be unpredictable as opposed to healthy subjects suggesting that migraineurs have an inherent incapability for cerebral autoregulation. Time to peak values of migraineurs' Hb are found to precede the healthy subjects at least eight seconds while their HbO2 values lagged around nine seconds. Our findings indicate that regulation of cerebral dynamics of migraine patients during breath hold task is significantly different than the healthy subjects.

Thesis No.: 214 Design of a Pressure and Flow Measuring Equipment for Medical Use.

Name: Gülşah Kaçur, Year: 2005

Advisor(s): Yekta Ülgen

Abstract: Accuracy and reliability of measurements play a very important role in health-care regardless of the field which may be therapy, diagnosis or life support. Medical equipment, on the other hand, is subject to failure due to mechanical damage, user abuse, component failure, aging or some other reasons and may cause undesired or irreversible results. Therefore, periodic inspections of medical equipment are essential to ensure safe and reliable use of medical equipment. In this thesis, blood pressure and gas flow measurement in medical fields have been focused on and a "Pressure and Flow Measuring Equipment", has been developed. This prototype instrument is, presently, capable of testing non-invasive blood pressure measuring apparatus and bedside oxygen flow meters with a high level of accuracy, hence providing a valuable inspection tool for preventive maintenance. The accuracy of the instrument has been tested against calibrated reference test equipment. The results obtained show that the prototype instrument developed is able to measure pressure in 100% agreement with the reference while it can measure gasflow within 95% confidence interval.

Thesis No.: 213 Design of a Transtelephonic ECG and Thermometer Device Using the Mobile Phone.

Name: Yüksel Yazıcı, Year: 2005

Advisor(s): Halil Özcan Gülçür

Abstract: The need of effective and low cost personal and emergency monitoring telemedicine solutions are the main concerns of this project. The patients who have heart diseases, ambulances are common examples of possible emergency cases, while critical care telemetry and telemedicine personal follow-ups are important issues of telemonitoring. In order to support the above different growing application fields we created a combined store and forward (nearly real-time) facility that consists of a base unit and a telemedicine (mobile) unit using a commercial mobile phone and an external little capture card. Essentially this will allow the transmission of two vital biosignals (3 lead ECG, Body Temperature). This system can also be portable to other sensor applications. This design consists of a two part, the hardware which is composed of three lead ECG and its peripheral circuits, power units and digital part which consists of PIC Microcontroller, TCP/IP chip and 512Kb EEPROM. Beside the ECG circuit a thermometer IC is used in 0.5 C resolution to measure body temperature. Transmission is performed through GPRS service network and the data is sent to certain IP address on internet using the commercial mobile phone. The software side which is provided by a PC assigned to Access server and Web Server. The data which are sent by patient remotely are stored in Access server and Web Page was designed to demonstrate and make it accessible from everywhere. This part of the project probably would be launched in patient observation center (hospital, specialized clinics etc).

Thesis No.: 212 Spatial Analysis of Event Related Brain Potentials (ERP) by Wavelet Transform.

Name: Ali Bayram, Year: 2005

Advisor(s): Ahmet Ademoğlu/Tamer Demiralp

Abstract: Localization of the cognitive activity in the brain is one of the major problems in neuroscience. Current techniques for neuro-imaging are based on fMRI, PET, and ERP recordings. The highest temporal resolution, which is crucial for temporal localization of activities, is achieved by ERP, but spatial resolution of scalp topography is low. To overcome the limitation of scalp topography, several current-density estimation techniques were developed whose goal is to find the locations of the three-dimensional (3D) intracerebral activities by solving an inverse problem. However, scalp topologies constituted by multiple sources which makes the inverse problem more complicated. The overall objective of this thesis is to perform spatial analysis of scalp topography by 2-D wavelet transform and isolate spatial frequency components. This analysis could give us less complex scalp maps for source detection. In this thesis, in order to see the topographic variations in neurocognitive processes, the ERP recordings were spatially enhanced by interpolation as a first step. At the second step, main topologies of ERP recordings were investigated by hierarchical clustering algorithm. Thirdly, different spatial frequencies of these main topologies were separated by 2-D wavelet transform. Finally, main topological maps and topographic maps of different spatial frequencies derived from them were used to find corresponding cortical activities (cortical activity maxima) by LORETA (Low Resolution Electromagnetic Tomography). Assessment of our spatial analyzing results was made according to the current density estimation results.

Thesis No.: 211 A New Hardware Design for Cardiac Passive Acoustic Localization.

Name: Yahya Civelek Civelek, Year: 2005

Advisor(s): Halil Özcan Gülçür

Abstract: Heart sounds contain valuable information about the function of the heart; expert clinicians can diagnose many heart disorders by listening to these sounds. One dimensional visual representation of heart sounds called phonocardiograms (PCG) are also used to facilitate the diagnosis. Although, PCG is an inexpensive, non-invasive diagnostic technique, it has been neglected until recently because of its limitations and enormous improvements in other diagnostic techniques such as ultrasonography, CT and MRI. Recently, a significant study on PCG was conducted by Y. Bahadırlar and H. Ö. Gülçür [2]; they developed a system which is composed of a specially designed multi-sensor probe in the form of a planar microphone array, precision amplifiers, filters and A/D converters, interface circuitry, a PC and special software and obtained 2-D and 3-D images of estimates of sound producing sites in the heart. The original system called CARDIOPAL (short for Cardiac Passive Acoustic Localizer) had some limitations mostly arising from relatively limited technology at the time. It had no ECG channel, the multi-sensor probe had coupling problems on non-smooth chests. Moreover it used DMA for data transmission, which made the system device-dependent. In the present thesis, a new, easy-to-use and more compact hardware for CARDIOPAL is developed. The new system (CARDIOPAL II) can work on most of the current operating systems without problems and get data more accurately in order to increase image resolution. An ECG channel is added to the system and ECG signals are acquired simultaneously with the sound signals. The acquired data is transferred to a PC using a highspeed USB 2.0 interface. Moreover, a new flexible design is developed to avoid coupling problem of the array for non-smooth chests. CARDIOPAL II is battery-powered; surface-mount technology was used for the design of all electronic circuitry to make the final system smaller, lighter, and more resistant to electromagnetic interference. The device was tested by acquiring signals coming from two point sources. The localization of these sources was achieved. The device was also tested by obtaining data from real subjects. No quality loss from the corner microphones due to the coupling problem was observed. ECG signals were acquired simultaneously and it was observed that the relationship between ECG and sound signals matched with theory.

Thesis No.: 210 Wireless Functional Optical Imager.

Name: Serkan Karaca, Year: 2005

Advisor(s): Ata Akın

Abstract: Functional imaging of brain offers the capability to investigate cerebral blood circulation and oxygen metabolism, as well as activity levels of the nervous system. In recent years, technological progress in biophotonics has led to the development of functional near infrared spectroscopy system (fNIRS) which provides non-invasive, rapid and affordable method of monitoring brain oxygenation levels during cognitive activity and even sleep. This M.Sc. thesis is involved with the development of a prototype of a compact wireless optical imaging system (WFOI). WFOI is composed of a probe that houses inexpensive photodiode detectors (PD), LED working in the near infrared spectrum, a LED driver circuit for constant current supply, a data acquisition unit composed of a microcontroller such as a PIC16F877, a data transmission unit, exploiting the RF communication technology and a PC based software for data logging and analysis. WFOI is designed to be used in sleep apnea studies as well as in pediatric research especially for hyperactive children.

Thesis No.: 209 Measurement of Vibrotactile Thresholds of the Non-Pacinian Channel.

Name: Özge Kalkancı, Year: 2005

Advisor(s): Burak Güçlü

Abstract: The aim of this study is to measure the thresholds of the Non-Pacinian I (NP I) channel which is believed to be mediated by rapidly-adapting (RA) fibers. Thresholds of the NP I channel were measured using a two-interval forced choice paradigm, a technique independent of the subject's criterion. The experiments were performed using the terminal phalanx of the human middle finger with a 40 Hz vibratory stimulus, but without using a contactor surround in order to enable comparison with population models of mechanoreceptive fibers in the literature. Since the Pacinian (P) channel and NP I channel have similar vibrotactile thresholds at 40 Hz, a forward-masking procedure was used to elevate the thresholds of the P channel with respect to the NP I channel. By this procedure P channel can be perceptually masked using a 250 Hz stimulus presented prior to the 40 Hz test stimulus. In this study the masking functions of subjects were found to be approximately linear on log-log axes and the threshold shifts were found to increase as the masking stimulus levels increased which indicates that the vibrations are perceived by the subjects more difficultly. The results confirm that the masking procedure is reliable and the NP I channel can be selectively activated at 40 Hz. The results are compared and discussed in relation to previous studies. The long-term objective of this research is to provide information for determining the thresholds of other psychophysical channels as well for the application of the same method in auditory and visual threshold measurements.

Thesis No.: 208 Evaluation of Renal Function Using First Pass Contrast Enhanced MRI.

Name: Okan Saldoğan, Year: 2005

Advisor(s): Cengizhan Öztürk

Abstract: Magnetic Resonance Imaging (MRI) of the kidney has a great potential because the functional parameters, which can be investigated obtained noninvasively are multiple: glomerular filtration, tubular concentration and transit, blood volume and perfusion, diffusion and oxygenation. These require either endogeneous contrast agents, such as water protons (for perfusion and diffusion) or deoxyhemogobin (for oxygenation), or exogenous contrast agents, such as gadolinium chelates (for filtration and perfusion) or iron oxide particles (for perfusion). In this thesis work, an integrated renal perfusion analysis method is presented, which allows multi-slice animation of renal perfusion images, automatic image registration, quantification of time-intensity curves from desired region of interests (ROI's), and estimation of indexes such as slope, time-to-peak, and contrast enhancement ratio (CER). It was designed as a MATLAB package for reading, displaying, saving and analyzing renal perfusion Magnetic Resonance (MR) images which are in DICOM (Digital Imaging and Communications in Medicine) format. Performance of this package was tested on data obtained from MRI scans on ten volunteers with normal kidney function and both efficient qualitative assessment of differential enhancement of the two kidneys and more accurate time-intensity curve evaluation free from respiratory motion were obtained.

Thesis No.: 207 Non-Invasive Monitoring of Gastric Motility in Humans.

Name: Koray Özcan, Year: 2005

Advisor(s): Ata Akın

Abstract: Stomach is an organ of gastrointestinal system where the food coming from the mouth through the esophagus is mixed by the rhythmic contractions of the smooth muscles, with acid and other gastric secretions. The control of motility of the stomach is performed by neuronal and hormonal factors that modulate the smooth muscles in generating muscular contractions. Electrogastrography is a procedure for recording gastric myoelectrical activity either invasively by placing electrodes on serosal lining of the stomach or non-invasively by using electrodes located on the skin of the abdomen. Compared with the development of other surface electrophysiological measurements, such as Electrocardiogram (ECG) and Electroencephalogram (EEG), the progress of the EGG has been very slow. The main problems include: (1) difficulty in data acquisition and analysis because of the low signal-to-noise ratio of the EGG; (2) difficulty in interpreting EGG data and extracting useful and relevant information from the EGG; and (3) lack of understanding of the correlation between the EGG and gastric motility. Today, numerous clinical and animal studies are being carried out by using EGG in order to have reliable, scientific data which can help the interpretation of the findings. The frequency of gastric contractions is controlled by the gastric slow wave, which is around 3 cycles per minute (cpm) and the appearance of gastric contractions is associated with spike activities. Today, conventional EGG devices are collecting data related with the lower frequency signals but it was shown on the animal models that higher frequency signals observed during peristaltic contractions can also be detected and quantified from EGG recordings by using a suitable method and perhaps, the patterns of this high frequency components can be correlated with the pathological processes related with the stomach. Our main interest arises on the collection and interpretation of the high frequency peristaltic contractions signals in humans using EGG.

Thesis No.: 206 Evaluation of Quadriceps Muscle Endurance with Functional Near Infrared Specroscopy (FNIRS).

Name: Ferda Devrim Erdem, Year: 2005

Advisor(s): Ata Akın

Abstract: Muscular endurance evaluation methods involve use of various optical imaging techniques including Functional Near-Infrared Spectroscopy (fNIRS) as well as Surface Electromyography (sEMG), exhaustive exercise protocols and biochemical investigation procedures. In this study, it is aimed to assess levels of tissue oxygenation trends in the contracting muscle during squat exercise via fNIRS, and electrical behaviour of the muscle during exercise evaluated via sEMG. In the study, twelve healthy male subjects, comprised of trained and less trained or sedentary individuals, exercised unloaded squat with the knee angle at 70º flexion from full extention until fatigue set in. Both fNIRS and sEMG measurements gathered from Vastus Lateralis (VL) of the quadriceps muscle. Deoxyhemoglobin (HB), Oxyhemoglobin (HBO2) and Oxygenation (OXY) parameters of fNIRS measurements and Root Mean Square (RMS), Mean Frequency (MNF) and Median Frequency (MDF) parameters of sEMG measurements assessed between subjects who were able to maintain exercise longer than five minutes and shorter than five minutes. The results of the study showed that in the less exercising subjects HBO2 amplitude is %54 and OXY amplitude is %58 small relative to exercising subjects which is concluded to be a result of training induced physiologic adaptations leading to altered oxygenation and oxygen extraction capability of the exercising muscle. However, sEMG parameters did not show a specific distinction in terms of their slopes between two groups yet, provided an objective sight about fatigue occurrance rather than subjective information from participants.

Thesis No.: 205 Formation of Turkish Norms in Gait Analysis.

Name: Şule Yılmaztürk, Year: 2005

Advisor(s): Mehmed Özkan

Abstract: In this study, a normative database of basic gait parameters, kinematics and kinetic patterns for 181 normal subjects with the ages of four, five, seven, eight, nine, sixteen, seventeen, eighteen and twenty is reported. Means, standard deviations and ranges were calculated for 15 parameters in basic gait parameters, 32 parameters in kinematics and 48 parameters in kinetics. These parameters were divided according to age and sex. It was found that there are differences between the outputs of this study (Turkish norms) and system's current normative data in kinematics and kinetic data concerning all three planes of movement, especially in transverse plane. Additionally, these two normative databases with two standard deviations were compared with each other in evaluating the kinematics data of hip, ankle and knee joints of thirty children of all five-year-old age (Twenty normal children and ten children with Cerebral Palsy). Sensitivity values, specificity values, positive predictive values and negative predictive values of the two databases were calculated for six hip movements, six knee movements and six ankle movements. According to the results obtained, it can be stated that system's current normative database is not a proper reference database for Turkish population. In addition, the results support the strong need for a proper and reliable reference data for Turkish population in gait analysis. These results also suggest that precise evaluation of a gait disorder needs to be done by comparing the patient with her/his own population. Turkish normative database can serve as a sensitive, specific and reliable reference data for Turkish population in gait analysis. Besides, this study will become a basis for many other gait analysis studies for Turkish population.

Thesis No.: 204 A Biochemical Model for the Interactions Between Tumor Cell Mass and Vascular Endothelial Cells Leading to Angiogenesis.

Name: Meryem Ayşe Yücel, Year: 2005

Advisor(s): Ata Akın/Işıl Aksan Kurnaz

Abstract: The fact that the growth and spread of tumors are dependent on angiogenesis and that rapid exponential growth of tumors does not begin until a new blood vessel forms from the existing bones brought new research areas and potential therapeutic opportunities to the researchers. This new blood formation process is called angiogenesis, and the identification of the important signaling pathways leading to angiogenesis is a major challenge to researchers. Understanding the importance of the pathways involved in angiogenesis, we have aimed to design a biologically significant in silico model of the individual cell signaling pathways within the signaling tumor mass and recipient endothelial tissue. In the tumor cell model, the signaling pathways respond to hypoxia that occurs due to high metabolic rates, and express and secrete the vascular endothelial growth factor, VEGF. In the endothelial cell model, endothelial cell response to this VEGF signal is studied, such as matrix metalloproteinase (MMP) production leading to angiogenesis and metastasis. The models are constructed using GEPASI 3.3 which is a freely-available kinetics simulation software package. In the tumor cell model it was observed that increasing the oxygen concentration to around 1x107 nM seems to have no significant effect on VEGF production, after which the levels decline dramatically, indicating efficient shut off from VEGF promoter. The response is much faster when the transcription and translation rates are increased, in accordance with enhanced metabolism in tumor cells. Similarly, in the endothelial cell models of endothelial cells, we successfully show that the highest MMP production in response to incoming VEGF signal is obtained when direct PKC activation of MAPK was present parallel to the Ras/Raf pathway.

Thesis No.: 203 Modeling of Photon Migration in Tissue

Name: Mustafa Fidan, Year: 2005

Advisor(s): Ata Akın

Abstract: Since biological tissue is a highly scattering medium in near infrared region, a feasible model is needed in order to understand the propagation of light. The most general model for light propagation in tissue is the diffusion approximation which is now used in many medical applications. In this thesis, we will briefly describe the diffusion approximation and give an outline of the solution to the heterogeneous diffusion equation using popular first order Born approximation method. Then we will give simulation results of the boundary measurements in human breast tissue hosting an optical anomaly. We used PMI Toolbox for our simulations, which was developed in Photon Migration Imaging Laboratory at Athinoulo A. Martinos Center, Massachusetts General Hospital. In order to figure out how the measurement sets change with tissue optical properties, a large range of parameters was studied, including the background absorption coefficient, the object absorption coefficient, the object size and the position. Then we added the biological noise to our simulations in order to investigate its influence on the measurements and we observed that the amplitude of measured signals is even decreased by 26% for low contrast heterogeneity having 40% volume fraction in the volume of interest.

Thesis No.: 202 Impementation of a Multi-Parameter Biomedical Monitoring System.

Name: Burcu Acar, Year: 2005

Advisor(s): Ata Akın

Abstract: This study implements a LabVIEW design of a multi-parameter data acquisition system to be used at the Institute's Biomedical Device Laboratory for educational purposes. The design of the Virtual Instrument is completed in LabVIEW. LabVIEW is a graphical development environment produced by National Instruments. The major benefits of virtual instrumentation include increased performance and reduced costs. Because the technology is controlled through software, the flexibility of virtual instrumentation is unmatched by traditional instrumentation. The aim of this work is to design a user-friendly interface that can capture and display current ECG, respiration, GSR signals simultaneously while saving previous acquired signals, calculate heart beat and respiratory rate, and review previous recordings for further analysis. The purpose of this interface is to give the opportunity to students to analyze ECG, airflow, lung volume and GSR data and have a chance to observe the effects of physiological changes between different physical conditions. This thesis was also developed in the hope that students and researchers will benefit from the data acquisition software in their thesis and projects.

Thesis No.: 201 Comparasion of Iterative Closest Point (ICP) and Thin-Plate Splines Methods for the 3-D Image Registration.

Name: İsmail Burak Parlak, Year: 2005

Advisor(s): Ahmet Ademoğlu/Cengizhan Öztürk

Abstract: In medical image registration, algorithm choice and its application on images depend on the localization and where and how images are acquired. In this study, a linear algorithm; Iterative Close Point and an elastic method;Thin-Plate Splines are used to register volumes obtained from different sensors. For the sake of 3-D image registration, their performances on different modalities are compared on MATLAB environment. This study shows the registration results of 5 different modalities; T1, T2, PD - weighted MR, PET and SPECT images. The slice information is collected for volume reconstruction and a 3-D Registration is implemented. Thin-Plate Splines efficiency is studied according to landmark numbers. The simulation is presented as the mean of 20 experiments for point pair measurements and registration results are compared with respect to Mean Distance Difference and Root Mean Square Analysis. The measurements on skull surface represent that Thin Plate Splines (TPS) gives better results than Iterative Closest Point (ICP) Algorithm for less landmarks. Nevertheless, we observed that ICP that does not necessitate landmarks in the measurements gives better registration results in case where TPS measurements are implemented with more reference points.

Thesis No.: 200 Design and Implementation of Synchronized Visual Stimulation System for Functional Magnetic Resonance Imaging (FMRI) Scanners.

Name: Baki Serhan Kalsın, Year: 2005

Advisor(s): Cengizhan Öztürk

Abstract: This study aims to solve a synchronization problem between an MR-scanner and the stimulation program used in functional brain studies as in fMRI. Synchronization is important for investigation of activation in the auditory, visual and frontal cortex without interference from the scanner's noise. To synchronize both systems an optical synch signal, generated by the scanner, is available. In order to detect these synchronization signal optical receiver and amplifier circuits are used and acquired by a commercial digital acquisition card by the help of Labview program. The system also includes an MR-compatible projection system, subject response button and screen-mirror system that is attached to the top of the head coil. The gradient signals are first passed through opto-isolator circuits and then acquired by the stimulation computer using the same DAQ Card. The system in this study was designed and implemented currently for Siemens MR scanners, but can be easily extanded to other scanners. Keywords: fMRI, fMRI setup, synchronization of MR scanner, opto-electronics

Thesis No.: 199 Designing a Phantom for Performance Evaluation of (DSA) Units.

Name: Pelin Doğruöz, Year: 2004

Advisor(s): Yekta Ülgen

Abstract: Digital subtraction angiography (DSA) is being widely used in hospitals and outpatient clinics. For the (DSA) system as well as all the other radiographic systems performance evaluation involves three main components; the selection of parameters relevant to securing satisfactory clinical results, the design of procedures and measurement devices to measure these parameters, the provision of methods to compare measured and desired performance. Performance evaluation and quality assurance testing for the x-ray units are implemented with phantoms, properly designed test objects, with tissue substitute materials. The purpose of this study is to design and produce a specific phantom for the evaluation of DSA systems, according to the American Association of Physicists in Medicine (AAPM) report No. 15. Assessment of each parameter requires a different combination of pieces of phantom. Tissue substitute materials are used for producing the phantom, namely acrylic is used for soft tissue and bone is represented with PVC material. For contrast material, iodinated epoxy is used to fill in the holes and channels of varying dimensions. The phantom produced consists of 9 pieces all together. The phantom is tested on several (DSA) systems. Results show that, AÂPM Report No. 15 performance parameters are easily tested by using this phantom.
Keywords: Digital subtraction angiography, phantom, tissue substitute materials, performance evaluation

Thesis No.: 198 Evaluation of Functional Electrical Stimulation on Hemiplegic Children for Correcting Drop Foot.

Name: Gülay Gül, Year: 2004

Advisor(s): Halil Özcan Gülçür

Abstract: Cerebral palsy (CP) is a disorder caused by damage to the brain, especially affecting ability to control movement and posture. It is the most common cause of severe physical disability in childhood. Rehabilitation of CP children involves the application of different therapeutic modalities. These treatments are used to maintain or improve joint range of motion, facilitate or strengthen weak muscles, inhibit or weaken spastic agonist muscles, provide support, improve muscle strength, and improve or normalize motor development. Accepted current practice to improve the gait of CP patients includes orthotics, botulinum toxin, physiotherapy, exercise, and surgery. An alternative and new approach is Functional Electrical Stimulation (FES). The objective of this study is to evaluate the effectiveness of FES on children with hemiplegic CP for correction of dropped foot. For this purpose, a single channel drop foot stimulator was used on the tibialis anterior muscles of the affected limbs of 1 1 children with left or right hemiplegic CP. Only 9 of the children tolerated this device. Electrical stimulations were applied for 30 minutes per day for one week during the gait cycle using force-sensing foot switches. Gait analysis was performed for each subject before and after treatment. One month later, gait analysis was repeated to compare the ankle planterflexion- dorsiflexion angle with previous data. Seven of the nine children with hemiplegic CP demonstrated improvements in ankle dorsiflexion angle at the gait cycle. Notable effects of drop foot stimulator were observed on 7 of the children. The results suggest that single channel drop foot FES was effective in improving ankle kinematics. Keywords'. Cerebral palsy, functional electrical stimulator, dropped foot

Thesis No.: 197 Experimental Measurement of Electromagnetic Pollution and Modeling Study in a Typical Turkish Hospital.

Name: Dursun Gökmen, Year: 2004

Advisor(s): Selim Şeker/Mehmed Özkan

Abstract: Equipments used in hospitals are designed to improve human health. It is often ignored that the electromagnetic field generated by medical equipment can endanger the health of the technicians, patients, and also the other medical devices. In addition to this, physicians use equipments that generate potentially hazardous electromagnetic fields in order to diagnose or treat illnesses. These equipments, for instance, Magnetic Resonance (MR), Intensive Care Unit (ICU) and physiotherapy equipments can be primary source of electromagnetic pollution. The aim of this study is to investigate the existing levels of electric and magnetic fields in a typical Turkish hospital and to compare these measured results with the second hospital's values, and the previous studies in the literature, and also the limits that are defined in the related standards for human being and medical devices. The existing levels of electromagnetic fields were obtained by using three different measurement devices in the hospital rooms. In order to understand the results of this study easily, graphical representation (3D) and table forms are utilised. In typical Turkish hospital, maximum electric levels were measured as 427 V/m, 65.9 V/m and 60.71 V/m and also maximum magnetic levels were 3.4 A/m, 1.950 A/m and 0.154 A/m in ELF, VLF, and RF range, respectively. As a result, all measurements are done under the normal operating conditions and most of the measured maximum values are below the limits found in the standards. Keywords: EMF, electromagnetic pollution, health effects, medical devices, hospital measurement, MR, ICU

Thesis No.: 196 Contractility Analysis of Left Ventricular Myocardium Using Phase Contrast Magnetic Resonance Images.

Name: Özlem Özmen Okur, Year: 2004

Advisor(s): Cengizhan Öztürk

Abstract: Examination of myocardial motion is important in the assessment of heart diseases. Current techniques for functional myocardial imaging include radionuclide angiography, echocardiography, computed tomography, and magnetic resonance imaging (MRI). The most advanced technique for detailed myocardial motion analysis is MR tagging, but with the advances of the MR hardware, phase based flow imaging techniques have been recently proposed for this purpose. In phase contrast magnetic resonance imaging (PC- MRI), each pixel (voxel) contains the velocity information, specifically the phase of the pixel (voxel) is directly proportional to the velocity of that tissue. This is achieved by adding critically located and calibrated bipolar gradients during regular imaging. Phase contrast MRI are used for routine clinical applications, but generally for the blood (or similar aqueous media) flow quantification. Application of this technique to the myocardium is currently limited and not used clinically. The overall objective of this thesis is to analyze the contractility of left ventricular myocardium from phase contrast magnetic resonance images and to develop a toolbox which can be used easily by the clinicians. A fast marching method based segmentation technique to locate the left ventricle in the cardiac phase contrast magnetic resonance images with minimal user interaction. After the segmentation, speed, velocity, strain and strain rate are computed automatically and displayed as parametric myocardial images. A comparison of strain analysis between the phase contrast and tagging is performed in short axis images from a healthy volunteer. It was shown that the results in PC-MRI are consistent with the tag analysis and the PC-MRI analysis needs less computation and therefore takes less time than tagging. Keywords: Phase contrast magnetic resonance imaging, strain, contractility, segmentation, fast marching.

Thesis No.: 195 Hippocampal EEG and AEP after Colchicine Lesions of Medial Septum Cholinergic Cells.

Name: Haydar Tan Özüak, Year: 2004

Advisor(s): Hale Saybaşılı/Reşit Canbeyli

Abstract: The effect of colchicine injection to the medial septum (MS) on the spontaneous electroencephalographs (EEGs) and auditory evoked potentials (AEPs) recorded from cornu Ammonis 1 (CA1) pyramidal cell layer of the rat hippocampus was investigated. Colchicine, by binding to tubulins, dissociates microtubules, destroys axonal transport, and causes death of cholinergic neurons in the MS, which, for their survival, require neurotrophic factors secreted by their target structure, the hippocampus. It has been suggested that mammalian neurons contain colchicine4ike endogenous molecules, which in time could cause neurotoxicity. Male Wistar rats were injected colchicine (n=6) or saline (n=5) into the medial septum, which is the major source of cholinergic innervation to the hippocampus. CA1 EEGs and AEPs were recorded. EEG spectral and AEP profile analysis were performed. Medial septal colchicine lesions did not alter spectral measures of CA1 EEGs. CA1 AEPs showed a negative peak at 40 ms (N40) and a positive peak at 80 ms (P80). The mean latency of the positive peak was 77 ms in the colchicine group compared to 86 ms in the saline group, which reflects narrowing of the N40 wave. The results suggest a disinhibition in CA1 and an earlier processing of the sensory information by this network. Keywords: Alzheimer's disease, cholinergic neurodegeneration, colchicine, hippocampus, EEG, AEP.

Thesis No.: 194 Optical Biosensors Based on Microdevices.

Name: Yiğit Ozan Yılmaz, Year: 2004

Advisor(s): Ata Akın/Ali Serpengüzel

Abstract: Microspheres have gained an important place in microcavity resonators by their morphology dependent resonances (MDR's) and high quality factors. Numerous potential applications have been proposed by using microspheres MDR's including microlasers, optical channel filters, and ultrafine sensing. Due to their high sensitivity microsphere's MDR's can be used for biomolecular sensing applications. In this work, elastic scattering spectra from the dielectric and semiconductor microspheres are experimentally obtained and morphology dependent resonances are observed. Biosensing applications of semiconductor microspheres were studied both experimentally and theoretically. Experimental elastic scattering spectrum from the silicon microsphere is observed for the first time. Biosensing experiments with silicon microsphere are performed. Due to the microsphere radius and the system resolution limit the expected MDR shifts have not been observed. Keywords: Microsphere, Morphology Dependent Resonances, Biosensor.

Thesis No.: 193 Development of a Visualization and Functional Analysis Software Platform for Cardiac MR Imaging.

Name: Ozan Kemal Erciyas, Year: 2004

Advisor(s): Cengizhan Öztürk

Abstract: Cardiac Magnetic Resonance Imaging (MRI) is an excellent technique for functional evaluation of heart because of its completely noninvasive nature and ability to acquire images with high soft tissue contrast. In tins thesis work first a Matlab toolbox (DicomBrowser) is developed for reading, sorting, displaying, saving cardiac MR images which are previously acquired and saved in DICOM format in backup media (CDROM). Additional functions for image contrast manipulations, region of interest selection, movie creation have been integrated in this toolbox. In the second part of the thesis, automatic contouring of endocardium is achieved for cine cardiac TRUEFISP images. These contours are used for ejection fraction calculation. The ejection fraction is defined as "the proportion, or fraction, of blood pumped out of your heart with each beat". The blood that travels around the body is pumped from the left ventricle and therefore the volume of the left ventricle (LV) at the start of the heart stroke (the systole) and the end of the stroke (the diastole) is measured to give the cardie output (ml). This is an important parameter used widely in cardiology. The automatically calculated EF values were compared with the manually contoured ejection fraction ratios in 12 subjects. It has been shown mat a strong positive correlation was found ($r(10)=.971$, $p<0.01$), indicating a significant linear relationship between manually and automatically calculated EF ratios. Keywords: Cardiac Magnetic Resonance Imaging, ejection fraction, active contours, automatic segmentation of myocardium, DICOM

Thesis No.: 192 Effects of the Low Level Laser Therapy on the Proliferation of Fibroblasts and Peripheral Blood Mononuclear Cells in Vitro.

Name: Gökmen Hurşit Özer, Year: 2004

Advisor(s): Murat Gülsoy

Abstract: This thesis study contains of two experimental studies. The purpose of the first study was to investigate the effect of low energy laser on the proliferation of fibroblast cells at skin tissue culture. 670-nm 1.9 mW (4.937 mW/cm2) diode laser was used for the irradiation over skin tissue samples. Low energy laser irradiation had an increasing effect on the proliferation of fibroblast cells for the specific energy levels. Especially in 8th and 11th days of irradiation, the proliferation of 30 sec laser irradiated group's was statistically higher than that of 10 sec laser irradiated group. But according to the results, 670-nm low energy laser irradiated fibroblast cell proliferation was not statistically higher than control group which was not irradiated. The second study aims to detect the proliferation of peripheral blood mononuclear cells due to the low energy 2.55 mW (324.68 mW/cm2) 632.8-nm He-Ne laser application. The effects of laser irradiation on the proliferation of peripheral blood mononuclear cells were investigated comparatively with those of the mitogenic stimulator PHA (phytohemaglutinin). Our results showed that He-Ne laser application enhanced the proliferation significantly. Moreover, laser dose was found to be a significant parameter. On the other hand, low level laser therapy (LLLT) was found to be less effective than PHA. Keywords: Biostimulation, 670-nm diode laser, fibroblast, He-Ne laser, peripheral blood mononuclear cells, PHA, proliferation.

Thesis No.: 191 Neurovascular Coupling Model of Brain Energy Metabolism.

Name: Sefer Burak Kacar, Year: 2004

Advisor(s): Ata Akın

Abstract: Modeling of biochemical events taking place in neuronal cells has drawn special attention by functional imaging groups due to the need to understand how neurovascular coupling is affected during health and disease. Despite striking advances in functional brain imaging, the cellular and molecular mechanisms underlying the signals detected by these techniques are still largely unknown. The main objective of this proposed thesis work is to generate an easy to use simulation environment that models the biochemical pathways of the brain cells when they are stimulated. The ultimate goal is to investigate the relationship between the hemodynamical signals measured by functional optical imaging method and electrophysiological activity measured by EEG during health and disease. This M.Sc. thesis is involved with the development and modifications of Aubert's neurovascular coupling model and also to investigate the neurol responses during health and disease cases in a user-friendly environment. This study simulates also how the the neuronal responses in hyperammonia patients should be affected according to this model. The differences generated in neuronal responses are compared with the healthy ones and this will give us a visual comparison possibility. Our model can be used for other diseases as well. Preliminary results show that our model is in good compliance with the human and rat experiments in medical literature.

Keywords: Neurovascular Coupling, functional brain imaging, simulation, EEG.

Thesis No.: 190 Automatic Myocardial Strain Analysis in Cardiac Tagged MRI.

Name: Evren Aydın, Year: 2004

Advisor(s): Cengizhan Öztürk

Abstract: Tagged MRI has been introduced to distinguish normal and abnormal myocardium. Tag features are introduced into the image by intensity modulation of the object magnetization before the actual imaging using specific saturation pulses. When the volume is imaged after a certain time delay; the change of the intensity pattern in images reflects the motion of the underlying myocardium. Tagging is particularly valuable in cardiac imaging, because the myocardial tissue provides few natural features for motion tracking. The tagged cardiac MR image analysis is composed of several stages: Segmenting the left ventricular (LV) myocardium is the first stage of the image analysis where inner and outer contours of LV cavity are drawn, usually manually. The second step is the estimating the tag locations within the LV wall. Once the relative position of the tags has been characterized by a string of detected tag points lying along tag lines, this information can be used to calculate a 3-D parametric motion field. At the end this field is utilized to calculate displacements or strains at any point in the myocardium. Myocardial motion may be reconstructed by detection and tracking of the tag points in a sequence of images. Our aim is to speed up and fully automate quantitative motion analysis of tagged cardiac MR images for routine clinical use. In our study, one of the previous approaches for automatic myocardial localization was extended, which utilizes a HARP based tag extraction and myocardial segmentation using harmonic phase unwrapping consistency along expected semicircular paths. We also combined myocardial and tag localizations methods with a B-spline based motion field fitting technique and obtained a complete heart motion evaluation package. In this thesis study, a motion analysis package, which is developed in MATLAB programming environment, is presented for left ventricular tagged MRI studies. Keywords: myocardium, tagged cardiac MRI, HARP, myocardial strain analysis

Thesis No.: 189 Managing the Safe Use of Fluoroscopy in Interventional Procedures: A Case Study.

Name: Özge Tığdemir, Year: 2004

Advisor(s): Yekta Ülgen

Abstract: In fluoroscopy, the machine settings such as kVp and mA are lower, but the patient exposure times are longer compared to conventional radiology. The immediate availability of images in digital fluoroscopy increases the tendency to take more images for better diagnostic quality. The purpose of this study is to establish standard operation parameters for each type of interventional fluoroscopic procedure. This study is conducted at the Radiology Department of a 240 bed private hospital in Istanbul area. Data are collected for a period of fourteen months, for eight most commonly applied interventional fluoroscopic procedures using Philips Multidiagnost III machine. Statistics of exposure parameters such as kVp, mA and exposure time are evaluated. Comparisons are performed according to procedure type, among the radiologists, with reference to guidelines. The control limits for the operators are set to the average values ± two standard deviations, as recommended by AAPM (American Association of Physicists in Medicine). To verify whether the process is in statistical control or not, "moving range of two" charts are used. In most cases, kVp and mA settings were above recommended levels implying higher doses delivered to the patients. The control charts had shown that the processes are not in statistical control. Also, comparisons among radiologists obviously indicated the need for optimization of the parameters in each fluoroscopic procedure.
Keywords: Fluoroscopy, dose management, quality assurance

Thesis No.: 188 Computer Simulation of Replication Potential of Cells Via Mapk Pathway

Name: İzzet Öney, Year: 2004

Advisor(s): Levent Kurnaz

Abstract: The defining feature of living organisms is the ability to multiply its genetic material by replication. In the case of single-celled organisms such as bacterium, multiplication of the organism is closely linked to nutrient availability. For multi-celled organisms, proliferation of the individual cell must be integrated with overall needs of the organism and therefore subject to some form of coordination. This is achieved by subjecting the behaviour of individual cells to be controlled by signals emanating from other cells. One possible scenario is the down flow of the external signal through mitogen-activated protein kinase (MAPK) to result in the transfer of quiescent cells into GI phase of the cell cycle. Signalling pathway starts with binding of growth factor to receptor at the cell surface and finishes with production of activation protein transcription factor (API) in the nucleus. To simulate cell replication potential, biochemical kinetics simulation software package GEPASI 3.3 has been used. The pathway has been defined in terms of reaction steps and for which both rate equation and rate constants are specified. The software package utilises these data to calculate the change in concentrations of species that produced during signalling pathway. The effect of rate of cytoplasmic to nuclear volume (V(/Vn), and translocation rates of ERKPP, c-fosRNA, c-junRNA and c-jun protein on simulation have been examined. The result of this simulation has demonstrated that by increasing Vc/Vn, translocation rate of ERKPP and c-fosRN A, concentration of AP- 1 has been increased, but on the other hand translocation rate of c-junRNA and c-jun protein has negative effect on AP-1 concentration because of autoregulation of these metabolites by AP-1.

Keywords: Signaling Pathway, Computer simulation, GEPASI, Cell cycle, AP-1

Thesis No.: 187 Design of Video Laryngeal Stroboscopy System for Studying Vocal Fold Pathology.

Name: Gökhan Işık, Year: 2004

Advisor(s): Halil Özcan Gülçür

Abstract: Video Laryngeal Stroboscopy (VLS) is a stroboscopic imaging technique that allows observations of standstill and slow motion images of vibrating vocal folds. It is a valuable tool for studying vocal fold pathology, for evaluating the degrees of infiltration caused by cancerous lesions, in identifying effects of changes in pitch, tension, or intensity. It is a relatively recent technique and has gained clinical acceptance within the last two decades. The recording of vibration provides a good teaching, learning and documentation material. The resulting image data has a clear and magnified image of vocal folds allowing clinician to compare pre treatment and post treatment status of vocal folds. Besides an endoscope and a video camera, video laryngeal stroboscopic examination requires a high-intensity, pulsed light source that consists of a high- voltage, high-power supply unit, a triggering unit (TU) whose frequency can be synchronized with the fundamental frequency of the vocal folds and a Xenon flash tube. Since human vocal fold vibration fundamental frequency may reach 500Hz (for a baby), the pulsed-light source used for VLS is quite different from that used for conventional stroboscopes. In this thesis work we designed and realized a power unit and a TU for VLS. The power unit is based on a flyback topology and operates either in QR (free-running) or fixed frequency mode. To maximize efficiency, only low voltage switching is used and at light loads, frequency is reduced. The operating mode can be changed from free-running to fixed frequency mode and the regulation characteristics from primary to secondary regulation by jumpers. The output voltage can easily be adjusted by a potentiometer; thus it can also to be used in other applications like laser pumps, defibrillators, etc. The power density of the power unit is about 3W/inch3, reflecting a state-of the-art technology. It has been tested at a power level of 250W. The TU is the unit that extracts the fundamental frequency of the vocal folds for firing the xenon flash tube. Vibrations of the vocal folds are picked up by a laryngeal microphone and amplified, passed through a notch filter to reduce 50Hz pick-up, and then through a 1000Hz low pass filter and a 70Hz high pass filter in series. This filtered signal is the input of a Schmitt trigger circuit. The signal at the output of the Schmitt trigger is then inverted and integrated using two reset integrators having different time constants. The integrator outputs are compared to obtain the triggering signal for firing the Xenon flash tube. The triggering signal can easily be adjusted to obtain either standstill images of the vocal folds or slow-motion images of the vocal folds. A peak detector included within this unit can be used to determine the peak amplitude of the speech. Frequency is displayed using an ADC. The unit is optically isolated for patient safety.Keywords: Video Laryngeal Stroboscopy, switched mode supply, free running, xenon flash lamp

Thesis No.: 186 Em Effects of 1800 MHZ Signal Generator on Rats' Brain.

Name: Bülent Akbenlioğlu, Year: 2004

Advisor(s): Selim Şeker

Abstract: The use of radio waves to carry information is an integral part of modem life and there are many different types of radio transmitter in the environment These include the broadcast transmitters used for radio and television, the radio equipment used by the emergency services, mobile telephones and their associated base stations. The 1990's have seen the introduction of digital cellular phones and an enormous increase in the using of mobile communications equipment. In this thesis, we studied the near field electromagnetic radiation of mobile phones (by using a signal generator at about 1 800 MHz), EM effects on blood brain barrier (BBB) and the temperature effect in unhealthy rats' brain (kindling model) due to electromagnetic radiation of the mobile phones. The animals were exposed to electromagnetic radiation with helix antenna in both experiments. The near electric field measurements of the mobile phone antennas are carry out at laboratories of Electronics department at Sakarya University. We were used FP 5000 isotropic probe to measure electric fields. Experiments were performed in I.Ü. Cerrahpaşa Medicine Faculty, Biophysics Department, and experiment animals breed center laboratory. The specific absorption rate (SAR) was calculated from temperature values in rats' brain. Results were compared with standards. In BBB test, it could not be observed on BBB negative effects. In temperature experiment, it was observed 0.67 °C temperatures increasing in subcutaneous, 0.05 °C in brain. Keywords'. Biological effects of electromagnetic radiation, mobile phones, rat, SAR, blood brain barrier (BBB), epilepsy.

Thesis No.: 185 Source Localization of Electrical Dipoles in Electroencephalogram (EEG).

Name: Adil Deniz Duru, Year: 2004

Advisor(s): Ahmet Ademoğlu

Abstract: As a noninvasive neuroimaging method, the dipole source localization of brain electrical activity has a much higher temporal resolution when compared with the func tional magnetic Resonance (fMRI) or Positron Emmision Tomography (PET) Imaging. It gives a direct image of the electrical events occuring in the brain. In this study, a user friendly computational system is developed for routine analysis of EEG activ ity, to perform electrical Dipole Source localization. The forward problem which is an essential part of source localization is solved by both the analytical and numerical methods. For the inverse problem, the Multiple Signal Classification algorithm (MU SIC) algorithm is used. The three concentric spherical shell and realistic head models which lead to analytical and numerical forward solutions, respectively are performed for different dipole parameters for evaluation and comparison. The center of grav ity (COG) approximation is used for the forward solution of the Boundary Element Method. The head model is obtained by the TI weighted average head image issued by the Montreal Neurological Institute. The graphic user interface is extremely used on epileptic data obtained from mesial temporal sclerotic patients. The results obtained are in agreement with the clinical diagnoses reached by MRI and other neurological tests.
Keywords:EEG, Dipole Source Localization, Inverse Problem, For ward problem, Boundary Element Method, MUSIC algorithm

Thesis No.: 184 Computer Simulation of NGF Induced TrkA Signal Transduction Pathway in PC12 Cells.

Name: S. Sertan Yılmaz, , Year: 2003

Advisor(s): Yekta Ülgen

Abstract: TrkA is a ligand activated tyrosine kinase receptor for Nerve Growth Factor (NGF). NGF-stimulated TrkA activates a mitogenic response in non-neuronal cells. However, this combination stimulates differentiation in cells of neuronal lineage. Activation of the NGF-stimulated TrkA pathway is not sufficient for the cellular response. The duration of the pathway also contributes to the biological output generated. In PC 12 cells it has experimentally been shown that Shc/Grb2/SOS/Ras/Rafl/transient MAPK pathway, activated by NGF-stimulated TrkA causes mitogenesis and FRS- 2/SHP2/Crk/C3G/Rapl/B-Raf prolonged MAPK pathway activated by NGF-stimulated TrkA causes differentiation. Computer simulation of kinetic models plays an important role in biochemical sciences. The aim of this study is to simulate, the NGF induced TrkA Receptor Signal Transduction Pathway in PC 12 cells by simulating; Shc/Grb2/SOS/Ras/c-Raf, and, FRS- 2/SHP2/Crk/C3G/Rapl/B-Raf pathways using a biochemical systems modeling software package called Gepasi. Effects of Shc/Grb2/SOS/Ras/c-Raf and, FRS- 2/SHP2/Crk/C3G/Rapl/B-Raf pathways on activation kinetics of MAPKs are shown by simulating these pathways in four different cases. Also the steps playing important role in sustained activation of MAPKs are determined. The distinction between these two pathways is of utmost importance because ifa cell that is supposed to be a neuron starts to divide, this process may have undesired consequences such as cancer. Hence the understanding of cancer starts at the cellular level with the understanding of signaling pathways.

Keywords: Computer simulation, Gepasi, NGF, PC 12 cells, TrkA

Thesis No.: 183 P-Vocad: A Portable Instrument for the Diagnosis and Follow up of Vocal Abuse Disorders.

Name: Hisham Alshaer, Year: 2003

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis, a battery powered, easy to use, compact and wearable (portable) instrument called P-VOCAD has been designed and realized for diagnosing functional voice disorders such as vocal misuse and abuse. These disorders can lead to vocal cord injury, development of edema, nodules, polyps and loss of voice. The current diagnostic methods depend on clinical examination and lack the facility to inspect the actual abused voice, as triggered by work conditions, noisy environment and daily habits. P- VOCAD is designed to overcome these diagnostic limitations by monitoring the voice for extended periods that last days to weeks and uses advanced electronics technology. It has two microphones; one is placed close to patient's mouth and is used to capture voice continuously, while the other is used to sense environmental noise. Signals are amplified with two HOdB CMRR instrumentation amplifiers. Thereafter, three 8th order band-pass switched capacitor filters, which are more stable and accurate than active filters, process the captured signals. Two of the filters separate voice harmonics above and below 2Khz, while the 3rd filter separates the ambient noise. An ADC embedded within the microcontroller, which is the main processor in the P-VOCAD, samples the filtered signals at 15Kz. The microcontroller calculates the power spectrum and the energies of voice frequency bands in real time. The results are then averaged and stored on an EEPROM. A real time clock within the P-VOCAD provides the date and the time at which vocal activities occur. To minimize power utilization the whole system goes into a low power sleep mode unless activated by voice signals via a wake-up circuit. The system is also equipped with an interface for transmission of the acquired voice data to a PC over the serial port. Once the data is transferred to the PC Excel or other suitable software can be used to further analyze the data. Keywords: Voice abuse, misuse, vocal diseases, portable diagnostic instrument.

Thesis No.: 182 Load Independent Trajectory Control for an Artificial Muscle.

Name: Alper Yaman, Year: 2003

Advisor(s): Mehmed Özkan

Abstract: In this study, the hysteretic characteristics of pneumatic McKibben artificial muscle were investigated to develop an alternative trajectory control method to tradi tional PID (Proportional-Integral-Derivative) controller avoiding feedback delays. Fur thermore motion trajectory is intended to be payload independent by developing a physical model that will adapt itself to mass changes. In this study, we focus on only one actuator and evaluate our model experimentally. The contraction of the muscle against different pressure values was measured for several different load masses. The proposed model requires computation of actual forces involved in the motion generation of the muscle. These forces are related to contraction ratio, speed, and acceleration of the actuator. First, the load mass that the muscle lifts is measured by force sensation. The mass assessment is performed by using a friction coefficient model. Next a mathematical model relating actuator pressure with its contraction ratio is established. The coefficients are related to both the load mass and the electrical current speed that controls the servo valve pressure. Because of the spring-like characteristics of the muscle, its contraction ratio is different for different loads for the same control signal. To achieve load independent trajectory control, the physical model must contain mass related parameters. In this control system, control signal (input electrical current) and electrical current speed are related to the target trajectory. The control system is open-loop, and has no feedback.
Keywords: McKibben, artificial muscle, rubbertuator, hysteresis, non-linearity, control.

Thesis No.: 181 Functional Near Infrared Spectroscopy as a Tool for Neuroimaging Studies.

Name: Meryem Çakıroğlu , Year: 2003

Advisor(s): Ata Akın

Abstract: Techniques to monitor brain function called functional neuroimaging techniques aim to localize and quantify physiologic changes during mental activity. Functional Near Infrared Spectroscopy (fNIRS) is one of the neuroimaging techniques based on measuring events, which are associated with hemodynamic and metabolic changes in active brain areas. fNIRS provides spectroscopic information on neurovascular coupling parameters during functional brain activation where neurovascular coupling is a generic term for changes in cerebral metabolic rate of oxygen (CMRO2), cerebral blood flow (CBF), and cerebral blood volume (CBV) related to brain activity. The aim of this study is to understand how blood oxygenation of the prefrontal cortex relates to the cognitive activity through detection of task-relevant cognitive events with functional NIRS. For this purpose, Target Detection Task Procedure was performed. We present a preliminary report on this study in order to stimulate further research. Data obtained from 6 healthy subjects was extracted from the eighth photodetector that is located over the middle orbitofrontal region from where fMRI signal increase has been found during the same task. Measured hemodynamic responses are fitted to a gamma function in order to estimate the values of behavioral response time (RT), latency (L), amplitude (C), and time constant (x) for HBO2 and HB data. Pearson Correlation Coefficient analysis and paired t-tests was performed to maintain information about changes in the parameters of [HBO2] and [HB] response to the infrequent target detection task. Preliminary results are promising to continue experimental studies on human subjects. The present investigations support the results from fMRI studies. Cross validation studies with fMRI, EEG and other modalities would secure the future of this technique as a rapid, non-invasive, affordable tool to assess brain functions and disorders. Keywords: fNIRS, Brain energy metabolism, Hemodynamic Response, [HBO2], [HB]

Thesis No.: 180 Shape Optimization of the Femoral Component of Cemented Hip Prosthesis Using Finite Element Analysis.

Name: Devrim Kılınç, Year: 2003

Advisor(s): Sabri Altuntaş/Aykut Sümer

Abstract: Aseptic loosening and strain-adaptive bone remodeling are the two most common phenomena that are associated with the long-term post-operative problems of cemented total hip replacement. These phenomena are related to the stress levels in the cement layer and in the cortical bone, respectively, In the present study, the prosthesis, the cement, and the bone are parametrically modeled. The assembly design is related to three design variables, which represent the length, the thickness, and the sharpness of the prosthesis stem. Two-dimensional finite- element models of the implanted and intact femora are created with the material properties and loading conditions obtained from the literature. A software program utilizing random search method is created and used to achieve the optimal shape of the stem. The objective of the optimization was to minimize the maximum stress in the cement layer, while maintaining a reasonable stress level in the cortical bone. A parametric study relating the stress with the length and the material of the stem is also conducted to verify the result of the optimization, Results of analyses are harmonious with the literature. After 51 solid models and 72 analyses, an optimum stem design is reached. The parametric study reveals that there should be an optimal stem length for each prosthesis material Keywords: Total hip replacement, finite-element analysis, stem design, optimization

Thesis No.: 179 Time-Frequency Analysis of Event Related Brain Potentials Elicited with Four Different Cognitive Paradigms.

Name: H.Yasemin Keskin, Year: 2003

Advisor(s): Ahmet Ademoğlu/Tamer Demiralp

Abstract: Event related potentials (ERPs), which reflect fundamental cognitive operations, are generated by the parallel and/or the sequential processing of different neural groups in the brain. In time domain representation of ERPs, temporally overlapping processes are hidden and they cannot be distinguished. However, the surface ERPs can be decomposed into functional neuronal components using time-frequency analysis. The aim of this study is to differentiate the time-frequency components that are related with specific cognitive operations (i.e. signal discrimination, motor response task, motor response inhibition, and context updating) in the auditory ERPs. For this purpose, by making systematic modification in cognitive content of the paradigms, experimental set that consists of four auditory paradigms was designed. ERP reflections of these modifications both in the time domain and in the time-frequency plane were explored in order to assign specific ERP sub components to specific cognitive processes. Data obtained from 16 healthy volunteers were decomposed by discrete wavelet transform into six sets of wavelet coefficients. Alpha, theta, and delta band coefficients and P200 and P300 measurements of the midline electrodes (Fz, Cz, Pz) that were obtained from individual average ERPs for each stimulus condition were analyzed with five-factor analysis of variance (ANOVA) design. Compared to time domain analysis, results of the time-frequency analysis brought detailed information about the stimulus processing steps in different conditions. However, some components showed varying topographic distributions across the paradigm set. Namely, the wavelet transform could partially decompose these spatially overlapping events into functionally distinct sub-components. Therefore, in order to decompose ERPs more accurately into their functional sub-components, spatial decomposition methods should also be incorporated to the time-frequency analysis.

Keywords: Event Related Potential (ERP), P300, P200, Time-frequency Analysis, Wavelet Transform.

Thesis No.: 178 Virtual Gamma Camera for Educational Purposes.

Name: Ozan Yılmaz, Year: 2003

Advisor(s): Albert Güveniş

Abstract: Nuclear medicine is a medical specialty that uses painless, safe, and cost- effective techniques to image the body and treat disease. In nuclear medicine, very small amounts of radioactive materials or radiopharmaceuticals are used to diagnose and treat diseases. The radiopharmaceuticals that are attracted to specific organs, bones, or tissues, emit gamma rays that can be detected by gamma or PET cameras. These cameras work with computers to form images, which provide data and information about the imaged area of body. The importance of Monte Carlo simulation in nuclear medicine imaging is increased by recent developments in nuclear medicine instrumentation and processing systems. The Monte Carlo method is very useful in medical physics due to the stochastic nature of radiation emission, transport and detection processes. Some of the applications of the Monte Carlo method in nuclear medical imaging are: Detector modeling, pharmacokinetic modeling, imaging systems and collimators design, attenuation and scatter correction techniques, image reconstruction algorithms, dosimetry and treatment planning. The aim of this work is to design a user-friendly interface that can perform a gamma camera simulation by using the Monte Carlo method. The purpose of this interface is to give the opportunity to students and researchers who have basic knowledge about gamma cameras, to understand the fundamentals of gamma camera imaging and to study the effects of the camera characteristics and parameters on the simulated images. Keywords: Nuclear medicine, Monte Carlo simulations, gamma camera imaging, image quality

Thesis No.: 177 System Characterization for a Fast Optical Imager.

Name: Uzay Emrah Emir, Year: 2003

Advisor(s): Ata Akın

Abstract: In contrast to morphological imaging, functional imaging captures informa tion about the functioning for living tissues, such as blood circulation and oxygen metabolism, cerebral nervous system, and changes in cromophore concentration. In recent years, progress in PET and MRI technologies has made these measurements possible. However both these systems are large and expensive and they have some lim itations such as not being approved for use with infants in non-clinical settings and low temporal resolution. Optical imaging fills this gap by being completely non-invasive, portable, unobtrusive, low-cost, and robust to motion artifacts. This M.Sc. thesis is involved with the development and modifications of a prototype fast optical imaging (FOI) system based on the functional near infrared spectroscopy system of University of Pennsylvania. FOI is designed by using inexpen sive photodiode (PD) detectors and LEDs working in the near infrared spectrum. In addition to this a new probe design considering limitations of the preceding versions is also completed. The aim of the work was to develop a simple and robust instrument and probe to monitor brain activity, during cognitive task. The ability and effectiveness of the system is tested by several experiments based on phantom studies. Preliminary results are promising to continue on human subjects.
Keywords: FOI, functional near infrared spectroscopy (fNIR), brain imaging, optical imaging, neuroimaging.

Thesis No.: 176 Production of Hydroxylapatite from Animal Bone.

Name: Şeyma Gören, Year: 2003

Advisor(s): Sabri Altuntaş

Abstract: Hydroxyiapatite (HAp) used in orthopedics and dentistry is a ceramic material with a very good biocompatibility. There are two ways of HAp production; production from the natural bone and tooth or, production from an inorganic synthesis method. In this study, HAp is obtained by NaOH degradation of the organic phase in calf femur. Optimum conditions of HAp production were investigated by changing the parameters of solution concentration and temperature in the degradation method. As temperature increases» solutions of lower concentrations gave shorter reaction times. Deproteinized bones were cabined at 850°C for 8 hours, ground, sieved to get particle sizes < 300 urn. Infrared spectrum (FTTR), ESEM micrographs, EDAX and X-ray analysis of natural hydroxyiapatite were obtained and the results were compared with a commercial HAp powder. In order to get porous HAp structures, naphthalene was added to HAp powder with particle sizes ^ 300 urn. Porous samples with porosity around 100 um were produced. As napthalene composition in the mixture increased, only the pore density increased, but not the pore size. ESEM images of dense and porous HAp structures were obtained and examined. Keywords'. Hydroxyiapatite, animal bone, deproteinization.

Thesis No.: 175 Characterization of Optical Properties of Biological Tissues.

Name: Ömer Pars Kocaoğlu, Year: 2003

Advisor(s): Murat Gülsoy

Abstract: Tıbbi laser uygulamaları hedef dokunun optik özellikleri hakkında bilgiye ihtiyaç duymaktadır. Bu çalışmada optik özellikleri ölçmek amacıyla bir deney düzeneği tasarlanmış ve oluşturulmuştur. Bu deney düzeneği kullanılarak koyun beyin, karaciğer ve kalbinin 632.8-nm deki optik özellikleri laboratuvar ortamında araştırılmıştır. Op tik özelliklerin hesaplanabilmesi amacıyla dokuların dağınık geri yansıyan, toplam geri yansıyan, dağınık iletilen ve toplam iletilen ışık şiddetleri tek toplayıcı küre tekniği kullanılarak ölçülmüştür. Elde edilen deneysel bilgi soğurulma ve saçılma kat sayılarını, albedo ve anisotropi faktörlerini hesaplamakta kullanılmıştır. Bu hesaplama için Lambert-Beer ve Inverse Adding-Doubling metodları kullanılmış, sonuçlar lit eratürdeki değerler ile karşılaştırılmıştır. Lambert-Beer metodunun verdiği sonuçların kısıtlı olmasına karşın Inverse Adding-Doubling metodu ile önceden kayıtlara geçmiş değerlere çok yakın sonuçlar elde edilmiş ve her iki metodun hesaplama prosedürü mod- ellenmiştir. Model sonuçları ışığın doku içindeki yayılışını gösteren bir Monte-Carlo simulasyonunda kullanılmıştır. Anahtar Kelimeler: Laser-Doku Etkileşimi, 632.8-nm, Optik Özellikler, Tek Toplayıcı Küre.

Thesis No.: 174 Microsphere Based Optical Biosensors.

Name: Şenol İşçi, Year: 2003

Advisor(s): Cengizhan Öztürk/Ali Serpengüzel

Abstract: Optical microsphere resonators have recently utilized in quantum optics, laser science, spectroscopy, and optoelectronics and attracted increasing interest due to their unique optical properties. Microspheres possess high quality factor (Q-factor) optical morphology dependent resonances, and have relatively small volumes. Q-factor can be defined as how sharp morphology dependent resonance in the elastic scattering spectrum. High-Q morphology dependent resonances are very sensitive to the refractive index change and microsphere uniformity. These tiny optical cavities, whose diameters may vary from a few to several hundred micrometers, have resonances with reported Q- factors as large as 3x 109. Due to their sensitivity, morphology dependent resonances of microspheres are also considered for biosensing applications. For instance, binding of a protein or other biomolecules can be monitored by observing the wavelength shift of morphology dependent resonances. A biosensor, based on this optical phenomena, can even detect a single molecule if a good system design is achieved. In this work, elastic scattering spectra from the microspheres of different mate rials are experimentally obtained and morphology dependent resonances are observed. Furthermore, the morphology dependent resonances of microspheres for biosensor ap plications were studied theoretically. Keywords: Biosensor, Microsphere, Morphology Dependent Resonances.

Thesis No.: 173 Effects of the 980-nm Diode Laser Versus the Monopolar Electrocoagulator on the Rat Brain.

Name: Haşim Özgür Tabakoğlu, Year: 2003

Advisor(s): Murat Gülsoy

Abstract: This work aims to compare thermal effects of 980-nm diode laser and monopolar electrocoagulator on rat brain. 980-nm diode laser was investigated for neurosurgery because of a local peak in absorption spectra of water around this wavelength. The ablation and coagulations created in Wistar rat brain with a diode laser and of electric current were investigated. Lesions were examined histologically by using Cresyl Fast Violet, and Hematoxylin and Eosin staining. Thermally altered areas were determined and classified under microscope. Dimensions of those areas were quantified. The parameters indicating thermal damage were defined as the degree of structural change considering thermal alteration around lesions, the extent of lesions and coagulated zones in three dimensional coordinates (anterior- posterior and ventral axis), and number of viable cells around lesions. Results provided data for greater laser induced ablation areas with less thermal damage to the surrounding tissue. Number of viable cells around ablated area was found greater in laser-lesioned tissue. 980-nm diode laser was found less harmful to adjacent tissues compared to monopolar electrocoagulator.

Thesis No.: 172 Comparison of 980-nm Diode Laser and ELECTROLYTIC LESIONS in RAT BRAIN BY SDS-PAGE and CD68.

Name: Özgüncem Bozkulak, Year: 2003

Advisor(s): Murat Gülsoy/Neşe Bilgin

Abstract: There are several techniques used for neurosurgical tumor ablations; lasers are the newest and most effective of all to apply on brain tissue. This thesis study aims to compare the after-effects of two different surgical tools, namely, the established electrosurgical unit and relatively novel surgical 980-nm diode laser on rat brain tissue. In this thesis, in order to analyze the extent of damage created by 980-nm diode laser (2W/2sec) and electrosurgical unit (1.5mA/20sec) in Wistar rat brain tissue, the thermally affected protein content after stereotaxic neurosurgery was investigated by Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE). The effects of both types of lesions on the whole brain and on the thermally altered nearby tissues were investigated. In order to observe the recovery period of brain tissue after bilateral laser induced and electrosurgical lesions, CD68 specific marker was used for the immunohistochemical staining. The morphology and size of thermally altered areas in both lesions were investigated and the amount of macrophages in lesion area were compared. After-effects of both surgical methods were found similar by SDS-PAGE. Thermal effect of electrosurgical unit on brain tissue was ~160% greater than that of laser. The accumulation of macrophages/microglia 7 days after the surgery in electrolytic lesion was nearly ~60% greater than that of laser lesion. No carbonization was observed in any electrolytic lesions. Finally it was found that, 980-nm diode laser (2W/2sec) can be an alternative to electrosurgical unit (1.5mA/20sec) to be used in neurosurgery. Keywords: CD68, 980-nm diode laser, electrolytic lesion, SDS-PAGE

Thesis No.: 171 Detection of Venous Gas Bubbles with Computerized Doppler Ultrasound.

Name: Kadir Tufan, Year: 2003

Advisor(s): Ahmet Ademoğlu/Murat ege

Abstract: Venous Gas Embolism (VGE) may occur during the brain and neck surgery where the operative site is higher than the heart. Medium where the pressure changes significantly like diving, aviation and space missions also promote VGE. For this reason, early detection of VGE is very crucial. The Doppler Ultrasound Audio (DUA) signals recorded from two divers are analyzed to detect the embolic waveforms. The optimal pass band characteristics of the embolic events are determined by an extensive band pass filtering analysis and the optimum band is determined as 4.5-8 KHz. A nonlinear Teager operator and and adaptive thresholding is also applied to the filtered DUA for automatic detection of the embolic events. As a last step, a software that can perform all the operations from digitizing the DUA recordings to detecting the embolic events is developed for off-line processing. Keywords: Doppler Ultrasound Audio, gas bubble, Teager energy operator, venous gas embolism, frequency band analysis

Thesis No.: 170 Fatigue Related EMG Power Spectrum Changes During Dynamic Contractions in Female Rowers.

Name: Selda Uzun, Year: 2003

Advisor(s): Mehmed Özkan

Abstract: The Surface Electromyography (SEMG) signal allows a good assessment of neuromuscular activity as a noninvasive tool. While muscle fatigue is a complex multifaceted phenomenon, in sedentary subjects it is characterized by changes of spectral parameters. If these criteria are also valid for athletes, monitoring training and performance development as well as scientific research on muscular adaptations during intense physical exercise will be facilitated. For this purpose, ten healthy female rowers of the Turkish National Team were selected. SEMG recordings were obtained from the muscles Vastus Lateralis (VL). The fatigue test with 80 % Maximum Voluntary Contraction (MVC) consisted of two identical tests. First, the subjects performed repetitive auxotonic knee extensions to maintain for as long as possible (till exhaustion). After a five-minute rest, the exercise protocol was repeated. The power spectrum was derived from the raw SEMG signal using the Fast Fourier Transform (FFT) algorithm. For the active phase of each contraction cycle the Median Frequency (MDF) and the Mean Frequency (MNF) were computed from the EMG signal. In addition, the Borg's Category-Ratio Scale (CR-10) was used to measure the perceived muscle exertion. The results of this study show that the inter-individual fatigue profiles differ in power spectrum. Differences are also noted for the first and the second experiments in terms of spectral values. But, the MDF and MNF graphics of both experiments are greatly similar. What is common for all the subjects is that there are periodic decreases and increases in their MDF and MNF values. Recruitment of larger motor units with higher discharge rates or cyclic recruitment of motor units during sustained auxotonic contractions may be the cause for these interesting findings. This result may represent a special muscular adaptation of elite rowers to intense muscular training. Keywords: EMG, sports, fatigue, contraction, median frequency, mean frequency, power spectral analysis, elite rowers.

Thesis No.: 169 A DSP Instrument for Real-Time Classification of Pulmonary Sounds.

Name: Sameer Alsmadi, Year: 2003

Advisor(s): Yasemin Kahya

Abstract: The analysis of respiratory sounds is often carried out on digitized signals once they have been sampled and stored as blocks of data. However, the advance of digital signal processing technology and the availability of high speed microprocessors specially designed for digital signal processing have now made it possible to develop systems that can apply complex signal processing algorithms in real time. In this work, a real-time diagnosis system, based on Motorola's 56311 Digital Signal Processor (DSP), was used to design an instrument capable of classifying lung sounds into two classes: healthy and pathological. The instrument has two inputs the first of which is from a microphone placed on the chest of the patient while the other is from a flowmeter that is used to label the lung sounds as belonging to the inspiration or expiration phase. Based on the information they bear and the different mechanisms that generate them, the stored lung sounds of a full respiratory cycle are divided, with the help of the flow signal, into six distinctive sub-phases. Next, each sub-phase is further divided into ten 25 per cent overlapping segments. After being weighted by a Hamming window with a length of 512 points, each segment is modeled by an autoregressive model of order six by means of the efficient Levinson-Durbin algorithm. The classification of each of the resulting 60 feature vectors can be done using two different types of classifiers: the k-nearest neighbor classifier based on either the Itakura, Euclidean, or city-block distance measure, and the minimum distance classifier based on the quadratic Mahalanobis distance measure. The classification of the whole respiratory cycle, however, is made using the majority voting method. Both of the classifiers were trained using different reference libraries obtained from 21 healthy subjects and 21 patients suffering from various restrictive or/and obstructive pulmonary diseases. The selection of the desired classifier type and the distance measure to be used in the diagnosis process can be done using the push-buttons located on the front panel of the instrument. These buttons also provide the user with the choices of recording, listening and digital filtering of the respiratory data. The software was written entirely in assembly language and a character display (LCD) was used for displaying the selected menu items, diagnosis result and other messages that convey information regarding the current state of the system. Keywords: Lung sounds, DSP, autoregression, k-nearest neighbor, real-time classification.

Thesis No.: 168 Alternative Aneurysm Coil Detachment System Used for Endovascular Treatment of Cerebral Aneurysms.

Name: Özgür Kocatürk, Year: 2003

Advisor(s): Mehmed Özkan

Abstract: Coil embolization is an endovascular treatment method for cerebral aneurysms that is an abnormal bulge or blister of an artery wall in the brain. In this treatment method, coils that fill the space of the aneurysm to exclude it from blood circulation must detach from catheter to remain within the bulge of the aneurysms. Today, there are several coil detachment systems that have important deficiencies. In this study, an alternative coil detachment system was developed by considering magnetic-based and nitinol-based approaches. The nitinol based coil detachment system was found reliable, inexpensive and instant detachment mechanism after the in vitro tests. Reducing the size of the catheter and animal studies are required to reach the exact conclusion about this alternative coil detachment system.

Keywords: Cerebral aneurysms, endovascular therapy, detachable coil

Thesis No.: 167 Non-Linear Analysis of Epileptic EEG Activity, 2002.

Name: Arzu Ergintav, Year: 2002

Advisor(s): Ahmet Ademoğlu

Abstract: Individuals with epilepsy suffer considerable disability from seizures and result ing injuries, the social isolation attached to having seizures, and from side effects of medical and other therapies. An automatic system that detects/predicts seizure onsets would allow patients or people near them to take appropriate precautions and provide them with more insight into the phenomena with objective manners. The aim of this study is to analyze the epileptic EEG data using correlation dimension and nonlinear prediction algorithms for the detection/prediction of seizure onsets. For this purpose, EEG recordings from three patients were analyzed. The channels used for each patient have been chosen based on the observations of an expert neurologist. The recorded data has been divided into segments of 5s duration. Surrogate data testing has pointed out the nonlinearity in the data sets. Correlation dimension values were observed to show some dependency on seizure events. However, the results obtained from the nonlinear prediction algorithms did not show the same consistency as the correlation dimension results did. Keywords: Epilepsy, EEG, Nonlinear prediction, Correlation Dimension, Sur rogate data testing.

Thesis No.: 166 Internet Based Communication Network Between Doctors.

Name: Ahmet Erol Fazlıoğlu, Year: 2002

Advisor(s): Albert Güveniş

Abstract: The main objective was to develop an information system that will meet the requirements of the Healthcare System in Turkey. Coordination problems among health professionals treating the same patient can occur due to the lack of proper communication methods and technologies. Previous work has shown the effect of this problem on health care quality and cost in the form of investigations and medication errors. A low cost solution to the problem of patient information management is proposed, which makes use of the widely available Internet services. The distributed system will store the patient records on a central database server if appropriate permissions are taken by the patients' doctors. The system will allow subscribed doctors to access patients' records using Internet whenever they need. On the other hand, patients can access their medical records using web-site http ://www. e-healthportal. com via a secure channel. This site will be the backbone of this system. In the near fixture, the collected medical data on the server can be used to perform statistical analysis. In addition, the system will allow doctors treating the same patient to perform medical teleconsultation on the Internet. The use of this tool may be highly beneficial in improving coordination among health care professionals. Keywords: Medical Information System, Health Portal, Distributed Medical Information System, Online Medical Consultation, Internet Online Communication Network, Chat Application..*& a

Thesis No.: 165 Model of Laryngeal Resonance and Its Use in Improving Voice Quality Through Surgery.

Name: İsmail Koçak, Year: 2002

Advisor(s): Halil Özcan Gülçür

Abstract: Voice production is the coordinated activity of thorax, larynx and the supraglottic cavities; abnormalities in this activity inevitably results in a change of perceived voice quality which may be classified by the public as "unnatural" or even "funny" that may lead to serious problems in one's social life. The disordered voice can be corrected by manipulating the vocal folds and related structures to remove the pathologies or deformations that cause abnormal vocal fold vibrations by changing their mass and/or length or by manipulating the framework structures in the vicinity of the vocal folds that indirectly affect the vibration quality, by changing their length, stiffness etc. Unfortunately, long-term surgical outcomes of these procedures are not always satisfactory due to a number of reasons including intraoperative vocal evaluation problems accentuated due to presence of intraoperative edema, paradoxical stress relaxation of vocal folds, inadequate resonance matching characteristics and limited frequency ranges of the procedures used etc. In the present thesis work the resonance characteristics of the vocal tract has been studied by means of external stimulation applied using a new resonator developed by us for this specific purpose. Various acoustic manipulation techniques, pitch altering surgery and relevant operative techniques have been reevaluated from a new point of view and patients who have undergone pitch altering surgeries have been carefully reexamined. It has been observed that (1) the laryngeal resonance characteristics largely determines the timbre and the quality of the speaking voice and (2) the hyoid region plays a key role on the laryngeal outlet resonance. Therefore, we have selected this particular anatomical site for modifying the laryngeal resonance and hence voice quality; we have developed a new surgical technique that we call "hyoidoplasty" for this region. This technique provides the necessary constriction and increases the first formant frequency, resulting in better voice quality. We have tried "hyoidoplasty" and two new modified laryngoplastic techniques developed on a group of patients with satisfactory results. Keywords: Voice surgery, laryngeal acoustics, airway resonator, laryngoplasty, hyoidoplasty

Thesis No.: 164 Radiological Report Entry Via Speech.

Name: Ali İskurt, Year: 2002

Advisor(s): Mehmed Özkan

Abstract: In this study, a general approach to dictation of Turkish radiological sound with relatively acceptable accuracy is presented. The work includes collection of training and testing data, methods developed for data preparation, interpretation of experimental results and discussion of critical factors affecting performance. In speech recognition of Turkish radiological words, HMMs (Hidden Markov Models) of triphones (phone with its neighboring phones) are trained and used. Enhancement techniques such as obtaining a large sound data, further training of HMMs, usage of triphones from radiological corpus and fine-tuning with special coefficients are applied. Various tests are performed on different recognizer models and finally, an accuracy performance of 95 % is achieved in recognizing words from Turkish Radiological Corpus produced in this thesis. Keywords: Recognition, Triphone, HMM, Gaussian

Thesis No.: 163 Classification of Lung Sounds Using Wavelet-Based Neural Network.

Name: Mete Yeğiner, Year: 2002

Advisor(s): Yasemin Kahya

Abstract: Computer-based systems for diagnosing diseases have been widely used in various areas of medicine in the last decades and similar studies have been performed to parameterize and increase the reliability of lung-sound based diagnosis by using computational techniques. In this study, two types of classifiers, namely wavelet-based neural network and conventional artificial neural network (ANN), are used and compared for the classification of healthy and two-class pathological lung sounds which are acquired using two microphones on the chest wall along with the air-flow signal. The inputs of classifiers are organized using two different methods, 'even-odd partitioning' and 'leave-one-out'. The lung sound signals belonging to inspiratory or expiratory phases are divided into thirty segments with 25% overlapping. In wavelet-based classifiers, the signals belonging to segments are decomposed to five levels using wavelet transforms and the reconstructed signal at each level is represented by AR parameters at the input of the network along with a volume constant indicating the sub-phases (early, mid, and late) of the respiratory cycle. The outputs of five networks belonging to five octaves are later combined to determine the performance of the classifier with respect to the frequency intervals used. For the ANN, the AR parameters obtained from the segments and the volume constant are used as inputs for the network. The classifiers operate on the respiration phases separately and a comparison between the results of the two phases indicates that expiration is more useful in diagnosis. Keywords: Lung sounds, artificial neural networks, wavelet-based neural networks, multiresolution analysis.

Thesis No.: 162 Development of a Quality Assurance System for Bone Densitometer (DXA).

Name: Murat Sürücü, Year: 2002

Advisor(s): Yekta Ülgen

Abstract: Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissue. Dual-energy X-ray absorptiometer (DXA) is used to diagnose and in the follow-up of the osteoporosis. In osteoporosis the density and quality of bone are reduced, leading to weakness of the skeleton and increased risk of fracture, particularly of the spine, wrist, hip, pelvis and upper arm. Osteoporosis and associated fractures are an important cause of mortality and morbidity. Bone mineral density (BMD) of the patient is measured by 6 months, 1 or 2 years period and the doctor decides on the future of the therapy. Quality Assurance is very important in bone densitometry because, little amounts of bone is gained or lost over a year. If a shift in the calibration of the device would occur, this would affect the results of the measurements, and eventually cause misinterpretation of the BMD. Although DXA is the gold standard in the diagnosis of osteoporosis, follow-up of the patients by the BMD measurements in DXA brings some questions because of the problems associated with the reproducibility of the device. In this study we aim to adapt the Qualtiy Assurance and Accreditation Guidelines that are used in Australia and New Zealand, and to develop guidelines that will be used in compliance testing and radiation safety control of the densitometers. To test the daily reproducibility of the densitometers, a computer program is written in Visual C++ 5.0 and Delphi 5, and executable on Windows media without the need of any other programs.

Keywords: Bone Densitometry, DXA, Osteoporosis, Quality Assurance, Re producibility, Radiation Safety.

Thesis No.: 161 Comparison of Surface Structures of Tooth Prepared by High Speed Rotary Burs and Air Abrasion.

Name: Arzu Beklen, Year: 2002

Advisor(s): Sabri Altuntaş

Abstract: Air abrasion technique first used in 1950's has gained popularity today due to its advantages in the clinical setting. Air abrasion device can open cavities on tooth tissue by throwing high speed aluminum oxide particles under high pressure through a small duct on the application probe thereby pushing away tissue from the applied area. However, despite of the disadvantages, high speed turning cutters are dentists' basic equipment today for cavity preparation. In this study our aim was to compare the advantages and disadvantages of the cavities prepared by using these two techniques in terms of the physical surface properties they cause when applied on the tooth tissue. The observation of the final surface properties after preparation would aid a dentist to have a better opinion on what type of material is best to use for restoration of the tooth. In classical SEM studies, the material to be examined is first coated with another material and this may causes a loss of resolution in the final image of the material under examination. The Field-Emission Environmental Scanning Electron Microscope (ESEM- FEG) instrument was used in this study. This enabled the observation of the tooth tissue in its most natural physical environment with a very high resolution and magnification. Using different parameters such as application pressure and application distance, cavities were prepared for direct examination under the ESEM-FEG microscope. The examination results showed that a smear layer was present in both methods. Also the cavities prepared using the high speed burs were observed to be sharper, rougher and wider crack formation was evident compared to the air abrasion technique. Keywords: Air Abrasion, ESEM-FEG, Surface Structure of Tooth.

Thesis No.: 160 Analysis and Classification of Temporomandibular Joint Sounds in Orthodontic Patients.

Name: Ayşegül Ergin, Year: 2002

Advisor(s): Halil Özcan Gülçür

Abstract: The Temporomandibular Joint (TMJ) is the joint attaching the lower jaw, called the mandible, to the temporal bone. Temporomandibular joints move each time we chew, talk and swallow. Temporomandibular disorder (TMD) is a collective term that embraces a number of clinical conditions that involve the musculatory musculature and/or temporomandibular joints and associated structures. Various studies indicate that over 50% of the population shows at least one of several signs of temporomandibular joint dysfunction (TMJD). The cause of TMDs is generally accepted as multifactorial in origin. One of the clinical conditions is characterized by TMJ sounds (clicking, popping and crepitation) during mandibular function. TMJ sounds are common in patients with temporomandibular disorders and electronic recording of these sounds has been suggested as a potential tool to characterize TMDs. The relationship between orthodontic treatment and TMDs is an important issue in orthodontics and there are conflicting viewpoints on whether the orthodontic treatment can resolve, cause, alleviate or have no affect on TMD characterized by joint sounds. In this study, joint sounds from 9-13 years old orthodontic patients having class II division I type and cross-bite type malocclusions are recorded electronically by using accelerometers and characterized by a time- frequency signal analysis method; evolutionary spectral analysis using using multi-window Gabor expansion. These patients are also clinically examined by bilateral palpation and stethoscopy. Evaluated joint sounds are classified as clicks, click with crepitation, coarse crepitation and soft crepitation. The correlation between the occlusions of patients and joint sounds before the start of orthodontic treatment is investigated and most of the findings are classified as crepitation type. Agreement between the findings obtained using three different techniques in determining TMJ sounds is investigated and it is concluded that the accelerometer method gives results that are more detailed. Similar findings are obtained using palpation and auscultation methods whereas the accelerometer method does not show a significant agreement with those findings except clicking sounds. It is estimated that the accelerometer method is able to catch very low amplitude vibrations while these sounds are considered non-existent by palpation and auscultation. Changes in the evolutionary spectral parameters of TMJ sounds consecutively recorded during the orthodontic treatment are also presented.

Keywords: Temporomandibular joint sounds, orthodonty, time-frequency analysis, classification, evolutionary spectrum, multi-window Gabor expansion.

Thesis No.: 159 Cardiac Motion Analysis in MRI for Classification.

Name: Dilek Göksel, Year: 2002

Advisor(s): Mehmed Özkan

Abstract: Although several techniques exist for the analysis of cardiac tagged MR images, a rapid screening tool do not yet exits. Our proposed technique tries to perform rapid classification to diagnose the abnormalities in human left ventricle and the final aim of this study is to identify the investigated myocardium in the analyzed tagged MR images as pathological and non. In this thesis, images are first analyzed using harmonic phase (HARP) analysis and synthetic tags are computed over the myocardium. The data is normalized to perform a comparison between different myocardiums having various tag lines and time frames. The aim of the normalization is to eliminate the shift, scale and rotation variance. Cubic curves are fitted to the normalized tags and curve parameters are compared at various regions of the myocardium. In this initial study, the curve parameters are examined with probability density function between normal and diseased hearts, such as left ventricles with dilated cardiomyopathy (DCM) and infarcted regions. Finally, the confusion matrix is evaluated to examine the correctness of the segmentation algorithm. This method could be a very fast and automatic screening tool for identifying diseased locations in tagged MRI. Keywords: tagged MRI, HARP, cardiac motion analysis

Thesis No.: 158 Bacterial Adhesion to Solid Surfaces and Its Prevention by the Application of Silver.

Name: Wassim Mohamad Amine El-Soufi, Year: 2001

Advisor(s): Sabri Altuntaş

Abstract: Silver, under different forms, has been proved effective for the elimination of bacteria and other microorganisms from liquid mediums, solutions and solid materials used in industrial, sanitary, and biomedical fields, such as reactors, pipes, filters, medical devices, biomaterials, etc. The effectiveness of different forms of silver antimicrobial application depends on the nature of these forms, the methods of application, and the field of application. The main objective of the thesis is to present a theoretical and experimental studies involving bacterial growth in liquid suspensions and solid surfaces and its prevention (disinfection) by different application of different forms of antibacterial silver: electro-colloidal silver, silver nitrate, silver sulfadiazine, and antimicrobial ceramics impregnated with silver ions. Bacterial growth is detected by viable bacterial agar plate counting and by observation of turbidity in suspensions. The experimental results showed superiority of the antimicrobial effect electro-colloidal silver over other used forms of silver used to disinfect liquid suspension. It was also shown that the antibacterial properties of the hygienic ceramics impregnated with silver ions were strong and durable. Keywords: Bacterial adhesion, bacterial counting, disinfection, colloidal silver, hygienic ceramic.

Thesis No.: 157 An Open Graphics Library (Opengl) Based Toolbox for Biomedical Image Display and Processing.

Name: Mehmet Olcay Kılıç, Year: 2001

Advisor(s): Ahmet Ademoğlu

Abstract: By the development of Computerized Tomography (CT) in the late 70's and Magnetic Resonance Imaging (MRI) at the beginning of 80's, three dimensional images of the human body were generated in terms of slices of 2-D images. The availability of 3-D images gives researchers a better morphological, relational, and functional as sessment of the anatomical structures. An Open Graphics Library (OpenGL) based image display and processing toolbox, called 3DVIEW, has been developed for the 3-D visualization of human tissues using the MRI/CT data. The 3-D rendering and visual ization are performed via the OpenGL library routines while the basic image processing routines and Windows based Graphics User Interface (GUI) are developed using the Borland Object Windows 2.0 programming language and Borland C++ Version 4.5 compiler. The toolbox is capable of displaying the MRI/CT images in 2-D and 3-D as well as performing basic image processing techniques such as filtering, edge enhance ment, and histogram watching. The Seeded Region Growing Algorithm (SRGA) is also included for the segmentation and 3-D visualization of different tissues. The toolbox is aimed to be an interface to which someone studying biomedical images can add other functions to perform his/her routine analysis and visualization. Keywords: OpenGL, Borland C++, ObjectWindows Programming, Image Processing, Segmentation.

Thesis No.: 156 The Effectiveness of UV Radiation on Airborne Particles and Microorganisms in the Operating Theater.

Name: Işıl Tezer, Year: 2001

Advisor(s): Yekta Ülgen/Selma Karataş

Abstract: The aim of this project is to assess the field of action of Ultraviolet Radiation (UVR) on airborne particles and microorganisms in the operating theater. The study is conducted in the operating theater, with all measurements performed during the weekends and repeated for 1 1 weeks. Following the general cleansing of the room; reference measurements are performed with the Sedimentation and the Particle Counting Methods. A 30 W UV lamp is turned on during the night for 12 hours. After UV measurements are then done using the same procedure. For the Sedimentation Method a total of 660 petri dishes are used; half of them containing Nutrient Agar for coccus and Bacillus, and the other half Sabouraud Agar for fungi. The samples are taken from 15 different locations; 12 dishes are placed on the floor, and 3 of them on the operating table. Particle counting is performed according to ISO 14644-1: 1999(E) Standard by using 3 1 0 Model LASAIR II Aerosol Particle Counter, for the particle sizes: 0,3 urn, 0,5 um, 0,7 um, 1 urn, 5 jam, and 10 um, at 5 different locations and at each location 3 air samples are taken. All measurements are performed at 20 °C with 45 % relative humidity. Collected data are statistically analyzed: the results of the Sedimentation Method are tested with the Wilcoxon Signed Rank Test. For coccus, 8 of 15 locations showed significant decrease; where for fungi, only one of 15 locations showed significant decrease. The results of Particle Counting Method is tested by Paired Sample t test: only one of 5 locations showed significant decrease and only for the 5 jam particle size. Keywords: UV radiation, airborne particles, airborne microorganisms, Sedimentation Method, Particle Counting Method.

Thesis No.: 155 Evoked Potentials in Volatile Substance Abusers.

Name: Nilgün Kara Uzun, Year: 2001

Advisor(s): Halil Özcan Gülçür

Abstract: Organic solvents (especially toluene) affect the membrane lipids of neurons and glial cells because of their liposolubility; causing central nervous system dysfunction and neurological impairments in humans and in animals exposed to these solvents. Cognitive, cerebellar and pyramidal damage, peripheric neuropathy, optic atrophy, sensorineural hearing loss may occur. The basic objective of the present study has been to determine possible alterations of evoked potentials in young volatile substance abusers and to show whether evoked potentials might serve as an objective marker of early neurological damage. For this purpose, a volatile substance (mainly toluene) abuser group which consists of 10 individuals was compared with an age and sex matched healthy group consisting of 9 individuals using visual evoked potential (VEP), somatosensory evoked potential (SEP), brain stem auditory evoked potential (BAEP), and event related (cognitive) potential (ERP) recordings. The mean age of the toluene abuser group was 15.50 ±1.26 and the mean exposure time was 435+2.26 years. Clinical neurological abnormalities were not seen in both of the groups. All VEP, SEP, and ERP recordings were found to be statistically similar in the two groups ($p>0.05$). Nevertheless some BAEP abnormalities in the toluene abuser group were observed. It was found that the wave III and wave V latencies of the right ear were delayed ($p= 0.05$ and $p= 0.04$, respectively). These findings, which need to be supported by further tests, suggest that (i) the neurotoxicity of toluene begins first in the brain stem and that (ii) evoked potential recordings could indeed be used as an early marker of subclinic neurological disorders.
Keywords: Evoked potentials, volatile substance abuse, neurologic impairment.

Thesis No.: 154 Atlas Guided Neurosurgery.

Name: Ertuğrul Burteçin Aksel, Year: 2001

Advisor(s): Mehmed Özkan

Abstract: In this work, a computer interface is developed to deform atlas overlays, so as to make them fit to a certain case, namely a particular patient's anatomy for pre-operational target determination for neurosurgeries. The integration of CT images with atlas overlays is the first achievement. Secondly, the ACTR (Atlas-CT registrar) is equipped with many abilities to manipulate the overlays and CT images in all axial, sagittal and frontal views, namely, to zoom them, to span in the zoomed one, to scroll through atlas overlays and CT images, and to place the overlays on their proper locations on sagittal CT image. One of the most powerful features of ACTR is its independence to zooming factor during placing process of overlays onto sagittal CT image, which is done respect to coordinates of Anterior and posterior commissure. It is also independent of zooming factor during the selection of analog points from a zoomed CT image and an atlas overlay. Deformation is done by analog points with no necessity of the measurement of the dimensions of the region of interest on CT console or film or of modeling of the cortical surface of the patient like in earlier versions of such tools, and the utilization of a 2-D deformation fed by the coordinates of analog points. In terms of time, the system is able to calculate the coordinates of region of interest within a quarter of an hour with a great range of selection for region of interest. Keywords: Computerised Tomography, Atlas Overlays, Image Deformation, 2-D deformations

Thesis No.: 153 Analysis of Tongue Motion Using Tagged Cine-MRI.

Name: Devrim Ünay, Year: 2001

Advisor(s): Yekta Ülgen/Cengizhan Öztürk

Abstract: The motivation of this study is to observe the motion characteristics of the tongue muscles during speech. Real-time Cine MRI (16 frames/s) with tagging has been used for imaging during the utterance of four short syllables, "sha", "gha", "ta" and "ba." Four-dimensional parametric motion field analysis has been used which allows point tracking everywhere on the tongue. Both surface and internal points of the tongue were used to achieve the analysis of tongue motion during the utterance of four syllables with a B- spline parametric motion field technique. In this study, two-dimensional displacement analysis of the surface points and three-dimensional compression/expansion analysis of the tongue was presented. It was shown that the surface points do not provide enough information for the reconstruction of the model of the tongue, whereas the internal points enable us to reconstruct the model and achieve an extension analysis for the tongue motion. Patterns of expansion and compression have been compared for different syllables and various repetitions of each syllable. The long-term objective of this research is to provide important information about the motion of the internal tongue muscles and shed light on the intricate relationship between these muscles and the final shape of the tongue during regular and abnormal speech patterns. Keywords: tongue motion, speech analysis, 4D B-splines, tagged MRI

Thesis No.: 152 Determining the Optimum Reference Points for Selecting the Most Suitable Standard Impression Trays.

Name: Esim Yergin, Year: 2001

Advisor(s): Cengizhan Öztürk

Abstract: A tray selected for the dental patient must adapt to the curvature of the teeth and allow the impression material to be in appropriate thickness everywhere. Generally, the impression trays are selected by the practitioner via testing them in the mouth. The present study was conducted to develop an automated technique for the selection of an appropriate tray for the patient and to offer a new design for the cast population used in the thesis. The developed automated technique was used for the alignment of six brands of upper and lower perforated metal trays of different sizes with 170 lower and 170 upper arch cast models collected from patients having Angle Class I type occlusion with minor malocclusions. The cast models and trays were scanned into a computer and critical points of casts and skeletons of the tray bases were collected. After alignment of casts and trays using a distance based alignment routine, the trays, which most adopted the curvature of the casts, were evaluated using the residual distance of alignment. The software used includes public domain data-fitting alignment software and an in-house Matlab program for the great number of objects being tested. The alignment was repeated for selected subsets of the points and the minimum point set that is necessary for identification of the correct tray was identified. By using least-squares matching algorithm of rigid body transformation the lower and upper arch casts were aligned separately and a new tray base design for both arches was developed. This method can be used in setting a routine, eliminating trial and error or, to design better trays to fit the needs of a given population. Keywords: Prosthodontics, Image Processing, Distance Based Alignment, Dental Casts, Dental Trays

Thesis No.: 151 Modification of Neuronal Inputs to Premotor Cells of the Superior Colliculus by Intracollicular Circuitry.

Name: Berna Aslan, Year: 2001

Advisor(s): Yusuf. P Tan

Abstract: Brief electrical stimulation of the superficial layer of the superior colliculus evokes prolonged bursts of excitatory postsynaptic currents in premotor cells of the subjacent intermediate layer. In this study, we demonstrated that there is intrinsic circuitry linking the superficial and intermediate gray layers of the superior colliculus. This result is consistent with previous studies. Intracollicular synaptic circuitry is very important to determine the motor output of the superior colliculus. In this project we used two powerful techniques to investigate the intracollicular circuitry: Brain slice technique and patch-clamp technique. It is well known that the superior colliculus receives dense acetylcholinergic fibers, which innervate the intermediate gray layer; these originate from the pedinculopontine and lateral dorsal tegmental nuclei. These observations may suggest that the acetyl cholinergic input to intermediate gray layer modulates the execution of visually triggered behavior. Despite the abundance of the anatomic data, the functional implication of the acetyl cholinergic input to the superior colliculus has not been understood. In this present study, we also investigated the effects of carbachol on the synaptic transmission between superficial and intermediate gray layer. With one exception, carbachol application caused an increase in amplitudes of the synaptic currents. This effect potentiated between -80 and -85 mV of holding potentials. Keywords: Oculomotor system, sensory motor integration, superior colliculus, cholinergic system

Thesis No.: 150 A Multi-Channel Biotelemetry System for the Acquisition and Processing of Respiratory Sounds.

Name: Rıfat Koray Çiftçi, Year: 2001

Advisor(s): Yasemin Kahya

Abstract: Respiratory disorders can be diagnosed by analyzing respiratory sounds produced during breathing. Main tool for physicians to analyze respiratory sounds is stethoscope. Developing a system capable of acquiring and displaying respiratory sounds and performing real-time analysis and classification is a challenging goal for researchers. This study presents a preliminary approach for the telemetry of respiratory sounds. Increasing the reliability and efficiency of the acquisition process of respiratory sounds is aimed. For this purpose, a system with two separate telemetry transmitters placed on the body of the patient and a remote receiver connected to a PC is developed. A radio frequency link is established between the transmitters and the receiver using frequency modulation. Communication between the PC and receiver is supplied via serial port. To control data acquisition process, a user interface is developed. The receiver can be tuned to any of the transmitters with the help of this interface, which provides the user with the choices of listening, recording and displaying data. A microcontroller is responsible for tuning the receiver according to the commands issued by the computer. The respiratory sounds are filtered by high pass and low pass filters having cut-off frequencies at 80 Hz and 2000 Hz, respectively. A sampling frequency of 5 kHz is selected. Data is digitized by an 8-bit analog-to-digital converter. Performance of the system is tested by measuring its response to some pre-defined signals and by recording respiratory sounds from human subjects. Promising results are obtained revealing the feasibility of telemetering respiratory sounds. Keywords: Respiratory sounds, telemetry, frequency modulation

Thesis No.: 149 Treatment of Standardized Femoral Osteotomies Using Extracorporeal Shockwave Therapy (ESWT).

Name: Feride Şermin Bilgen, Year: 2001

Advisor(s): Ahmet Ademoğlu/Aykut Sümer

Abstract: ESWT is used in treatment of pseudoarthrosis and may also be considered for distraction osteogenesis (callus lengthening) operations. In this study, effects of ESWT on the callus were studied. On 20 male, ten-week-old white Wistar rats transverse femoral osteotomies were performed at mid-diaphysis, and internally fixated with Kirschner wires. At the end of the third week, animals, randomly divided into two groups, underwent ESWT with 1500 (Group I) and 500 (Group II) shockwaves/treatment at a generating voltage of 10 kV on their right femurs; left femurs were used as controls. At the end of the ninth week, animals were sacrificed. Both femurs were examined using X-Ray, computerized tomography (CT), Dual Energy X-Ray Absorptiometry (DEXA), and histological methods. X-Ray data showed that Group I femurs displayed a higher percentage of nonunions and secondary axial displacements than Group II. Group II had a higher percentage of unions and fewer secondary axial displacements than Group I. CT data showed that ESW treated right legs in both groups had a greater callus area, and lower average density of image pixel than controls. In the DEXA analysis of Group II, although there was no significant difference in neither the bone mineral content (BMC) nor the bone mineral density (BMD) between the treated and untreated bones; the treated femurs had a slightly lower mineral content and mineral density than the untreated femurs. The histological score of Group II was considerably higher than that of Group I. In agreement with other studies done on bone healing, the exuberant amount of callus observed after ESWT did not correlate with the level of bone healing.

Keywords - Bone, femur, callus, X-Ray, CT, DEXA, histology, rat.

Thesis No.: 148 An Information System for Quality Monitoring and Improvement in Obstetrics- A Six Sigma Approach.

Name: Ufuk Şentürk, Year: 2001

Advisor(s): Albert Güveniş

Abstract: The broad objective of this thesis is to apply the continuous quality improvement and critical pathways techniques to the area of obstetrics in health care. Various studies and indicators show that obstetrics is one of the main areas that need to be addressed urgently in Turkey. Birth defects are quite high compared to known best standards (According to Country Report 1997, infant mortality rate in 1996 is 42.2 %o). Various reasons are known to produce high birth defects and other birth defects such as patient characteristics, lack of proper medical resources, poor education and lack of standard protocoles. In order to find the optimal patient care and improvements, one must have exact data on variances, that is anything deviating from the standard. These variances can be patient variances such as socio-economic status, pre eclampsia, age, weight, or process variances such as smoking, alcohol, neglected medical tests. Unfortunately, very little is known about these variances and the measurement, improvement and test cycle cannot be carried out. Furthermore, no standard software system is available to allow continuous improvement. In order to address these problems, first the pregnancy process and then the relevant variances have been investigated. Both literature survey and interviews with doctors have been carried out. Then a continuous improvement system and software have been developed. The system is designed to monitor the quality level, pinpoint the highest variances and how they affect the outcomes such as birth weight and abortion rates. It also serves as a patient record system for the obstetrician. Pregnancy Software was developed for clinical use in Obstetrics, as a database for pregnants and births.It is a tool for improving health care quality using Continuous Quality Improvement technique. It was written in Borland DelphiT Version 4.0 and runs under the Microsoft Windows 95T or higher verisions on IBMT PC and IBMT PC compatible machines. Keywords : Quality, Continuous Quality Improvement, Six Sigma, Obstetrics

Thesis No.: 147 EM Effects of Different mobile Handsets on Rats' Brains.

Name: Çiğdem Günsür, Year: 2001

Advisor(s): Selim Şeker

Abstract: Wireless cellular telephony and other mobile personal communication services are the fastest growing field in the telecommunication world. But there is an uncertainty about the health effects of RF that mobile phones emit on human beings. In this thesis, we studied the near field electromagnetic radiation of different kinds of mobile telephones, EM effects on blood brain barrier (BBB) and the temperature effect in rats' brain due to electromagnetic radiation of the mobile telephones. We also simulate EM field of mobile phone with helix antenna and compare them with the actual measurement results. The near electric field measurements of mobile phone antennas are carry out at laboratories of Sakarya University and "KEMA-ESİM". In vivo experiments were conducted in Î.Ü. Cerrahpaşa Medicine Faculty, Biophysics Department, and Î.Ü. Çapa Medicine Faculty, Biophysics Department. The several electric field levels at 900MHz and mobile phones were used to expose rats, which they are divided as control group and test group. At the end of each experiment the BBB functions of animals and temperatures increasing in the rats' brain were investigated. The specific absorption rate (SAR) of rats' brain was calculated from these temperature values and compared with standards and literature. The good agreement was obtained. Keywords: Biological effects of electromagnetic radiation, mobile telephones, rat, SAR, blood brain barrier

Thesis No.: 146 An Automation Software for Anesthesia Information Management.

Name: Sedat Yoğurtçuoğlu, Year: 2001

Advisor(s): Ahmet Ademoğlu

Abstract: In this study, a software is developed to store and analyze large amount of data managed in the departments of anesthesiology and reanimation, at the hospitals in cooperation with the Anesthesiology and Reanimation Department at Marmara University, Medical School. Anesthesiology and reanimation departments are responsible for polyclinic, operating room and intensive care units. The software is designed based on client/server architecture to run on local area networks and allow to be used from different locations inside the anesthesiology department. The application supports multi user environment, and saves the data on a central PC. The software, resulted in a faster and easier way to manage patient information. The software is now installed on a single Server in Marmara University Medical Faculty, Department of Anesthesiology and Reanimation. A one-day training is held for all the doctors that will use the program. The previous information that is kept in the archive is being entered to the program. The data entry is being performed by all the doctors in the department, so that they get used to the program. In the meantime, the program is tested and the test results are studied and maintenance is being done. ATMS is demonstrated to be a tool for increasing the efficieny of monitoring and analysis of applied anesthesiology methods.
Keywords: Anesthesiology, reanimation, software, network, database

Thesis No.: 145 Specific Absorption Rate Assessment in a Human Head Model Exposed to Radiation from Cellular Phone.

Name: Binay Özsoy Demirbilek, Year: 2001

Advisor(s): Selim Şeker

Abstract: The increasing use of electromagnetic (EM) devices has caused growing concern about possible health hazards produced by EM radiation. So it is imperative to be able to quantify both the absorption of electromagnetic energy in the human body and the resulting thermal effect. In this study, the specific absorption rate of radiofrequency radiation (900 MHz) from cellular phones on the human head was investigated. A comprehensive review of the available data on EM radiation safety standards and electrical properties of human tissues was added. The electrical properties of the tissues are generally frequency dependent. Thermal properties are, in contrast, fixed and can simply be adapted from research literature on hyperthermia. As it is not possible to perform the experiments on human in vivo, we simulated the human head and the antenna radiated in 900 MHz. Two geometrical models for the head can be considered, namely the spherical model and the realistic head model. In this study the spherical model with a single layer and three layers was simulated by using the Agilent High Frequency Structure Simulator, which employs the finite element method (FEM), and the EM power absorption rate of tissue was calculated by a C++ program. The results were compared with the results of the studies in the literature performed by using Finite Difference Time Domain Method and Moment Method and Green's Function and great agreement was obtained. Keywords: Specific Absorption Rate (SAR), Electromagnetic radiation, Finite Element Method (FEM)

Thesis No.: 144 Computer Information System in the Clinical Laboratory.

Name: Nesibe Ebru Evran, Year: 2001

Advisor(s): Halil Özcan Gülçür

Abstract: At some point of our lives, we all have been in a position to go to a hospital to be diagnosed by a doctor. Most commonly, the doctor, for a more solid diagnosis, requests from the patient several examinations to be conducted. Considering that the laboratories of state hospitals and university hospitals in our major cities handle 1000 - 1500 distinct samples daily, it is easy to understand how serious can be the consequences of a small error or a delay in the obtainment of the laboratory results. In this thesis, a Laboratory Information System (LIS) has been designed which will help reduce such errors to a minimum, improve accuracy and speed of the laboratory results obtainment process, store patient related information and facilitate access to the historical laboratory results of the patients. It has been written in Microsoft Visual BasicT, version 6.0 and runs under Microsoft Windows 95T - 98T - MET operating systems and IBMT PC and IBMT PC Compatible machines. The present LIS, which has been specially developed for the Turkish hospitals, is a user-friendly system. The system can easily be used by even users who know little about computers, it can be customized for any laboratory, can remove repeated tests, facilitate flexibility for the integration of new parameters and provide complete data privacy and security. At present, the database of the developed system includes data tailored for biochemical laboratories. However, the system is flexible and this database can easily be updated and extended. It can entitle users and seperates the operations of each individual. Keywords: Laboratory information system, Visual Basic, laboratory, test, data.

Thesis No.: 143 Hippocampal MR Image Optimization for Early Detection of Intractable Epilepsy.

Name: Hazan , Havlucu, Year: 2001

Advisor(s): Halil Özcan Gülçür

Abstract: Epilepsy is a brain disorder in which clusters of nerve cells or neurons in the brain sometimes signal abnormally. Most of the people with epilepsy can live normal lives, as long as they take anticonvulsant medication. However, 20-30% of patients with epilepsy will continue to have recurrent seizures despite maximally tolerated trials, with single or multiple anti epileptic drugs (AEDs). This group of unfortunate patients constitute medically intractable or refractory epilepsy. For victims of intractable epilepsy it is vital to detect this condition and the location of the lesion causing it as early as possible. Since the hippocampus has long been known to be extremely sensitive to seizure induced neuronal damage, it is the most likely place to investigate. In fact, hippocampal volume loss has been shown to be linked to the development of intractable epilepsy in adults who have had prolonged seizures. Therefore, it has been hypothesized that the "hippocampal volume of children with prolonged (> 30 minutes) febrile seizures will atrophy over time and these changes can be quantified using MRI". MRI has been considered for this application because being a sophisticated technique for non-invasively imaging anatomical structures, it can often be very useful in visual estimation of the progression of neuropathology. Sequential MR images are expected to provide reliable and accurate means to estimate quantitatively hippocampal volumes. In the present thesis the reliability of the commercially available multi- (four dual- and one triple) echo MR sequences have been compared by generating T2 maps. Twenty healthy voluenteers without any history of seizure or known neuropathology were included in the study. Oblique coronal images perpendicular to the head of the hippocampus were obtained using a 1,5T (25mT/m) scanner Four dual echo sequences were performed with identical matrix and field of view: Spin echo (SE), turbo spin echo (TSE), turbo gradient spin echo (TGSE), turbo inversion recovery with TI = 2000 (TIR). In addition a triple echo (TSE3) sequence was also performed. T2 relaxation of the same circular area of the hippocampal head were measured on computer generated T2 maps by copying function bilaterally. Mean value with stadndard deviation (SD) and cofficient of variation (cov) of each sequence were compared. The highest T2 measurements were obtained with the TIR sequence (mean: 147.7) and the lowest were obtained with the SE sequence (mean:76.5). SE sequence also produced the smallest SD, narrowest range of T2 values and coefficent of variation accordingly (SD = 2.7, range = 71.4-83.0, cov = 3.5). The TSE3 sequence provided a smaller cofficient of variation (cov = 4.3) than the other sequences except the SE. The mean standard deviations of the T2 values within the region of interest (ROI) was also smallest for the SE sequence (mean SD = 3.4). The mean difference between the T2 values of each side was smallest for the TGSE sequence (-0.3) and greatest for the TIR sequence (-2.2). The smallest range was obtained with the SE sequence (2.7, -5.7). Keywords: MRI, epilepsy, hippocampus

Thesis No.: 142 Feature Extraction from Mamographic Mass Shapes and Development of a Mammogram Database.

Name: Gökhan Ertaş, Year: 2001

Advisor(s): Halil Özcan Gülçür

Abstract: Breast cancer is one of the most common malignancies in women and a rare malignancy in men. It has been widely reported that breast cancer has become the second leading cause of cancer death among women. Over a lifetime, one in nine women risk contracting breast cancer. However, women who are diagnosed at an early stage can survive this often deadly disease. Mammography provides the best screening modality for detecting early breast cancer, even before a lesion is palpable. Because of the malignant mass pathology, the shape of the mammographic mass can be used to discriminate between malignant and benign masses. In this study geometric parameters such as area, perimeter, circularity, normalized circularity, radial distance mean and standard deviation, area ratio, orientation, eccentricity, moment invariants and Fourier descriptors up to ten, are calculated. The process starts with a segmentation phase, in which an expert radiologist segments the mammographic mass shapes within the mammographic database set. These pre-segmented mammographic mass shapes are then processed by a mass boundary detection algorithm to obtain descriptive geometric parameters. A carefully designed classification scheme is used in the final step to classify masses as benign or malign. The results show that normalized circulatory area and the Fourier descriptors can be used successfully for feature extraction. The software developed utilizes this finding in the automatic classification of the suspicious masses. A mammogram database designed to store the images of the masses, calculated shape descriptor parameters and some additional data, such as patient history, category of the mass and biopsy report, if performed, which are required in BI-RADS is also introduced. The developed database is designed to be an Open Database Connectivity compliant relational database to support some future uses, such as screening the growth of suspicious masses, telemedical service support for sharing mass information and for facilitating statistical data analysis. A touch on memory system has been used as a tool to permit secure access to the electronic patient record in the mammogram database. The software is written in Delphi and runs on machines equipped with MS Windows. Keywords: Breast Cancer, Mammography, Bayesian Classifier, ROC Analysis, Relational Database Management System, Touch on Memory, BI-RADS

Thesis No.: 141 Data Management System for the Pathology Department.

Name: Abdullatif Ersoy, Year: 2001

Advisor(s): Halil Özcan Gülçür

Abstract: PATHOS is a data management system, specifically developed for the pathology department to organize workflow, to improve data security and data accuracy, to facilitate pathological data management and report management. It saves digitized images of pathological specimens in JPEG format in its database for later referral purposes. The use of SQL and a relational database structure in its design makes it a useful and functional tool for academic research and for statistical analysis. PATHOS has been developed using MS Visual Basic 6.0. It employs MS Access database tables, integrated into Visual Basic 6.0. Its open relational database design allows importation of other database structures into its base without problems. It has a user- friendly, windows-based graphical interface, and can easily be used by anyone without much prior experience in computers. PATHOS has been developed to meet the demands of the Turkish hospitals and has been developed in Turkish. The developed software has five main menu items including Patient Entry & Modification Menu, search engine, system operations, daily operations and exit. Each of the menu items plays a different role in personalization of the program for specific users. PATHOS has ability to be modified for each hospital or user without changing of the program codes. Keywords: Data management system, pathology, automation, Visual Basic, SNOMED, telepathology, pathological history recording, archiving

Thesis No.: 140 Pacs Infrastructure feasibility analysis in a 2500 Bed Hospital.

Name: Güneş Yavuz, Year: 2000

Advisor(s): Ahmet Ademoğlu/Tamer Demiralp

Abstract: Günümüzde, radyolojik çalışmalar için, digital görüntüleme tekniklerinin kullanımı yönünde büyük bir gelişme kaydedildi. Bu gelişme, Digital Anjiografi ve Bilgisayarlı Tomografi sistemlerinin tanıtımı ile başladı ve hala konvensiyonel filmlerle işlenmesine rağmen, büyük miktarlarda, digital verinin elde edildiği bugünlere geldi. Bugünkü teknoloji, daha az film veya filmsiz çalışabilme yetisine sahip. Bu da imajların görüntülenmesinin monitörlerde, arşivlenmesinin elektronik arşiv sistemlerinde yapılabilmesi ve dağıtımının da network bağlantılarıyla uç kullanıcı terminallerine ulaştırılması anlamına gelir. Bu tanım, genel anlamda Resim Arşivleme ve İletişim Sistemleri (PACS) olarak adlandırılır. PACS sistemleri görüntü otomasyon kontrolünü Radyoloji bölümü içinde sağlarken, Radyoloji Bilgi Sistemleri (RIS), Radyoloji bölümü içindeki diğer bütün çalışma verilerinin akışının otomasyonunda kullanılır. Bu çalışmanın temel amacı, istanbul Üniversitesi Tıp Fakültesi için uygun bir PACS fizibilite analizi gerçekleştirmekti. Bu çalışma, Radyoloji bölümünün olası PACS istekleri için bir altyapı bilgisi sağlamasının yanında, hastanenin gereksinimlerine uygun olarak hazırlanmış bir çözümü de içerir. Anahtar Kelimeler. PACS, RIS, fizibilite analizi, Radyoloji Bölümü

Thesis No.: 139 Differential Diagnosis of Neuropathy and Myopathy using Surface EMG and Spectral Techniques.

Name: Asım Samlı, Year: 2000

Advisor(s): Ahmet Ademoğlu

Abstract: Electromyography (EMG) has long been in the service of clinicians for diagnosis of neuromuscular diseases. Needle EMG is the most widely used option, as it is the only quantitative EMG available currently. In needle EMG, it is difficult to attain the needed patient cooperation, due to the discomfort, pain and fear accompanying insertion of needle electrodes; especially with younger children. In this respect, surface EMG has numerous advantages, from being practical to being more hygienic. The aim in this study has been to develop quantitative methods for surface EMG to be used in neuromuscular diagnosis. Spectral analysis and AR modeling tools have been applied to EMG data to obtain quantitative parameters in building a comparative database. Two different groups; infants (age 0 to 7) and adults (ages older than 20) have been studied. In the infant group 8 myopathy, 10 normal and 10 neuropathy cases and in the adult group 12 myopathy, 3 normal and 11 neuropathy cases were examined. Spectral analysis methods gave good results in infants, but poor results in adults. This was partly due to the small sample space. AR parameter comparisons gave differentiating values in infants. To overcome the analytical handicaps resulting from the use of a small sample space, we proposed some statistical manipulations to synthetically increase the sample space. Results in this larger artificial space are better as expected, showing at least some of the deficiency of the analysis is due to the small sample space. Validation of our synthetic model is open to discussion. Although the results of the normal analysis gives promising diagnostic clues, they are not satisfactory for clinical use at this level. Keywords: Surface EMG, neuropathy, myopathy, spectral analysis, AR modeling w, YtasiDDû?uniM mmm&

Thesis No.: 138 An Automated Real Time Physiological Viscometer.

Name: Ahmet Usta, Year: 2000

Advisor(s): Mehmed Özkan

Abstract: Viscosity as hemorheological criteria has become far more important after the clinicians started to blame it for some pathological conditions. There is a bunch of study showing that the blood viscosity is apparently relevant with erythrocyte aggregation, endothelial damage, intimal thickening, coronary artery disease (angina pectoris), and diabetic ischemia. Besides, there is suspicion of strong association with sudden deafness, sudden vertigo, ischemic retinopaty, aseptic bone necrosis and many other diseases of ischemia. ?Creating a handy and reliable viscosimeter will be very helpful for both researchers and clinicians that try to investigate the relation between elevated blood viscosity and some disorders. Blood viscosity information is also valuable in monitoring the patient's body reaction to medical treatment. An Automated Real Time Viscometer with the microcapillary tubes was developed using reusable dome transducers, high gain, low noise, low frequency DC preamplifiers, an AD/DA converter card and a PC with appropriate software that can measure flow rate with small scale precision and compute the viscosity values at high speed. The automated real time physiological viscometer is currently assembled in a laboratory room in the Department of Anatomy, Istanbul Medical Faculty - University of Istanbul, with the name of Viscosity Laboratory. It serves as a routine laboratory. Preliminary results obtained indicate that the system can be used for creating reference values and monitoring any kind of diseases with a blood viscosity problem. Keywords: Hemorhelogy, Blood Viscosity, Capillary Viscometer

Thesis No.: 137 Design and Development of Portable Tinnitus Masker.

Name: Nuri Açıkgöz, Year: 2000

Advisor(s): Halil Özcan Gülçür

Abstract: Tinnitus (ear ringing) is the perception of annoying and almost never-ending sounds, like wind, water flow, hissing, wheezing, roaring, whistling, bell sounds or more complex time-varying sounds in the absence of an external sound source. It is one of the most common complaints in the practice of otolaryngology. Even though tinnitus is a symptom like pain, temperature, headache, dizziness etc., distress with tinnitus is subjective and difficult to appreciate. In many cases the mechanism(s) causing tinnitus are unknown; however, frequently some form of hearing loss accompanies tinnitus. There is no known cure for tinnitus, except for a few cases of disease symptoms or pathological conditions that can be medically corrected. However, there are a number of symptomatic treatment methods for patient relief, including drug therapy, biofeedback, electrical stimulation, acupuncture, hypnotherapy, and acoustic masking. Among these acoustic masking stands out as the mostly used non-invasive symptomatic treatment method. It is based on the introduction of sound from external sources to assist in covering the tinnitus, providing distraction or offering psychological space for the individual to assist in breaking the focus or preoccupation with the tinnitus. In a previous study conducted in our institute, Çelikyurt and Gülçür have developed a system using a PC with a sound board, for tinnitus evaluation, and patient-specific masking sound generation and have compared the effectiveness and acceptability of masking of tinnitus using white noise, specially generated patient-specific narrow-band masking sound (PSNBMS) and placebo on a large group of patients with severe tinnitus. They have demonstrated that the individually tailored narrow-band masking sound was very effective for the relief of severe tinnitus. In the aforementioned work, tinnitus patients used audio cassette players with cassettes recorded with the PSNBMS. The present thesis study is an extension of this work. In this thesis, a programmable, wearable tinnitus device and its programmer, have been developed to replace the cassette system. Weight, size, large power consumption, presence of many confusing control buttons and relatively long duration of tape preparation are the main disadvantages of the cassette system. The newly developed masking device eliminates these handicaps; it is a robust, lightweight and durable, single- chip device and is no larger than a matchbox and consumes very little power. The programming device consists of a PC and a specially designed interface unit. Using this interface a PSNBMS can be loaded to a masking device within an impressive 16 seconds. Keywords: Tinnitus, acoustic masking, tinnitus masker

Thesis No.: 136 In Situ Calibration of Earphone Input Signals Using Inverse Filtering and Implementation of a Feedback System.

Name: Tuna Aydın, Year: 2000

Advisor(s): Yekta Ülgen

Abstract: Diagnostic measurements in audiology often use the presentation of some sort of a stimulus to the ear. Most techniques utilize insert earphones for this purpose. The studies have shown that the stimulus that is formed in the ear canal is different than the originally generated signal, due to the modifications made by the acoustic structure of the ear canal itself. The aim of this study is to construct an in situ calibration algorithm that alters the stimulus generated in order to achieve a desired signal inside the ear canal. Such a calibration shall create a standardized stimulus inside every ear canal, and thus reduce the intersubject variability of measurements such as click evoked otoacoustic emissions and auditory brainstem responses. This reduction is especially important in creating a data set for determining the normal and abnormal features of any data, for pathological discrimination. The calibration routine makes use of an inverse filtering approach, and treats the modification between the original signal and the signal in the ear canal as a transfer function. By obtaining the transfer function of such a system, the function could be inversed to obtain a new function which will eliminate the effects of the first one when the signal is inside the ear canal. This study describes how such a calibration routine can be implemented, and compares the data from different subjects. It also illustrates the effects of the calibration on the diagnostic measurements. Keywords: Calibration, inverse filtering, audiology

Thesis No.: 135 Design of an Intraoral Artificial Larynx System for the Total Laryngectomees.

Name: İmran Göker, Year: 2000

Advisor(s): Mehmed Özkan

Abstract: The cancer of larynx is treated with a surgical method called total laryngectomy whether it is diagnosed in the later stage of the disease. In this procedure, the larynx and the vocal cords are removed. Consequently, these patients are loosing their voice and their ability of speech production. The aim of this study is to establish an intraoral artificial larynx system that will produce vibrations at the fundamental frequency of the vocal cords and which will be worn easily as a dental prosthesis to provide a speech rehabilitation method to the laryngectomees. The circuit of this system is first setup on a breadboard. A prototype of that system is manufactured using micro-components and mounted in a dental prosthesis. To establish clinical studies and to compare with electrolarynx, two other prototypes individual to each patient are manufactured and applied to two total laryngectomees. These patients are trained to perform exaggerated articulation while using the intraoral artificial larynx system. Audio records are taken while the patients are reading text materials using both electrolarynx and the system. These records are listened by twelve testers which, are requested to write what they understood on a form prepared for this purpose. According to the results gathered from the testing process, the average success percentages are calculated for both system to compare both of them. This study shows that even though the performance of that system is lower than that of electrolarynx, it may be used as a speech rehabilitation method provided that some technical improvements are accomplished. Keywords: Speech Rehabilitation, total laryngectomy, laryngeal cancer XJL YÜKSEKÖ?RETİM KDKDU

Thesis No.: 134 True T1, PD Image Computation From A set Of T1 Weighted Images.

Name: Bora Büyüksaraç, Year: 2000

Advisor(s): Mehmed Özkan

Abstract: Segmentation of tissues in magnetic resonance images is essential especially for a radiologist to be able to identify a disease, tumors, or any tissue. In any magnetic resonance image there exists many different types of tissues each with characteristic Ti and T2 decay times and proton densities. If these parameters of tissues can be calculated from the regular magnetic resonance images, the type of tissue could also be determined on any MR image independent of MR hardware characteristics. One such important hardware limitation is the varying sensitivity of an imaging coil spatially. Segmentation algorithms can not distinguish between an intensity variation caused by the imaging coil sensitivity or a variation by tissue change. Calculated TIf T2, and PD images provide consistent pixel intensity corresponding to the same tissue therefore easier to utilize in conventional segmentation algorithms. To be able to calculate true Ti and PD parameters, a slice of human head were imaged sixteen times by holding TE fixed and changing TR each time. Levenberg-Marquardt Method is applied to the data and T! and PD values were estimated. The true Ti and true PD images were produced. The maximum likelihood classification is then applied successfully to four MR images of different slices of human head and the robustness of this method in segmenting CSF, WM, and GM is illustrated. Keywords: TI, T2, PD, segmentation, Levenberg-Marquardt, maximum likelihood classification

Thesis No.: 133 An Intelligent Diagnostic System From the Clinical Narratives in Turkish.

Name: Muhammed Oğuzhan Külekci, Year: 2000

Advisor(s): Mehmed Özkan

Abstract: Expert system usage emerges in many areas as well as in medicine. Different methodologies of artificial intelligence have been employed to set up such systems. In this study an intelligent diagnostic system is build that accepts Turkish medical narrative texts as inputs and generates a decision based on keyword analysis. Natural language processing has to be implemented to make such a system work. With this purpose a new morphological analysis methodology named as KOZ is developed for agglutinative languages and a Turkish morphological analyzer is implemented with this technique. Among the different techniques of morphological analysis, KOZ is the only one that makes a group vise suffix search. A word-parsing algorithm, which is designed to use with this method, is also introduced and given name "Left-Right-Middle (LRM)" search. The overall view of the system includes finding the roots of the words in the input Turkish medical text by the morphological analyzer deployed, and matching the roots of the input with the knowledge database that keeps the keywords of the illnesses. According to the detected keywords a report is prepared explaining the results obtained. The system is tested with 69 patient records having four different classes of illnesses as respiratory, cardiological, hematological and vascular diseases. The application classifies these 69 patients' medical narratives with 94 % accuracy. The usage of the developed morphological analyzer is not restricted with this study and is discussed at the conclusion for future benefits. Keywords : Natural language processing, morphological analysis, medical keyword analysis, Turkish morphological analyzer 1C YUKSEKtXJM i iM ki' k.

Thesis No.: 132 Software Interface Development for Electrical Impedance Tomography.

Name: Berke Öncü, Year: 2000

Advisor(s): Yekta Ülgen

Abstract: Electrical Impedance Tomography (EIT) uses impedance measurements to ? determine the electrical properties of materials. This technique has a wide application i from medical diagnosis to geophysical exploration. One of the promising applications for ? this technique is in the medical imaging field, where electrical currents are injected into the. body while voltages are measured using surface electrodes. Then cross-sectional image of resistivity distribution is reconstructed using the Finite Element Method. The aim of this thesis is to develop a graphical software interface for the EIT reconstruction algorithm by collecting and arranging the codes previously written in Turbo Pascal. The software developed is designed with Borland Delphi 4.0 under Windows operating system. The reconstruction algorithm is the modified Newton-Raphson method that uses the finite element model in the solution of the forward problem. To cure the ill- conditioning of the Jacobian matrix, either of the Singular Value Decomposition or Marquardt's methods has been used. The algorithm is tested with Ankara Data Set which was prepared by Hacettepe University and Middle East Technical University EIT groups. Keywords: Electrical Impedance Tomography, Finite Element Method, modified Newton- Raphson, Singular Value Decomposition, Marquardt's Method

Thesis No.: 131 Correlation Dimension Analysis of EEG Data from Patients with Epilepsy, Schizophrenia and Alzheimer's Disease.

Name: Elif Balcı, Year: 2000

Advisor(s): Ahmet Ademoğlu

Abstract: In this study, it has been tried to find out whether correlation dimension (D2) computation may be a sufficient way of analyzing EEG records of patients with mental disorders. For this purpose, the records of one patient with epilepsy, seven patients with schizophrenia and five patients with Alzheimer's disease are analyzed, each record of epilepsy and schizophrenia including also a control record. The seizure and control records for epilepsy and schizophrenia are compared, and the records of Alzheimer's disease are ordered according to their D2 values. The analysis is repeated for several sweeps and channels of each signal, and a statistical approach is taken to discuss results. Before the analysis, surrogate data testing has been made for each record to detect nonlinearity. For the choice of optimal time delay of the signals, autocorrelation function analysis is used. The results of the surrogate data testing are not perfect, but good enough to insist on the nonlinear structure of the records. The method seems to be successful in distinguishing two different conditions, like the records taken during and after the seizure in epilepsy and schizophrenia. The statistical results are satisfactory enough to insist on the distinction between the signals except for a few cases. However, the same statistical success is not seen in the comparison of more than two groups, as in the case of five patients with Alzheimer's disease. Although the means of the D2 values are correctly ordered according to the degree of the disorder, the standard deviations are too high to say that the five patients can be distinguished statistically. The possible reasons for not being able to find more precise results are the small size of the sweeps used and the noise generated by the discrete structure of the recording system and computer.

Thesis No.: 130 General Purpose PC-Based Biopotential Data Acquisition System.

Name: Mustafa Mihmanlı, Year: 2000

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis, a hardware and software system that cover amplifying biological signals, digitizing and converting them to graphical data on the computer was developed so that it is used in physiology laboratories. The system has four channels. Because each channel is unique and each channel gain is digitally adjustable, four different biological signals are processed and monitored at the same time. Each channel has two amplification stages. While at the output of the first stage, there is an analog high pass filter with 0.2 Hz corner frequency, at the output of the second stage, there is an analog low pass filter with 2 kHz corner frequency. 50 Hz line noise is filtered by using digital filter techniques after digitizing signals. The system has calibration and impedance check features, as well. In addition, the system complies with medical safety standard, IEC 601.1. Keywords: ECG, EEG, EMG, biopotential data acquisition

Thesis No.: 129 Reading Aid For Visually Impaired (A Turkısh Text-To-Speech System Development).

Name: Barış Bozkurt, Year: 2000

Advisor(s): Mehmed Özkan

Abstract: Among various reading aids for blind, Text-To-Speech systems are the most advantageous, regarding their high information processing speed and easiness of storage and usage. The function of a Text-To-Speech (TTS) Synthesizer is automatic production of speech from a given text. The method used in this study is to synthesize speech by concatenation of speech segments extracted from a prerecorded speech corpus. A direct concatenation of speech segments fails to achieve good intelligibility. In this study, the Time Domain Pitch Synchronous OverLap Add (TD-PSOLA) algorithm is used as the concatenation algorithm, which provides smooth transitions at phoneme boundaries and reduction in mismatches due to prosodic differences by allowing prosody alteration. A speech corpus is needed for the application language to be utilized. We constructed a Turkish speech corpus by recording a script of sentences read by a speaker. The recorded speech signal is first submitted to a time domain pitch-marking algorithm to obtain pitch marks. The segmentation of phonemes in the corpus is done manually using a wave editor. During synthesis, our TTS engine extracts phoneme segments from the speech corpus in a way to achieve most intelligible synthetic speech. A search through the speech corpus within the context of the neighboring phonemes provides highly intelligible results. Then TD-PSOLA algorithm is used to alter prosody of segments for more natural concatenation. The intelligibility of synthetic speech is highly dependent on the quality and size of speech corpus. Performing subjective evaluation tests, we studied corpus size effects on the intelligibility. We conclude that the system developed in this study can successfully be used as a reading machine for blinds with the existence of a high quality speech corpus. Keywords: Text-To-Speech synthesis, time domain concatenation, reading aids, pitch marking, TD-PSOLA.

Thesis No.: 128 Design and Implementation of Microprocessor-Controlled Single Channel Functional Electrical Stimulator.

Name: Mehmet Şayan, Year: 2000

Advisor(s): Mehmed Özkan

Abstract: Functional electrical stimulation (FES) refers to a wide collection of techniques for restoring the lost functions of the paralysed limbs and organs by electrical stimulation of the excitable tissues. The aim of this study is to design a microprocessor controlled single channel functional electrical stimulator and to implement it with semiconductor circuit components. For this purpose, PIC16C84 microcontroller has been chosen as a processor tool, because microcontrollers have some superiorities upon microprocessors. These are integrated structure which includes processor, ROM, RAM and interface, and having restricted instruction number. This suggests efficiency and comfort in design and programming considerations. In hardware design, the usage of microcontroller and IC technology also provided some improvements. These are smaller circuit dimensions and low power consumption. In general, the device can be searched under two main sections. The first section which generates and controls the signals is digital one and the other which amplifies and drives them is analogue, respectively. The generated signals can be selected and parameters of them are controlled by PIC16C84. A software programme developed for the designed hardware in Assembly Language. A transformer is also used to amplify the driven signals and to handle patient isolation requirements. During the clinical applications, many different types of therapeutic signals were tested with carbonised electrodes. Although long-lasting clinical experiments couldn't be done, primary indications could be stated as positive from electrical capability and safety points of view. Keywords: FES, microcontroller, design, Assembly Language, electrode.

Thesis No.: 127 Validation of Bioelectrical Impedance to Assess Body Composition Changes at Altitude.

Name: Erdem Yavuz, Year: 2000

Advisor(s): Yekta Ülgen

Abstract: In this study, Fat Free Mass (FFM) and %fat were assessed by multi-site, multi-frequency bioelectrical impedance analysis (BIA) on 6 volunteering divers who took part in an altitude diving research program on Mountain Kaçkar (3412 m). Impedances were measured from 10 different sites which are the combinations of trunk and limbs at 5 discrete frequencies using a custom made 4-probe impedance analyser. Skinfold, circumference and hydrostatic weighing (hydrostatic weighing was performed only before exposure to altitude) measurements were used to determine the correlation with BIA results. At sea level, all measurements and corresponding equations showed a good correlation for FFM and %fat. Although correlation between skinfold and circumference did not change upon exposure to altitude, it decreased for BIA. BIA showed an increase in total body water fluid with a slightly higher increase in the extracellular fluid compared to intracellular fluid. BIA can predict fluid compartmental changes whereas skinfold and circumference measurements can monitor the local composition changes of the body parts. As a result BIA method has to be checked with changing conditions (altitude, drug use, ionic changes) and has to be combined with skinfold and circumference methods. We suggest that, an equation that combines BIA, skinfold and circumference methods, would more precisely estimate the FFM and %fat. Keywords: Bioelectrical impedance, body composition, skinfold, %fat, altitude dive

Thesis No.: 126 Laser Assisted Photorefractive Correction Surgery.

Name: Bahaa Bou Khazam, Year: 1999

Advisor(s): Mehmed Özkan/İnci Çilesiz

Abstract: By photoablating the corneal layers with 6.4 e.v.(electron volt) photon energy, the ArF (Argon Fluoride) excimer laser corrects for myopia, hyperopia and astigmatism. Central photoablations flatten the cornea thus correcting for myopia while peripheral photoablations correct for hyperopia by steepening the cornea.Hyperopia and astigmatism are corrected by the Summit SVS Apex Plus ArF excimer laser system with the help of a mask where the beam replicates the mask shape onto the cornea. LASIK is a double surgical procedure involving cutting of a corneal flap and an excimer photorefractive procedure where the beam is delivered into the stroma. Both pre and post-operative corneal topographies and Snellen charts from a study group consisting of 38 eyes have been used for the evaluation of the laser system and the operations at Dünya Göz Hastanesi. Except for some deviations,the results fall in agreement with those in European and American studies. If the criteria for the success rate are: being within ± 1 D.(diopter) of emmetropia, within 1 Snellen line loss, no induced Keratoconus and no blur, then 60.5 percent of the eyes were successful at 5.3 weeks average post surgery. Keywords: Photorefractive, LASIK, Excimer, Snellen chart, corneal topography.

Thesis No.: 125 Investigation of the Heating Effect of MRI on the Patients with Metallic Orthopaedic Implant Materials.

Name: Salih Bilgin, Year: 1999

Advisor(s): Mehmed Özkan

Abstract: It is increasingly becoming common that orthopaedic patients are having implant materials in their body. On the other hand MRI with its potential diagnostic value can not be utilised well on the patients with metal implants due to potential hazardous interaction of metal and magnetic field. Normally, if a metal is facing a magnetic field change, there is the induction of eddy currents on the metal and the induced currents are being dissipated through the resistance of the metal, producing heat. The aim of this study is to investigate the temperature rise due to metal implant and MRI interaction. For this purpose we have prepared a phantom, which comprises a metallic implant embedded in polyacrylamide gel in order to simulate the human tissue and the implant material inside. This phantom is scanned under MRI using the common protocols for the orthopaedic patients. The temperature rise has been monitored during the scanning. A theoretical model of the heat dissipation has been established. Eddy current induction on metals is due to the change of magnetic field applied on the metal planes. There are two sources of magnetic field in MRI, the gradient field and the RF field. It has been observed that there is a temperature rise due to the gradient fields and the RF system of the MRI equipment. As a result of this study we showed that using present MR technology the amount of the temperature rise observed remains within the tolerable range not to cause tissue necrosis when the implant is made of stainless steel metal.

Thesis No.: 124 Indentation Properties of Alumina Reinforced Polymethylmethacrylate (PMMA) Composites.

Name: Ayşe Aslan, Year: 1999

Advisor(s): Hikmet Üçışık/M.Alp Göksan

Abstract: In this study, alumina reinforced PMMA composites have been used as candidates for implant materials for load bearing applications. There have been two kinds of samples; with silane and without silane each containing weight percent of 5, 10, 15, 20% alumina in-polymer. Because of the roughness of the samples, surface of the samples have been polished firstly. Then surface studies and indentation hardness tests have been performed on the samples and the Vickers indentation responses of alumina reinforced PMMA composites have been studied. It is found that, the hardness of the composite is time-dependent. There is a general decrease in hardness with the increase in time, e.g., duration of the test load. This may be the result of the viscoelastic properties of the polymer. The microhardness is not dependent on the indentation load. The depth of indentation increases with the increase in the test load and time. There is generally an approximate linear relationship between the depth of indentation and the square root of the test load. This means that, alumina particles are distributed homogeneously inside the polymer matrix. Thus, use of Vickers indentation is a convenient tool for evaluating the hardness and structure of the composite.

Keywords: Polymethylmethacrylate (PMMA), alumina reinforcing, indentation.

Thesis No.: 123 A Diagnostic Expert System for Cardiological, Respiratory, Vascular and Hematological Diseases.

Name: Evren Burşuk, Year: 1999

Advisor(s): Mehmed Özkan

Abstract: An expert system has been developed as a teaching aid and as a pre- classification tool for patients with cardiological, vascular, respiratory and hematological problems. The system is capable of making reasonable diagnosis concerning related diseases and is equipped with a facility to supply the users with recommendations concerning further tests and treatment plans. The software is written using a rule based programming language, CLIPS. The knowledge base is formed from medical reference books and experts' personal experiences. This knowledge is represented by "facts" and "rules". The type of inference engine is forward chaining and it goes from facts to conclusions. Decision-making trees (or disease trees) are used to develop the inference engine. Data from a study group consisting of 75 patients have been used for the evaluation of the system. Except for some deviations for respiratory disease patients, the diagnoses of the system were found to be in agreement with those of the experts'. Keywords: Expert system, disease trees, rule based medical expert system

Thesis No.: 122 Somatotopic Organization of Kinesthetic Cells in the Globus Pallidus Interna of Parkinson's Disease Patients.

Name: Melsen Tunca, Year: 1999

Advisor(s): Hale Saybaşılı

Abstract: In this study, the characteristics of 402 kinesthetic cells included in the 2142 single cell recordings obtained from globus pallidus interna of 90 Parkinson's disease patients who had undergone pallidotomy by microelectrode recording method was analyzed statistically. Pallidal kinesthetic cells were examined to express the output of the motor rather than the somatosensory cortex. The upper limb joints were found to have a wider representation in the globus pallidus interna, relative to lower limb joints. A standardized 3 dimensional model was also proposed in order to define the somatotopic organization of kinesthetic cells methodically. An evaluation by the utilization of this model demonstrated that posterio-lateral segments of globus pallidus interna was the most probable area for the localization of upper limb joints related kinesthetic cells while lower limb joints related kinesthetic cells appeared to cluster in the anterio-lateral segments with the exception of hip which showed a uniform distribution throughout the globus pallidus interna. Tremor-related cells were observed to localize commonly in the postero-lateral segments of globus pallidus interna. The deviant electrical activity discharging neurons were observed to spread out in a larger volume in globus pallidus interna of the patients who had the syndromes of Parkinson's disease for more than 15 years compared to the patients with younger history of illness. Keywords: Parkinson's disease, pallidotomy, globus pallidus interna, kinesthetic cells, somatotopic organization.

Thesis No.: 121 Quality Improvement in Designing Diagnostic Tests.

Name: Mehmet Tolga Taner, Year: 1999

Advisor(s): Albert Güveniş

Abstract: Diagnostic tests are widely used in many areas of modern technological society, but they are of particular importance in medicine, where early and accurate diagnosis can decrease morbidity and mortality rates of disease. How the quality of diagnostic information and decisions should be measured in a meaningful way has become increasingly important and urgent in recent years as an abundance of new diagnostic tests have been introduced. Both the government and public grow ever more insistent that the medical community must justify and minimize the costs and possible risks of diagnostic tests. A number of seemingly independent indices are studied for evaluating diagnostic performance such as the ROC curves and signal-to-noise ratios. ROC curve analysis is the state-of-the-art method constructed by plotting sensitivity against specificity as the decision threshold for diagnosis is altered on the decision axis. The optimum threshold of the diagnostic system is found by Youden Index. ROC curve is also shown to be related in a direct and natural way to cost/benefit analysis of a diagnostic decision-making. This thesis has undertaken a comparison of signal-to-noise ratios developed by Taguchi in quality engineering and system performance in manufacturing industry, their parallel conceptual framework with ROC Method highlighting the potential applications of Taguchi Methods to healthcare. A hybrid method of ROC/Taguchi Method, average loss function is computed and its relevance to physicians as an efficient assessment method in maximizing loss determination is proposed and strongly encouraged. Keywords: Diagnostic performance, receiver operating characteristic (ROC) curve, Taguchi methods, signal-to-noise (S/N) ratio.

Thesis No.: 120 Electrical Stimulation of Hemiplegic Forearm.

Name: Burçin Kaynak, Year: 1999

Advisor(s): Mehmed Özkan/Yekta Ülgen

Abstract: A cerebrovascular accident (CVA) leading to a structural and physiologic change in the central nervous system causing dysfunction is called stroke. A stroke results in hemiplegia or paralysis of one side of the body, limbs, and sometimes the face and oral structures that are contralateral to the hemisphere of the brain that has the lesion. In stroke rehabilitation, therapeutic exercises and certain innovative approaches such as biofeedback and electrical stimulation have long been in clinical use. The therapeutic benefit of electric stimulation method in comparison to certain therapeutic exercise methods is a mostly controversial subject, however. On the other hand, electrical stimulation is not only used for the rehabilitation purposes but also to generate controlled motion in upper motor neuron injured cases. In this study, we aim to accomplish two jobs; 1) to compare the effects of therapeutic exercise and electrical stimulation of hemiplegic hand, 2) to investigate possible means of hand function generation for upper motor neuron injured patients. For the first part of the study, conscious, cooperable 30 hemiplegic patients were divided into four groups as Brunnstrom exercises (PT), electrotherapy (E), both approaches together (PT+E), and conventional treatment (C). The study was conducted at 70. Yıl Rehabilitation Hospital in Istanbul, Turkey, during 6 months. The patients' recovery was evaluated according to their recovery stages, grasping force, wrist, hand and thumb movements. After 3 weeks treatment, wrist stabilization levels of E group patients showed a significant change (p=O.03) when comparing to those of PT and C group patients. In conclusion this study suggests that, NMES application on hemiplegic forearm could facilitate wrist stabilization in patients at early recovery period (<6 months). For the second part of the study, a detailed research was conducted to establish the ground work for hand motion generation of patients with upper motor neuron injury. Keywords: NMES, hemiplegia, upper extremity, hand

Thesis No.: 119 Electrical Impedance Spectroscopy of Human Blood.

Name: Mana Sezdi, Year: 1998

Advisor(s): Yekta Ülgen

Abstract: In this study, the specific impedance of human blood for a hematocrit range extending from 3 1 % to 50 %, is measured over the frequency range up 100 kHz to 1 MHz. An instrumentation system is designed for performing true four probe impedance measurements on human blood samples, in the range of 100Q - IkQ, with better than 1% accuracy. The specially designed conductivity cell (2 cm x 0.65 cm x 2 cm) applies current through gold plate electrodes and measures voltage by means of stainless steel point electrodes. A blood volume of 2.6 ml is required for each measurement. Blood volumes were drawn from 9 healthy donors using sodium heparin as anticoagulant, and diluted with 0.9 % saline to obtain 3 different blood hematocrit values from each donor. Multifrequency impedance measurements are fitted to Cole-Cole diagrams using a LMS algorithm; Cole-Cole parameters pe, pi, Fc and a, that are characteristic of blood, are used to model the equivalent electrical circuit for a range of hematocrit values at room temperature. It is shown that all model parameters are linear functions of hematocrit, over the 3 1 to 50 % hematocrit range, although their ratio of change with hematocrit vary among individuals. Keywords: Red blood cell, cell complex conductivity, impedance spectroscopy, Cole- Cole plot, hematocrit.

Thesis No.: 118 A Study on Alumina Reinforced Polymethylmethacrylate (PMMA) Composites as Dental Materials.

Name: Aslı Tuğluoğlu, Year: 1998

Advisor(s): Hikmet Üçışık

Abstract: In this thesis, alumina reinforced PMMA composites were studied as dental materials with improved wear resistance and hence increased life time. The powders were pressed after blending by heating at 200C° in moulds. Two groups of samples; with silane and without silane were studied. Density measurement, surface tests, micro hardness, friction and wear, corrosion tests were performed. It is found that "PMMA - Alumina" composites have many advantages in dentistry. The results show that abrasion rate was decreased significantly in all groups with alumina. All groups with silane-treated alumina showed more or less the same wear in comparison with other groups with non-silane treated alumina. Corrosion tests performed in an aggressive environment have shown that silane caused more lost of material than that of without silane. The results indicate that in dental applications the use of silane may not be appropriate. However further tests should be performed to come to an exact conclusion. Keywords: Polymethylmethacrylate (PMMA), alumina reinforcing, dental materials, wear resistance

Thesis No.: 117 Determination of Fluid Loss During Hemodialysis by Bioelectrical Impedance Analysis.

Name: Sedat Kesmen, Year: 1998

Advisor(s): Hikmet Üçışık

Abstract: The object of this thesis was to determine the fluid loss of the dialysis patients during dialysis session by bioelectrical impedance analysis. A bioelectrical impedance analyzer with a 1mA (50 kHz) constant current source is constructed for the measurements. By using the analyzer on "four probe" (tetrapolar) measurement system, the resistance values of the patients during dialysis are collected by making use of disposable ECG electrodes. The measurements are repeated every hour for each dialysis patient. The data obtained are correlated to the measured weight changes of the 30 hemodialysis patients. To improve the weight loss estimations, the calculations are repeated for segmental method with multiple regressions, weight normalization, and classification of the patients into two groups based on their body mass index. The Fat Free Mass (FFM) and body densities of the patients are also calculated. It was finally concluded that the segmental height method is best suitable to our purposes. The experimental results support the clinical usefulness of this technique in determining body fluid loss in dialysis patients.

Keywords: Bioelectrical impedance, hemodialysis, body composition

Thesis No.: 116 A Statistical Insight into Orthopaedic Procedures Performed in Turkey During 1995.

Name: Efe Onganer, Year: 1998

Advisor(s): Hikmet Üçışık

Abstract: The advances in various areas of science and technology have shown their action on various interventions of orthopaedics and have altered them for the best at an unprecedented rate. After the 1960's advances have been established in material science, production and operative techniques to bring the use of biomaterials into the daily life of medicine. Today the use of biomaterials has reached a trade capacity of nearly 10 million US dollars. But, these new designs of biomaterials have resulted in new problems apart from their practical use. The study was designed to try to paint a picture of the use of orthopaedic biomaterials in Turkey and try to assess its share in this vast market, while pointing out the necessity in utilization of the information technology in routine medical practice. The study consisted of the distribution of surveys and their analysis to determine the properties of hip and knee orthopaedic implant materials and osteosynthesis materials used in surgeries performed at the orthopaedics clinics in Turkey in 1995. 39 (27.5 percent) out of the 142 institutions surveyed have responded. The respondent centers housed 16 747 beds (28.3 percent) with 1 094 (19.5 percent) of these belonging to orthopaedics clinics. State hospitals have shown greater interest in our survey (14 out of 39; 39 percent). 100 percent of the respondent institutions have stated that they are capable of performing a total of 2043 hip arthroplasty. Whereas 50 percent of the institutions have replied to questions considering the number of knee arthroplasty operations they were performing; a total of 535. Our study has revealed the average mean time of follow-up of patients throughout the institutions that have contributed to our study to be 6.01 years. The study has helped to reveal a constructive insight into the arthroplasty work done by orthopaedics surgeons in Turkey. Key Words: Arthroplasty, bio-material, tracking, data-base.

Thesis No.: 115 Fractal Modeling of Surface Electrompogaphy (EMG) Signals for EMG Pattern Recognition by Artificial Neural Networks.

Name: Mehmet Eylem Kırlangıç, Year: 1998

Advisor(s): Aykut Sümer/Yağmur Denizhan

Abstract: Patterns of electromyography (EMG) signals of different musculo-skeletal motions are important features that can be used for applications like, control of prostheses in medicine or control of robot arms in industry. So as to use EMG signals for such applications, the signal is to be modeled in order to obtain parameters which can be useful for pattern recognition. Fractal Modeling is a new approach in signal modeling which was not previously used for pattern recognition applications. The objective of this study is to use Fractal Modeling techniques for EMG pattern recognition and compare these results with those of Autoregressive (AR) Modeling which is a conventional method. For this purpose EMG signals of sixteen different motions of the arm and the hand, are acquired in Istanbul University Medical School Neurophysiology Laboratory from a twentyfour years old male. These signals are modeled with both AR and Fractal Modeling techniques. Fractal Modeling is tested at first for reconstruction and data compression implementations. Having seen the satisfactory results of fractal modeling in terms of reconstruction of the signals, the AR and the fractal models are studied for pattern recognition purposes via artificial neural networks. The results indicate that the contraction factor in Fractal Model can be a criteria for recognition. However, the AR Model parameters yield better results in terms of classification and recognition of motions via surface EMG analysis. Keywords: Surface electromyography (EMG), fractal modeling, autoregressive modeling, pattern recognition, artificial neural networks.

Thesis No.: 114 Heat Sensitive Magnetic Resonance Imaging For Tissue Classification.

Name: Ufuk Öztoprak, Year: 1998

Advisor(s): Mehmed Özkan/Ahmet Ademoğlu

Abstract: One of the most important factors in magnetic resonance imaging (MRI) is the tissue discrimination quality. Among other parameters of MRI, it is known that the longitudinal-relaxation time, Ti, is also tissue specific and in addition dependent on temperature. Hence, a new method for discriminating tissues based on temperature variation was proposed, and tissue characteristics under thermally changing conditions were investigated by using MRI. Phantom studies were performed within the temperature range of 30°C-50°C to determine the optimal temperature sensitivity and resolution by testing various Ti weighted MRI protocols. The three best MRI protocols were also tested within the temperature range of 30°C-40°C on in vitro tissues. In the phantom study, a Turbo Spin Echo sequence with a TR of 425 msec produced best results with 0.72°C temperature resolution and 12.7 pixel intensity/°C temperature sensitivity. In tissue studies, the same sequence produced 4.41°C temperature resolution for liver, 7.60°C temperature resolution for spleen and 4.81°C temperature resolution for kidney with 5.90 pixel intensity/°C, 5.20 pixel intensity/°C and 6.73 pixel intensity/°C temperature sensitivity respectively. The phantom and all tissues displayed linear decrease in intensity with increasing temperature. An image processing algorithm using the information obtained from this common behaviour was developed to discriminate tissues. It was concluded that tissue discrimination based on temperature change of tissues is possible by using magnetic resonance imaging and hyperthermia and the proposed technique is promising. Keywords: Ti weighted, temperature imaging, tissue discrimination, MRI, hyperthermia.

Thesis No.: 113 Nocturnal Penile Tumescence monitoring in Erectile Male.

Name: Metin Vural, Year: 1998

Advisor(s): Halil Özcan Gülçür

Abstract: An instrumentation system called Penile Tumescence Monitor (PTM) has been developed for monitoring and studying nocturnal penile tumescence, related to the sympathetica! and parasympathetical nerve activities in the REM and non-REM phases. The system is non-invasive and consists of a specially constructed resistive tumescence sensor, a PC equipped with a 12-bit A/D converter board and appropriate software. It can detect and monitor the occurrences and the tumescence of erections and gives valuable clues concerning the psychological and/or metabolic factors that can lead to sexual problems. The PTM has been designed to be both biologically and electrically well within safety limits. There is no hazard of electrical shock or chemical contamination. The performance of the PTM has been tested in a sleep laboratory in a university hospital on over 50 different subjects. Its performance has also been compared to a recent commercially available instrument. The PTM has been shown to have a good potential for being a useful tool in the diagnosis and treatment of male sexual problems and in criminal investigations related to sexual offenses. To study the importance of psycho-social effects and stress on the male sexual problems, a survey was also conducted on males over 45 years of age, accepted as a risk group and the patients of the sleep laboratory.

Thesis No.: 112 Detection of P300 Component in Single Traials by an Artifical Neural Network.

Name: Yusuf Kenan Yılmaz, Year: 1998

Advisor(s): Halil Özcan Gülçür/Tamer Demiralp

Abstract: In order to classify the P300 wave in single trials of an auditory oddball paradigm, an artificial neural network based on backpropagation error learning algorithm is implemented. After training, the neural network is expected to classify the responses into two categories according to the applied rare (target) and common (non-target) stimuli types. To prevent overfitting, which is one of the most important weaknesses of the backpropagation, early stopping and 10-fold cross-validation are applied. The total data set is divided into 10 subsets. Eight of these are used for training the net. One of the remaining subsets is used for validation and the other is used for testing. All the possible combinations (90) of training, validation and test sets are considered. The neural network, after training with the original data set without any purification, can classify 72% of the responses correctly. The averages of the responses classified incorrectly by the network are plotted. It is observed that the responses to the target stimuli, classified as non-target by the network, contain no P300, which is the most obvious component in normal responses to the target stimuli. In turn, the responses to the non-target stimuli, classified as target by the network, contain the P300 wave. A simple data purification method is suggested and applied to purify the data set before training the neural network. After purification, the neural network shows an improved performance of 96% correct classifications. The responses from each of the 19 subjects are tested with the neural network individually to see whether or not unexpected responses are observed. The results are presented in a table indicating that each subject produces some number of the unexpected responses.

Thesis No.: 111 Development of an Expert System for Nephrology.

Name: Hüseyin Nafiz Şengül, Year: 1998

Advisor(s): Halil Özcan Gülçür

Abstract: N_EXPERT is an expert system developed for general clinical use in nephrology, as an educational tool for training medical students and as a file manager for facilitating medical history taking and record keeping tasks. It has been written in Microsoft Visual BasicT, Version 4.0 and runs under the Microsoft Windows 95T environment on IBMT PC and IBM PC compatible machines. NEXPERT is designed to be a user-friendly system. It is simple to use even for the novice users who know little about computers. When the patient data is entered, a rule- based system operates to reach optimal conclusions. Patient data, probable diagnosis etc. can easily be checked and changed by the user since they are stored in the PC. N_EXPERT is also equipped with useful help screens for a number of complex symptoms. At present the database of the developed system includes 98 symptoms and 26 illnesses. However, the system is flexible and this database can easily be updated and extended. The system examines the symptom combinations presented and selects four possible diagnoses with the highest level of probability among the 26 illnesses. The symptom-diagnosis relations can be followed from the source code of the program. Although the most probable diagnoses are listed in the order of probability, the probability values are deliberately not made transparent to the user in order not to cause any oversights and to avoid the chances of misdirecting the user. Keywords: Expert system, nephrology, Visual Basic, diagnosis, symptoms, medical history recording

Thesis No.: 110 Quality of Fater Used in Water Treatment Systems for Hemodialysis.

Name: Kamal Atwat, Year: 1998

Advisor(s): Hikmet Üçışık

Abstract: Hemodialysis is a method of blood purification for patients with acute and chronic renal failure. There is perhaps nothing more crucial to the successful treatment of chronic hemodialysis patients than the dialysis fluid (dialysate) itself, which is made up mostly of treated water mixed with an aqueous concentrate. The first step in preparing dialysate is to ensure that the chemical and bacteriological quality of the available water is safe for patient use, a procedure performed by a water treatment system which is composed of a series of devices for water purification. The adverse effects of inadequately purified water are potentially serious, and have tragic, even fatal, consequences. The objectives of this thesis were to determine the levels of contaminants or elements in the dialysis water and dialysate, to compare them with the standard levels of contaminants, to judge the quality of water treated by the systems used at some hemodialysis centers, to aid in solving hemodialysis water quality problems, to judge the blood counts of dialysis patients on the dates of the experiments, to implement Urea Kinetic Modeling (UKM) to the collected data of the patients in order to determine the adequacy of hemodialysis on the dates of the experiments. Atomic absorption spectrometry was used to determine the levels of elements in samples collected from feed water, treated or product water at different stages of purification, and dialysate solutions. It was concluded that feed or municipal water contained high concentrations of some contaminants -especially aluminum, iron and copper-, a fact which caused the levels of such elements in treated water to be higher than their standard limits. The reverse osmosis systems were inefficient in removing some contaminants from water because the temperature of processed water was much lower than the optimal temperature for reverse osmosis performance. In addition, the salts used for preparation of dialysate were the main source of disturbances for the levels of ions in dialysate. The average blood counts and Urea Kinetic Modeling results for the patients indicated adequate hemodialysis quality at both hemodialysis centers.

Thesis No.: 109 A Tinitus Masking Software for Clinical Usage.

Name: Alper Gadiş, Year: 1997

Advisor(s): Halil Özcan Gülçür

Abstract: A PC based Tinnitus Masking System called TMEX is developed. The system is composed of an IBM compatible PC with a Sound Blaster compatible 16 bit sound card, a record player, a specially developed software for tinnitus masking and headphones. The system first performs an audiometry test and determines patient's hearing thresholds for 80 different preselected frequencies. These thresholds are stored and used in later steps to automatically adjust sound levels during pitch matching and during the individual tailoring of the masking noise to avoid over-stimulating patients with excessive sounds levels. The next step is the tinnitus frequency determination step in which the tinnitus frequency is determined through pitch matching. In this step pure tone sine waves are used. The third step is the mask determination step, in which white noise and various narrow band noise - whose center frequencies match to the tinnitus frequency -, are presented to the patient. After experimenting with these specially synthesized narrow band masking noise the patient selects one which seems to relieve his or her complaint best. In next step the masking noise is recorded on an audio cassette and given to the patient. The software is easy to use so that the patient can quickly adapt and perform most of the preliminary work required for the preparation of the masking sound with minimal doctor or operator guidance by the help of the menu driven topology of the software and its friendly Graphical User Interface (GUI). MS Windows is chosen as the programming platform. Visual Basic 4.00 is used as the programming language for its ability to use MS Windows resources effectively. The resources used as Windows Application Interface (API)s are mainly the ones related with sound processing procedures widely used during tests on tinnitus masking software. By the help of efficient usage of these APIs, the speed needed for handling sound data is attained. Keywords: Tinnitus, tinnitus masking, pitch matching

Thesis No.: 108 Internet Based Distributed Medical Information System.

Name: Özkan M. Serin, Year: 1997

Advisor(s): Albert Güveniş

Abstract: The broad objective was to develop an information system that will meet the requirements of the Primary Health Care System in Turkey. Coordination problems among health professionals treating the same patient can occur due to the lack of proper communication methods and technologies. Previous work has shown the effect of this problem on Health Care quality and cost; for example repeat investigations and medication errors. In this work, an overview of the Turkish primary care system is given. A gradual and low cost solution to the problem of patient information management is then proposed, which makes use of the widely available Internet services. An Internet based Distributed Medical Information System (IDMIS) developed for this purpose is described. IDMIS uses the Internet e-mail facility and a modified copy management technique for updating data, allowing subscribed physicians to collect patient records from distant nodes and have local access to these records when required. The use of this tool may be highly beneficial in improving coordination among health care professionals and reducing unnecessary repeat investigations.

Thesis No.: 107 Correlation Dimension Conputation of EEG Time Series.

Name: Ersin Taşkın, Year: 1997

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis, a software package, to be used in correlation dimension (D2) computation of human electroencephalograms (EEG), is developed. The main algorithm calculating the D2 is based on the Grassberger Procaccia (G-P) theorem. Rigorous algorithms are developed to speed up the process without a loss in accuracy. The package is developed under Windows 95 in Delphi 2.0 environment, which enables the program to be a natural part of the contemporary 32 bit environments, and provides the user with a user friendly graphical user interface. The software developed is applied to two groups of signals: 1) Signals, whose D2's are known a priori- a sinusoidal, a Henon map, and a segment of white noise. 2) EEG samples recorded (whose D2's have to be calculated from experimental measurements) under various experimental conditions, from various groups of individuals, which comprise steady state responses of flash driven subjects, alpha dominant waves, beta dominant waves, and beta dominant waves from subjects having minor epilepsy. The numerical results obtained are analyzed, and compared with those in the literature.

Thesis No.: 106 Production of Hydroxylapatite Reinforced Polymer Composites for Biomedical Applications.

Name: Aylin Şendemir, Year: 1997

Advisor(s): Sabri Altuntaş

Abstract: Bone can be thought of as a composite material, being made up of a collagen fiber matrix stiffened by hydroxylapatite crystals. Changes in the mechanical environment after prosthesis insertion may influence bone remodeling. The high modulus prosthesis may alter the functional strain environment in the bone, lead to proximal bone loss and instability. The ideal bone replacement material would have a modulus equal to that of bone, would be bioactive to produce a strong mechanical bond, and would be tougher than bone, so that in the case of trauma, the material which fractures is the bone, which would repair naturally, rather than the implant material. These requirements can be met by polymer matrix materials stiffened by bioactive ceramics such as hydroxylapatite. Hydroxylapatite is the main mineral content of the bone and show high biocompatibility and bonding characteristics. In this study, high density polyethylene, which is used for acetabular components of total hip replacements, and polypropylene, which is mainly used in sutures and soft tissue replacements are chosen as the matrix materials. Hydroxylapatite is mixed with the polymers in different amounts by a laboratory type intensive mixer. The resulting composite materials are injection molded into standard tensile and impact test specimens and their mechanical properties are examined. Experimental results showed that stiffness and hardness of the composites increase with increasing HAp content while a decrease is observed in toughness, percent elongation and impact energy. No significant change was observed in tensile strength while an increase is significant in yield strength related to HAp content. Polypropylene composites had better impact properties while polyethylene composites showed more ductile behavior under tension. Although this work does not totally solve the problem of mechanical compatibility in bone implants, it suggests that hydroxylapatite reinforced polymer composites are promising alternatives to traditional implant materials and deserve further research.

Thesis No.: 105 Electromagnetic Compatibility of Hearing Aids with Digital Mobile Phones.

Name: Ali İhsan Yürekli, Year: 1997

Advisor(s): Mehmed Özkan

Abstract: When the intensity of emissions from a radio transmitter varies.at «an audihlfuate, it causes interference on sensitive electronic equipment. Hearing aid user complaints caused by this kind of interference were increased by the introduction of digital mobile phones in recent years. Interference reveals itself as a disturbing "buzzing" sound in the hearing aid output. The electromagnetic compatibility of 16 different hearing aid types was measured for high-frequency electromagnetic fields, particularly for those emitted by digital mobile phones. An automated PC-controlled test setup was developed for testing. Setup consisted of a GTEM cell where high frequency fields were generated. Draft version of IEC 118-13 standard was utilized as a basis for the test methodology. All of the hearing aids showed susceptibility to some degree. Interference levels up to 140 dB SPL was measured in 800- 960 MHz range of the carrier frequency. Six of the hearing aids were found to produce levels above the level (55 dB SPL Input Related Interference Level) proposed by the standard. Increasing levels of the electric field strength resulted in a quadratic increase in sound pressure levels produced by the hearing aid. This 1:2 dB ratio proves to be a helpful tool in interpolating for any field strength level that was not tested. Test setup and methodology developed for this study together with the results can be used to evaluate the electromagnetic compatibility of hearing aids to high frequency electromagnetic fields.

Thesis No.: 104 Mass Angular Scattering Pofer Method Applied to the Therapeutical Electron Beams.

Name: Fatih İşbakan, Year: 1997

Advisor(s): Yekta Ülgen

Abstract: A method for determining the kinetic energies of therapeutical electron beams is described. The theoretical basis of the mass angular scattering power method is analysed. The kinetic energy of therapeutical electron beams is determined from the Gaussian spread of a pencil beam. The pencil beam is obtained from a broad electron beam by using a simple technique. The data taken with a "closed collimator" are subtracted from those measured with the "open collimator" in order to isolate the pencil beam dose distribution. The spatial spread of a pencil electron beam in air is, as predicted by the Fermi-Eyges Theory,is Gaussian whose variance is a function of the mass angular scattering power, which in turn is related to the kinetic energy. The dose distribution is measured by an ion chamber which is moved by an "empty" water phantom system. The energies obtained by the mass scattering power method in air are significantly close to measured values obtained with the range method in water. The mass angular scattering power method is driven from the inelastic collisions in air and uses a probabilistic approach while the range method uses emprical formulas.

Thesis No.: 103 Stereotactic Guidance System.

Name: Dilek Ekşi, Year: 1997

Advisor(s): Mehmet Melek

Abstract: The word stereotaxy is derived from the Greek "steros", meaning three dimensional, and "tactos", meaning ordered or arranged. Stereotactic neurosurgery consists of the introduction of instruments or direction of radiation beams into a small, well defined but invisible target in the human body with the aid of stereotactic instruments. The objectives are to explore the functional properties of target tissue, to biopsy or to alter it by physical or chemical means. Adaptation of tomographic imaging modalities such as MR (Magnetic Resonance), CT (Computer Tomography), to stereotactic techniques have enabled precise positioning of target location. Localization of target is usually accomplished with the use of a computer based surgical planning system. In Turkey, the surgical planning is performed with manual target coordinate determination. However that defeats the whole purpose as the stereotactic instrument used consequently loses its sübmilimetric sensitivity. The aim of this study is to develop a computer assisted stereotactic guidance tool for treating brain tumors more efficiently and safely. The PC based system that works with MRI is developed in this study. The system is used for preoperative surgical simulation or trajectory planning to employ the safest and least invasive route possible without causing neural damage. This system also enables the user to display all 12 bits of intensity information on the computer screen, by employing windowing and leveling techniques.

Thesis No.: 102 Construction of a Medical Database System for Hemodialysis Patients Care and Tracting and Implementation of Urea Kinetic Modeling on IBM Compatible PCS.

Name: Orhan Sancaklı, Year: 1996

Advisor(s): Hikmet Üçışık

Abstract: Today worldwide about 500.000 dialysis patients and average cost of $30,000 US of one patient per year makes dialysis therapy one of the most expensive ones among other types of medical therapies. Urea Kinetic Modeling (UKM) is increasingly recognized as the most efficient way for quantitating and monitoring hemodialysis treatments. However, despite the acknowledged advantages of the UKM, the methods of performing the procedure are complex, subject to error, and the calculations require the use of a computer program. For this reason during the last years there has been a proliferation of simplified approaches to directly calculate the Kt/V. However, this fact, instead of simplifying things, has generated great confusion due to extreme difference in the values of Kt/V obtained and has stressed the urgent need for the selection of the best method for calculating Kt/V. The objective of this thesis was to construct a medical database system for hemodialysis patients care and tracking on IBM compatible PCs. Another aim was implementing Urea Kinetic Modeling directly to the available patients data to determine adequacy of hemodialysis treatments. Additionally most popular ten UKM methods were predefined in order to support determination of most appropriate UKM approach thanks to comparative studies.

Thesis No.: 101 A Reconstruction Algorithm for Dynamic Imaging of Electrical Impedance.

Name: İpek Torun, Year: 1996

Advisor(s): Yekta Ülgen

Abstract: In electrical impedance imaging, several proposed reconstruction algorithms have employed the concept of a sensitivity matrix, which can be used to relate the magnitude of a boundary voltage change of a 2D object to the change in conductivity inside the object that has given rise to it. This thesis is concentrated about the software for dynamic imaging of Electrical Impedance Tomography. An EIT image, represents the variation of electrical resistivity over the different regions of the body, such as thorax. Direct Sensitivity coefficients matrix method is used to reconstruct the dynamic resistivity distribution of body. A circular region model, with 8 layers- 208 square elements mesh structure and 16 peripheral nodes (eletrodes) is used. To reconstruct the image, firstly, the region of interest is divided into small, discrete square-shaped elements and then Direct Sensitivity coefficients are calculated. Then a current is injected between adjacent electrode pairs and peripheral potential differences are measured. For one injection and one specific current drive position, 13 voltage measurements are obtained. These measurements form the voltage difference data matrix. The resistivity distribution is estimated by multiplying the Voltage Difference Matrix by the Direct Sensitivity Coefficients Matrix. In this study, an algorithm based on direct sensitivity coefficient matrix has been developed. The algorithm is tested using the standart Ankara data set. It has been shown to perform succesfully within the limitations imposed by the assumptions on which it based.

Thesis No.: 100 A User-Friendly Software for Generating Patient-Specific Masking Noise in Relieving the Incurable Tinnitus.

Name: Murat Fırat, Year: 1996

Advisor(s): Halil Özcan Gülçür

Abstract: Tinnitus is a widely suffered complaint concerning the human auditory system. The tinnitus-stricken patient is generally characterized with hearing loss and suffers from an almost never-ending sound in his ears. These whistle, wind, water fowl, water flow, hissing, etc.-like sounds are always subjective and thus, their detection is quite difficult. There are plenty of tinnitus treatment methods that all focus on controlling these sounds, and are incapable of curing the disease. Masking the tinnitus sound is one of the most successful non-invasive methods of coping with the tinnitus. In order for the masking method to be acceptable and successful, the masking sound should be individually tailored for the patient. This requires precise determination of the tinnitus frequencies, which is not an easy task and is time-consuming, since objective means of measurement are not available and trial-error methods must be used. Clearly there is a definite need for a system that could speed up the tedious work needed for the determination of the tinnitus frequencies and for the generation of the matching masking sound. In this thesis work, such a system, consisting of a PC equipped with a sound card and specially developed software has been proposed and its cost-effectiveness has been demonstrated. In this system, in order to detect the tinnitus frequency, the sensitivity of the ears is measured and with the help of this audiometric data, during the tinnitus detecting phase, the volume level is adjusted. The pure tone audiometric test is applied for frequencies between 125 - 8000 Hz, at six different frequencies. This measurement is performed separately for both ears. After the pure tone audiometry, the process of finding the correct frequency, the "pitch-matching" starts. This process begins with the application of pure tone at 860 Hz. With patient's guidance, the software successively approaches to the tinnitus frequency using a technique similar to the one used in the Newton-Raphson method. The frequency band of the pitch-matching applied is between 125 - 8000 Hz. When this process is completed, a narrow-band white noise with a pure tone at the pitch frequency is synthesized. The software includes a database for the personal information and the measurement data of the patients. This database file can also be edited by most popular database software.
Keywords: Incurable tinnitus, tinnitus masking, controlling tinnitus

Thesis No.: 99 A Quasi-Linear Model for Finite Deformation of Human Articular Cartilage.

Name: Ahmet Feyz Pirimoğlu, Year: 1996

Advisor(s): Hikmet Üçışık

Abstract: Articular cartilage, is a biphasic material consisting of a solid matrix phase (collagen fiber network and proteoglycan macromolecules) and a fluid phase (water). The articular cartilage having such a physiological structure, generates little friction even when subjected to high loading at very slow movements. With these properties, the articular cartilage not only prevents the wearing of the bone surfaces by the movement of the parts of the joint, but also acts as a shock absorber that protects the bones to be broken under high and sudden loads. Both for the replacement of damaged cartilage and for the production of long-life, stable total joint prostheses, the properties of the natural human articular cartilage should be analyzed and quantified well. In this study, starting with the stress relaxation experimental results, we have provided a mathematical model for the stress-strain relationship of the human femoral head articular cartilage using the Fung’s Quasi-Linear approach. This model fits well to the relaxation and loading phases of the cartilage indentation experiments, but for complex loading experiments such as repetitive loading-unloading experiments it diverges from the experimentally obtained values.

Thesis No.: 98 Tracking and failure analysis of orthopedic implants.

Name: Parivash Hamvatan, Year: 1996

Advisor(s): Hikmet Üçışık

Abstract: Orthopaedic implant materials have been used for repairing damaged portions of the body, for several centuries. Although there are many successful efforts in using these implant materials due to the recent scientific and technological improvements, we are not in a perfect position yet. The aims of this thesis was to investigate the types and frequency of orthopaedic implant materials used in turkey from 1991 to the end of 1994 and to analyze failures of some retrieved implants. The first part of the thesis contains the results of a survey according to the responses from 12 orthopaedics clinics. The type and frequency of hip and knee arthroplasty operations and their complications caused to revision were studied. In the second part of the thesis, two ostheosynthesis plates and one osteosynthesis pin, which have been removed from the patients because of different reasons, were analyzed. Macroscopical and microscopical studies have been performed using some metallurgical methods to find failure mechanism of these retrieved implants.

Thesis No.: 97 Comparative studies of ultrasonography in orthopaedics,

Name: T. Ufuk Eren, Year: 1996

Advisor(s): Hikmet Üçışık

Abstract: In this study ultrasonographic images of different musculoskeletal parts of human body have been examined to see whether they can be used for orthopaedic applications. In some of the examinations, comparisons of the ultrasonographic images with X-Ray films have also been performed. Due to the wide difference between the characteristic impedances of soft tissue and bone, it is very difficult to obtain a clear bone image; only an echogen band and behind it an acoustic shadow can be obtained with ultrasonography. As the results of the 47 examinations on the patients which have been performed in the Orthopaedics and Traumatology, and Radiology Departments of the Istanbul Medical Faculty with the help of the high frequency transducers, some results are obtained. Ultrasonography may reveal components of cartilage which may be obscure in some X-Ray films. Moreover, it can be used to study bone metastasis. Being a safe technique, ultrasonography may be used in "real-time" mode on moving joint parts like shoulder, hip, knee, wrist, ankle and elbow, to obtain valuable diagnostic information.It is shown that ultrasound may be used as an adjunct to radiography in the diagnosis of lesions of bone. The impermeability of bone tissue to ultrasound may be used to analyze the effects of bony lesions on adjacent soft tissue. This approach could make it possible to diagnose bony destruction, inflammation, and new bone formation. It is demonstrated that, in the diagnosis of these kind of pathological changed bone-related parts, ultrasound is a excellent adjunct modality to radiography.

Thesis No.: 96 Comparison of spinal instrumentation systems.

Name: Cemil Arsun Kutur, Year: 1996

Advisor(s): Hikmet Üçışık

Abstract: Spinal Instrumentation Systems are mechanical devices that are mounted to the human skeletal system for orthopaedic purposes. Of the materials of orthopaedic implants the stainless steels, especially the 316 L type have superseded the others and are utilized predominantly as implant devices. In this study a comparison of three different spinal instrumentation systems are presented. Specimens representing the rods of these systems were subjected to a metallurgical characterization. The studies involved metallographical preparations, microstructural analysis, energy dispersive spectrometer analysis and measurements of potentiostatic examinations. The results are presented in terms of a comparative evaluation. The significances of these physical and mechanical findings are investigated and discussed. Exact conclusion of comparison requires the close cooperation of multifarious experiments and systematic long term approach.

Thesis No.: 95 Spectral analysis of heart murmurs for the detection of stenotic aortic valves.

Name: Altuğ Ergin, Year: 1996

Advisor(s): Halil Özcan Gülçür

Abstract: The diagnosis and evaluation of aortic stenosis today is primarily performed by cardiac catheterization and echocardiography. Both, although accurate, are expensive and invasive techniques. However it may be possible to assess the severity of the aortic stances based on the murmur produced by the stenosis in the systolic region. A crescendo--decrescendo type of murmur has a clear diagnostic potential. Therefore the aim of this study is to determine the characteristics of murmur generated in aortic stenosis. For this purpose a special instrumentation system developed in the Biomedical Engineering Institute of Boğaziçi University is used. The system consists of a PC equipped with an A/D converter, channels for the recording of heart sounds and an environmental probe for the recording of ambient sounds. The recorded sounds are filtered using high pass and low pass filters having cut-off frequencies at 80 Hz and l000 Hz, respectively. A sampling frequency of 4 kHz was selected. 512 data points are transported to a signal processing software package, DADISP. By using a Hanning window and FFT, Welch periodograms are estimated. The systolic murmur energy ratio (MER) between 96-500 Hz (A2) and 20--500Hz (AI+A2) is calculated and correlated with the measured trans-aortic gradient. The correlation coefficient between the transvalvular pressure and the calculated MER is r=0.975. This study shows that spectral analysis of systolic murmurs have the potential of being used as an inexpensive adjunct technique for assessing the severity of aortic stenosis.

Thesis No.: 94 Implementation and Analysis of a Mammalian Ventricular Myocyte Model.

Name: S. Semahat Demir, Year: 1996

Advisor(s): Yusuf. P Tan

Abstract: A mammalian cardiac ventricular cell model is implemented and analyzed. The contributions of ionic currents to the ventricular cell action potential are discussed in their control cases and total block cases in both the time domain and phase planes. The significance of the ventricular action potential repolarization in interpreting electrocardiogram (ECG) is investigated; and the ionic basis of the clinical problems such as long QT syndrome, T wave, ischemia and creation of ectopic beats are simulated. In short, this kind of single cell study contributes to the understanding of the underlying ionic currents in the action potential and ECG waveforms, and also guides new modeling studies.

Thesis No.: 93 Design of a Vectorcardiography Monitoring and Recording System.

Name: H. Kerim Oal, Year: 1996

Advisor(s): Yekta Ülgen

Abstract: Recording the electrical activity of the heart yields to the most helpful data in the diagnosis of heart diseases. ECG is the most common way of recording the electrical data of the heart. The vectorcardiogram technique is another way of recording the electrical activity of the heart. At present time, the vectorcardiography is used only in medical centers and by specialty medical groups. Its value is limited for routine clinical practice. The vectorcardiogram discussed in the thesis enables the physiologist to monitor the three VCG projections of the spatial vectorcardiogram onto the frontal plane, the transverse plane and the sagittal plane. The data can be recorded in a file and several different recordings can be drawn on the same screen in order to compare them. The electrical safety of the vectorcardiograph is obtained by using optical isolation and isolated power supply. The vectorcardiograms recorded at the end of the study, have the typical features of the normal vectorcardiogram. Results show the changes of the cardiac vector during the loading of the heart.

Thesis No.: 92 Biocompatability of Hemodialysis Membranes.

Name: M. Emin Aksoy, Year: 1996

Advisor(s): Hikmet Üçışık

Abstract: With the development of biomaterials the term biocompatibility was required to classify these materials in regard to their biological interaction. Biocompatibility in extracorporeal blood treatments like haemodialysis is especially important, because all the pathways to bioincompatability become active, when the blood interacts with the membranes used for haemodialysis. . .The objective of this thesis was to have a better knowledge about the membranes used for haemodialysis and the blood-membrane interactions. In this study, stereomicroscopic evaluation, scanning electron microscopic (SEM) evaluation and tensile testing of the dialysis membranes have been performed. Besides these experiments, patient monitorization and blood tests consisting of the determination of blood fibrinogen levels, complement 3 levels and white blood cell count during haemodialysis using four different membranes (Polysulfone, Cuprophan, Hemophan and Cellulose- diacetate). Depending on the experiments performed, it can be concluded that polysulfone membranes were the best ones in terms of biocompatibility, while cellulose-acetate was the worst one.

Thesis No.: 91 Temperature and Electropotential Changes of the Head-Skin and the Skull of the Rabbit due to Audio Stimuli.

Name: Senih Gürses, Year: 1995

Advisor(s): Halil Özcan Gülçür

Abstract: Thermal behavior of the head-skin and skull of a rabbit under audio stimuli was studied to see whether it is possible to reconstruct a thermal image of the stimulus induced thermal activity. An index showing the differences between the random thermal fluctuations and thermal changes evoked by the audio stimulus, based on 1D ANOVA method, was defined and computed using the data taken from head-skin and skull of the rabbit. It has been shown that, there is a suitable basis for image reconstruction based on the thermal activity of the skull, whereas it is more difficult to do the same thing directly from the head-skin. Auditory potentials, evoked at certain specific sites of the animal's brain, were also checked against the thermal data, in order to see whether there is a direct correlation between the stimulus induced thermal changes and the stimulus evoked potentials.

Thesis No.: 90 A Mobile Robot with A Biologically motivated Vision System.

Name: Çağatay Soyer, Year: 1995

Advisor(s): Işıl Bozma/Yorgo İstefanopulos

Abstract: Studies on the vertebrate visual system provide us with many clues about the powerful mechanisms of natural vision. It is evident from physiological and psychological studies, that human visual system also employs selective perception, besides being massively parallel. This work develops and presents the preliminary performance results of an active vision system motivated by these findings. The mechanical hardware implemented to support visual processing is a simple mobile robot, called APES. Design specifications and the vision system of APES are described in detail, with experimental demonstrations. Successful results are obtained for real time performance on a simple recognition task.

Thesis No.: 89 Electrical Properties of Bone and Isolated Skeletal Muscle.

Name: Şule Gündüz, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: In this thesis, an instrumentation system has been devised for measuring the electrical parameters, such as the electrical conductivity and the relative permittivity, of bone and isolated skeletal muscle over the frequency range of 1 kHz to 1 MHz Bone specimens with and without bone marrow are tested using 3M-Littmann 2325VP 6,25 cm² Al-Spot ECG-Electrodes. For testing the skeletal muscle from sheeps and chickens, a cylindrical plexiglas test cell is designed for four electrode measurement technique to avoid electrode polarization errors. All measurements are performed on the HP-4284 A LCR-Meter and a special preamplifier is built for sample connection in the true four electrode mode. The collected data are used then for drawing the graph of the dielectric permittivity and the electrical conductivity as a function of frequency from 1 kHz to 1 MHz The results of these measurements show that the electrical and dielectric properties of bone and skeletal muscle are frequency dependent, as well as direction dependent.

Thesis No.: 88 Development of an Ultrasound Doppler Flowmeter for Measuring Low Blood Flow velocities.

Name: Ufuk Sovuksu, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: Ultrasound Doppler systems are widely used for flow measurement in both medicine and industry, having the advantages of being non-invasive and comparatively simple and therefore inexpensive. However, these systems have nor been applied to capillary blood flow measurement because the velocities encountered are much smaller than those for which Doppler systems have so far been used, and also because of difficulties in separating the echoes from moving blood cells from the much stronger echoes derived from the stationary tissues which surround the capillaries. In this thesis, a system which has been designed to measure low blood flow velocities is described. A 2.25 MHz continuous-wave, non-directional Doppler flow meter has been developed which is capable of measuring flow velocities below 2 cm/s. Ultrasonic transducers utilized in the system, and a flow phantom used to calibrate the flow meter have also been produced.

Thesis No.: 87 Development of a Computer Assisted Motility Monitoring System for Evaluation of Sleep Patterns of Newborns.

Name: Levent Hekimoğlu Hekimoğlu, Year: 1995

Advisor(s): Halil Özcan Gülçür

Abstract: Many scientists have hinted that the newborn period may offer uniquely favorable conditions for assessing the functional status and adaptive capacities of infants. Thus in this thesis, a test has been developed for monitoring the motility and for evaluating the sleep patterns of normal and asphyxiated newborns. The system consists of a commercially available pressure sensitive pad placed under the baby, an amplifier, an A/D converter, and an IBM compatible personal computer (PC). Signals produced by the newborns' respiration and body movements are continuously recorded using the PC for three hours at a sampling frequency of 10 Hz. The output signals are then converted from binary format to ASCII. These signals are further processed by a special software using Pascal language. An attempt has been made to detect the sleep states of infants, normal and those with asphyxia using the computerized motility monitoring system. The first 72 hours of life has been evaluated and the sleep patterns of infants been classified using the same method as Thoman et al. Although the previous studies indicated that sleep patterns may differ in hypoxic conditions, sleep states of both groups in this study did not have statistically significant difference.

Thesis No.: 86 A Hardware Design for Brain Electrical Activity Mapping.

Name: İsmail Taşkın, Year: 1995

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis a hardware was developed for Brain Electrical Activity Mapping and also for standard EEG and EP recording. The study involves design and implementation of 32 bipolar, high CMRR, low noise and low cost biopotential amplifiers for EEG and EP measurements, and an analog to digital converter system, a digital optoisolation unit, and an interface card to communicate the system to an IBM compatible PC. Digital opto-isolation is advantageous since it is immune to nonlinearity and gain instability effects with which analog isolation suffers. The system developed has electrode impedance check and calibration check utilities. Two selectable analog low pass filters and a 50 Hz notch filter has been employed in each analog channel. The CMS of the analog amplifiers was measured and found to be very high, which is very advantageous for EEG and EP recording. The system was tested as a whole by recording real EEG and EP data from a normal subject.

Thesis No.: 85 Electrogastrography and the Analysis Using the Adaptive Spectral Analysis Method.

Name: Işıl Soysal Soysal, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: This thesis focuses on the recording techniques, analysis and the clinical applicability of electrogastrography. Electrogastrography (EGG) is referred to the non-invasive technique of recording electrical activity of the stomach. In this study, a software algorithm is developed to analyze the raw EGG data. The algorithm is based on Autoregressive Moving Average Modeling. To test the performance and to ensure the reliability of the algorithm, some typical EGG abnormalities are simulated and analyzed. The analysis results show that the algorithm gives accurate results and can be used to analyze the real EGG data. The algorithm is also used to analyze the real EGG data and it is concluded that the algorithm may be a useful clinical tool for the diagnosis of patients with the gastric motility disorders. This study also includes the comparison of the two different analysis techniques. The comparison of the fast Fourier transform and Autoregressive Moving Average Modeling technique shows that the second method gives more precise information and more accurate results. This study includes a brief overview of the studies on the clinical applicability of the EGG because these studies accelerate the emergence of the EGG as a clinical tool.

Thesis No.: 84 Detection of Auditory Brainstem Responses by Adaptive Filtering

Name: Banu Baykara, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: In this thesis, EEG recordings taken by non-invasive scalp electrodes from human brain (real data) are processed by three different filtering algorithms which are developed for the detection of ABR buried in EEG data. These methods are the Adaptive Filtering (AF) algorithm and Averaging & Adaptive Filtering (AAF) algorithm. The third method is the Adaptive Line Enhancement (ALE) algorithm and has a rather different filtering structure. The algorithms are implemented on a IBM compatible PC and compared for their rate of convergence. Their performance is evaluated in terms of the Mean Residual Error (MRE), the Integrated Mean Square Error (IMSE), Distortion Index (DI) and the correlation coefficient between the filter output and the template signal. The template signal is chosen as the 1024 averaged data. It is shown that ALE converges faster than the AF and AAF algorithms. The correlation between the reference signal and the template is an important criteria for the convergence speed. AF adapts itself slowly when compared with AAF and ALE, on the other hand, it converges faster than the averaging algorithm.

Thesis No.: 83 A Study on " Alumina-Zircon Ceramics as Biomaterials.

Name: Fulya Gümüşburun, Year: 1995

Advisor(s): Hikmet Üçışık

Abstract: Implant materials are made of polymers, metals, ceramics, and composites. This type medical materials always contact with cells, tissues, organs and organ systems. Before wide applications, they should be tested in terms of toxicity, carcinogenity, antigenity, and mutagenity. In other words, they must not have any side effects on the biological systems. In this study, varying compositions of (10, 15, 20, 25, 30%ZrO2) Alumina-Zircon mixtures were prepared. They were pressed at 350 kg/cm2 in tablet form, in open air and sintered at 1680oC Microhardness tests, X-ray diffraction, chemical analysis, SEM studies and subcutaneous tissue reactions (using rats) were performed. In in-vivo testing of ceramics containing 15, 20 and 30% zircon, didn't form any foreign body reaction, for two months period of implantation. 20% zircon containing sample has the highest hardness value, about 1600 Vickers hardness number which is less than that of pure alumina. It is found that some compositions of alumina-zircon mixtures are promising in terms of candidate implant material. But more tests should be performed to come in exact conclusion.

Thesis No.: 82 Detection of Sensorineural Hearing Impairment by Classifying Latency and Amplitude Parameters of DPOAE'S

Name: Nevcihan Avarisli, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: Distortion Product Otoacoustic Emissions are evoked in the form of intermodulation products by two pure tones with specific frequency and amplitude ratios. The distortion product at 2F1-F2 is of higher amplitude and detected in almost all normally hearing ears. Both amplitudes and latencies of Distortion Product Otoacoustic Emissions (DPOAE) at 2F1-F2 are measured over the range 1-9 KHz and 1-6 KHz of F2 respectively, from 86 normally hearing and 22 hearing impaired human ears. First the normality ranges are determined from a population of 86 subjects for amplitude and latency of DPOAEs. Classifiers such as the K-means and Artificial Neural Network techniques have been tested and both have shown that the latency and the amplitude parameters must be used together to increase the rate of success in identifying the hearing impaired subjects with sensorineural hearing problems.

Thesis No.: 81 Analysis of Tracheal Sounds Acquired from Patient with Lung Cancer.

Name: Fatih Karaaslan, Year: 1995

Advisor(s): Halil Özcan Gülçür

Abstract: In this study an attempt has been made to determine the quantitative characteristics of the sounds which are caused by the presence of a tumor in the bronchial tree. For this purpose, a special instrumentation system consisting of a PC equipped with an A/D converter, a water-sealed spirometer and amplifiers for tracheal sounds, environmental sounds and a flow potentiometer have been used. Using this system the tracheal sounds of the subject, environmental noise and flow rate of the breathing of the subject were recorded simultaneously. Although vocal cords and oral cavity produce interfering sound signals, trachea was selected as the precise location to acquire the diagnostic lung sounds. This is because the malign tumors of the lung are mostly found in the large bronchi, • respiratory sounds measured at the trachea undergo very little filtering, and • characteristics of the tracheal lung sounds do not depend on subject's morphology to a great extend. The sound signals were filtered using high pass filters having cut-off frequencies at 100 Hz and 2500 Hz, respectively. A sampling frequency of 5 Hz was selected. 1024 data points were extracted from the proper inspiration and expiration phases of each subject. Using a Hanning window and DFFT, the Welch periodogram was estimated. Because patients with lung cancer and chronic obstructive pulmonary disease (COPD) are usually heavy smokers, they have similar symptoms. Therefore, COPD patients were also included to this study. Regions of diagnostic significance in the frequency spectra of subjects studies have been identified and confirmed using the statistical t-test. The area of such a region in the frequency spectra above 633.8 Hz in the inspiration phase of patients with lung cancer and COPD was determined as a distinctive feature with a possibility of less than 18% error.

Thesis No.: 80 A Flexible Hardware Implementation for Multifrequency EIT Measurements.

Name: Fırat Matur, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: In electrical impedance tomography (E.I.T.), the boundary voltages obtained from the boundary of a cross sectional area of the object in response to injected currents are used to reconstruct the internal impedance distribution for visualization. The overall performance is determined by both the hardware and software. Considering that the electrical impedance of tissues is frequency dependent, for tissue characterization, measurements must be performed at several frequencies in the range from 10 kHz. The hardware system that is constructed supply 8 different operating frequencies ranging from 10 kHz, and number of these frequencies can be upgraded up to 16 with the theoretical maximum operating frequency of 1 MHz without affecting the system performance. Any of the existing EIT data collection strategies can be selected from the computer through the control software, making the hardware system very flexible. The data collection system is tested using a Pspice simulated resistive phantom both for homogeneous and non-homogeneous distributions.

Thesis No.: 79 Multiple Frequency Bioelectrical Impedance Analysis to Assess Body Fluid Composition Changes with Altitude.

Name: Fırat Yeşilleten, Year: 1995

Advisor(s): Yekta Ülgen

Abstract: In this study, the body fluid composition changes due to exposure to high altitudes is assessed by multifrequency and multisite bioimpedance analysis. For this purpose a portable Bioimpedance Analyzer that is capable of measuring the resistance and the reactance of the tissues and body parts at five different frequencies was designed. To assess the effects of altitude, the instruments is used in performing multifrequency bioimpedance analysis on 10 subjects who participated in the third week of Kaçkar 94 Expedition. Kaçkar 94 Expedition of Boğaziçi University Skin and Scuba Club (BUSAS) lasted for three weeks on Mt. Kaçkar (3412m.). The data was, collected before, during and after the expedition and discussed to investigate the effects of altitude on body fluid composition changes. Based on the empirical formulas of previous studies, the Fat Free Mass is observed to decrease with high altitude due to the dehydration during the trip, the heavy activities causing depletion of fat reserves and by the effect of hypoxia which is a part of the acute mountain sickness. To question the overestimation in previous studies that use 50 kHz bioimpedance analysis to assess body fluid changes with altitude, a different approach based on Cole-Cole plot that was used to calculate the characteristic frequency fc, R0 and R¥. A large increase in fc value was observed regardless of the site of measurement upon initial exposure to hypoxia, followed by a gradual increase, recovering back to the original value upon coming back. In this way we can deduce that the body composition change during acute exposure to hypoxia and heavy exercise during climbing and trekking. The individual analysis of the trunk is compulsory to assess the body fluid composition change. But due to the anthropometric factors, the truck measurements are not reliable. However a higher percent variation in the resistance of the trunk R compared to the arms at 5 kHz measurement is explained by a change in extracellular fluid composition and the trace of the trunk measurement changes which display a decrease followed by a recovery in the acclimatization and returning back suggests a local edema, probably in the lungs which remained subclinical to the subjects.

Thesis No.: 78 A Neural Network Approach for Noninvasive Detection of Coronary Artery Disease.

Name: Mine İzlem Doksatlı, Year: 1994

Advisor(s): Halil Özcan Gülçür

Abstract: Coronary Artery Disease (CAD) is the major cause of death and this disease can be detected by an expensive, risky and invasive technique called angiography. Therefore, many research work has been done to find a non-invasive technique for detecting coronary occlusion before they become serious enough to induce symptoms. This technique is based on the knowledge that coronary stenoses produce sounds due to the turbulent flow in partially occluded arteries. Recently, experimental systems that make use of the heart sounds for non-invasive detection of CAD have been the subject of active investigation by some research groups. In this study, we intended to improve on the previous studies concerning non-invasive detection of CAD, using some adaptive noise cancelling schemes and artificial neural networks for automatizing detection. For this purpose, using a system developed in the Institute, which includes a PC, two sensitive sound channels and an ECG channel, a number of clinical studies have been performed. Heart sounds from 60 patients (22 healthy and 38 diseased) that all had some cardiac problems and recently had coronary angiography, were recorded in a relatively quiet hospital room, while ambient sounds and patient's ECG were also simultaneously recorded. A sampling frequency of 4 kHz was used for data acquisition. Using ECG information, diastolic portions of the sound signals were isolated manually. The sound signals were first passed through an analog band-pass filter with 150 Hz and 1200 Hz cut-off frequencies and then an adaptive frequency domain filter was used to eliminate the background noise. Window functions of periodogram were employed to achieve better spectral estimation. For this purpose, Hamming window with segment length of 256, and an overlap of 128 (50%) were used. Then, frequency regions that were related with the coronary flow was defined. A two layer neural network with eight hidden nodes was trained using data from 20 patients, including 10 healthy and 10 diseased. The neural network was then used for the diagnosis of the remaining 40 patients and gave correct classification rate of 62.5%. In our study, a comparison of the spectral energy distributions showed a marked difference between the normal and diseased subject groups; spectral energy over 600 Hz turned out to be significantly greater for diseased subjects. The results confirm that the technique used has a potential for non-invasive identification of stenoses in coronary arteries. The artificial neural network, after training with a larger data-base can be used for pre-screening of patients and deciding those who need more detailed examinations. This system can be also useful for screening patients after angioplasty.

Thesis No.: 77 Acquisition of Diastolic Heart Sounds Via a Noninvasive Method.

Name: Murat Taşkıran, Year: 1994

Advisor(s): Halil Özcan Gülçür

Abstract: It has recently been shown that sounds caused by the turbulent flow in partially occluded coronary arteries may be used for detecting the location of occlusions and is valuable for an early, non-invasive diagnosis of coronary arteriosclerosis. Unfortunately, it is difficult to isolate and analyze these sounds directly, since they are corrupted with sounds having similar characteristics which originate from certain internal sources, such as the valve sounds, or sounds from some external sources. In this thesis work a special instrumentation system for the acquisition of diastolic heart sounds is developed and physically realized. The system consists of two passive sonic probes, two sound channels, an ECG channel, various filters, a Personal Computer equipped with an analog-to-digital converter board and a special data acquisition software. To reduce amplifier saturation and cut-off problems, which might arise when the sensitive amplifiers of the system are subjected to momentary large inputs, like the S1 and S2 valve sounds, a logarithmic amplification has been used. One of the sound channels is used for monitoring the environmental noise. Using the information from this channel, the system software adaptively cancels out the effects of external noise, allowing measurements in ordinary, non-sound-proof rooms. The ECG channel is used for placing time windows properly, during the diastolic phase of the heart, at which time background noises are minimum and the sounds coming from the occluded coronary arteries are maximum.

Thesis No.: 76 The Use of Laser Scanning in the Preparation of Computerized Skin Pigmentation and Topographic Maps.

Name: Gökhan Mert Koral, Year: 1994

Advisor(s): Mehmet Melek

Abstract: This project involves a study of imaging the surface variations in both pigmentation and topographical aspect, including a survey of the earlier studies of relevant topics. Pigmentation and topographic view of skin varies with different types of tissues. Tumors and stains have different colour pigmentations. This variance results in different absorption levels of light. Using this phenomenon, a Helium-Neon laser unit was used as the light source to investigate the possibility of imaging the surface pigmentation and topographic variations of the surface, and monitoring the subcutaneous layers of tissue by means of an experimental setup. The experimental tissue to be scanned was divided into pixels, and each pixel illuminated with the laser beam, where the back-scattered light intensity was measured via a specially designed absorption scanning unit. Using computer program, the images were reconstructed by forming data matrices and assigning a colour code for each range of pixel value that was predetermined out of these matrices. As a result of this study, it was confirmed that the occurrences on the skin surface and the subcutaneous layers of skin might be detected by using laser as a light source

Thesis No.: 75 A Novel PC-Based System for Evaluation and Management of Tinnitus Using Masking.

Name: Cengiz Çelikyurt, Year: 1994

Advisor(s): Halil Özcan Gülçür

Abstract: The objective of this study was to develop a system, using a PC with a soundboard, for tinnitus evaluation, and patient-specific sound generation. The system was tested on 98 patients who presented with severe tinnitus in the otolaryngologic clinic of the Pendik State Hospital during the first five months of 1994, ranged in age from 23 to 82 (mean age of 53.3). To compare the effectiveness and acceptability of masking of tinnitus, white noise, custommade narrow-band noise and placebo were used. The duration of tinnitus varied from one to 30 years (mean of 4.5 years). 26 (26.5 per cent) patients were satisfied with reassurance, examinations and investigation of tinnitus, requiring no further treatment. Patients listened to PC-generated white noise, individually tailored narrow band noise and placebo recorded on cassette tapes at the lowest masking level for three weeks.37 patients completed the trial. Three patients (8.1 per cent) found white noise more effective. 34 patients (91.9 per cent) found both the individually tailored narrow-band noise and the white noise effective; but they preferred individually tailored narrow band noise ; because the narrow band noise sounded more effective and pleasant to them. No patient found the placebo effective. The study indicated that masking of tinnitus using custom-made narrow-band noises generated by the system developed, was very effective for the relief of severe tinnitus.

Thesis No.: 74 Development of an Expert System for Medical Diagnosis of Most Common Lung and Ear-Nose-Throat (ent) Diseases.

Name: Cem Cüneyt Kavaslar, Year: 1994

Advisor(s): Yekta Ülgen

Abstract: An expert system for medical diagnosis of the most common lung and ENT (ear-nose-throat) diseases was developed. This system diagnoses which are tuberculosis, pneumonia, lung cancer, chronic obstructive pulmonary system diseases (COPD), acute sinusitis, chronic otitis media, chronic tonsillitis and chronic bronchitis. The system runs under PC and PC-Compatible machines and MS-DOS operating system or Windows 3.x. It has been written in both C and Pascal programming languages. The knowledge base of the system consists of medical knowledge involving illness-symptom relationships which were established from questionnaires and archive work. The inference engine of the system uses a rule-based approach. Uncertainty management is achieved by two different methods using either Subjective Probability Theory (Bayes' Theorem) or the certainty factor method. The expert system produces two different reports. The program utilizing the Bayes' theorem reports the illness probabilities as percentage values, while to one using the certainty factors (CF) method assigns values in the range of -1 to +1 to the illnesses with -1 implying absolute health and +1 implying absolute illness. Comparison of the expert system results with those obtained from the doctors for lung diseases such as lung cancer, COPD, pneumonia, and tuberculosis, show that the computer diagnosis can be as good as 60 per cent or better in a population of 62 patients. The expert system diagnosis of ENT diseases, however, can be as reliable as 88 per cent to 100 per cent since these diseases have no symptoms in common.

Thesis No.: 73 Applicability of Boride and Nitride Type Ceramic Coatings on Surgical Stainless as Implant Materials.

Name: Osman El-Maarri, Year: 1993

Advisor(s): Hikmet Üçışık

Abstract: Biomaterials to be used as implants, in the human body, must be safe. These materials must never induce any biological rejection or disorganized growth in the tissues in which they are immersed. In this study the safety (the biocompatibility) of Boride and Nitride coated 316 L stainless steels is tested. For this, two in vivo tests have been performed: a systemic toxicity test (using mice), and a subcutaneous implantation test (using rats). Histological observation of tissue around the coated samples showed a higher degree of response than the uncoated 316 L surgical stainless steels. This higher degree of response was attributed to the presence of foreign bodies around the coated implants. Based on these primary testing performed, it has been found that the coated implants, under the performed experimental conditions, were of a lesser degree of biocompatibility than the uncoated 316 L surgical stainless steel.

Thesis No.: 72 Design of an ECG Gated Data Collection System for Electrical Impedance Tomography.

Name: Daron Ermen, Year: 1993

Advisor(s): Yekta Ülgen

Abstract: This thesis is concerned with the design of an ECG-gated electronic hardware for data collection in electrical impedance tomography. The actual design uses the current injection-voltage measurement technique with 16 electrodes. The electrodes are addressed through four analog multiplexers. A 50kHz sinusoidal current is injected between adjacent electrode pairs and peripheral potential differences are recorded by serially stepping around adjacent electrode pairs. Data collection synchronization is achieved using R-wave detection. After each R-wave of the patient's ECG, 13 voltage measurements are done for a specific current-drive position, and total data collection is achieved in 16 cardiac cycles. To comply with electrical safety requirements, both voltage measurement and current injection circuits are isolated from each other as well as from earth ground.

Thesis No.: 71 A Study of Hospital Information Systems from a technology Selection Viewpoint.

Name: Yavuz Serovaoğulları, Year: 1993

Advisor(s): Yekta Ülgen

Abstract: This thesis is a study of the Hospital Information Systems (HIS), with special interest in the selection of the underlying technology and possible integration of HIS to a nationwide Health Information System. An integrated HIS approach through database administration has been adopted and an application software has been developed and installed at the Farabi Hospital of Karadeniz Technical University of Trabzon. Clinical Information System, still under development, will be installed at the same hospital in the near future. Apart from widely accepted requirements of HIS, three distinctive features of this study are; (i) Integrated HIS approach through database administration, (ii) client-server architecture with distributed database capabilities, (iii) physician-configurable tree structure for the symptoms and signs allowing physicians to customize the application for their own style of medical case recording.

Thesis No.: 70 Simultaneously Monitoring of Standard ECG Leads.

Name: Levent A. Atan, Year: 1993

Advisor(s): Yekta Ülgen

Abstract: ECG yields the most helpful data in the diagnosis of heart illnesses. A multichannel recorded ECG can be more helpful than one channel ECG track. The multichannel ECG monitor discussed in this thesis enables the physiologist to monitor the three basic lead derivations simultaneously. In addition signals from chest electrodes can be monitored simultaneously, up to five chest electrodes. The number of the chest electrodes, however, can easily be duplicating chest electrode amplifiers. The electrical safety of the system is obtained by means of optical isolation.

Thesis No.: 69 Statistical and Failure Analyses of Orthopedic Implants Used in Turkey.

Name: Erhan Baş, Year: 1993

Advisor(s): Hikmet Üçışık

Abstract: Recent advances in science and technology have greatly improved both the design and efficiency of orthopaedic implants thereby widening their use. This thesis aims both to determine the use of different types of implants in Turkey and to analyze the causes of postoperative deformations in the implants. The first part of the thesis presents the results of a survey designed to determine the types of implant materials and the frequency that hip and knee prostheses and osteosynthesis materials were used in the operations performed at the orthopaedics throughout Turkey in 1991. Responses received from a total number of 102 orthopaedics clinics also demonstrate the causes and the incidence rates of deformations that most frequently occurred in the implants used by these clinics. The experimental study presented in the second part of the thesis makes use of 24 implant materials that were obtained from the orthopaedics clinics of Istanbul Medical Faculty and Cerrahpasa Medical Faculty. These implants had previously been removed from patients' bodies because of reasons identified as healing, fractures and loosening. Macroscopic and metallurgical analyses were undertaken to unravel the structure and the causes of deformations that occurred in the implants.

Thesis No.: 68 Mechanical Properties of Knee Joint Ligaments in Comparison to Tendons.

Name: Zeina Babetty, Year: 1993

Advisor(s): Hikmet Üçışık

Abstract: Design of a synthetic replacement or selection of a biologic substitute requires detailed knowledge of the mechanical properties of the normal ligament. Ligaments and tendons have been frequently experimented for this purpose. In light of distinguishing their histological characteristics which were obtained form previous literature surveys a comparative evaluation of the mechanical properties of the human knee joint ligaments and tendons would be of interest, leading to some relevant conclusions. Mechanical parameters such as maximum load, elongation, ultimate stress, strain to failure, stiffness are compared among various ligaments and tendons of the knee joint. In preconditioning tests, energy measurements were computed from areas of hysteresis loop indicating the elasticity of the specimen, graphs of energy absorbed versus loading-unloading cycle number are obtained. Instron Testing Machine was used to run the tensile tests, special grips made of rubber were provided to hold the specimens and a video-camera recording system was used to photograph some parts of the experimental procedure. Tendons were found to withstand higher stresses than ligaments, and hence support the fact that they can be used in ligament reconstructions.

Thesis No.: 67 Image Reconstruction Using the Modified Newton-Raphson Algorithm for Electrical Impedance Tomography Based on A Finite Element Method.

Name: Meltem Demirtürk, Year: 1993

Advisor(s): Yekta Ülgen

Abstract: Electrical Impedance Tomography injects constant current (10kHz to 50kHz) into the body, using a pair of surface electrodes and measures the resulting voltages between all other peripheral adjacent electrodes, arranged in pairs, to estimate body's internal resistivity distribution. For reconstructing the body resistivity image, the forward problem is solved first, by representing the body with its Finite-Element model. For this purpose, the region of interest is divided into small discrete triangular elements. 3-layer, 56-element mesh structure and 16 peripheral nodes (electrodes) are used to simulate the resistivity distribution for known circular and elliptical regions. To solve the inverse problem, the modified Newton-Raphson method is used as an iterative reconstruction method. The ill conditioning is eliminated using the Singular Value Decomposition technique. Reconstructed images with the modified Newton-Raphson and improved Perturbation methods are then compared.

Thesis No.: 66 Computer Interfaced CCD Camera.

Name: S. Murat Egi, Year: 1992

Advisor(s): Yusuf. P Tan

Abstract: This thesis work is aimed at the building of a computer interfaced CCD (Charge Coupled Device) camera, which will be part of a fluorescence ratio imaging system, measuring cytostolic free Ca++ concentration. As in the current systems, for ratio imaging of rapidly responding cells, the incompatibility with the standard video is a serious problem; the analog video output is directly digitized using a flash ADC (Analog to Digital Converter) and 7-bit digital data is transferred to the computer memory using DMA (Direct Memory Access). So, the data acquisition rate is only limited by the CCD and the computer performance. The system is designed around an IBM compatible PC/AT. Electronic hardware is composed of four cards : an adapter card connected to PC via the expansion slots, a voltage regulator, an ADC and a CCD card. The mechanical hardware is simply a light isolated housing carrying the last three cards. It is coupled to a student microscope with removed oculaire to give a real image on the CCD surface. The charge packages are collected at the potential wells of CCD which are clocked out by supplying the gating pulses. The gating pulses together with the DMA control signals are generated at the adapter card. The software initiates the data acquisition process. When a word (two bytes) of data is ready, the PAL (Programmable Logic Array) produces A DRQ (DMA Request) signal. When the data is transferred to memory PC sends DACK (DMA Acknowledge) signals. PAL holds the clocking out of the CCD until DACK comes. Once all of the pixels are clocked out, PC sends a TC (Termination Count) signal which in turn generates a hardware interrupt. Once this interrupt is recognized by PC: a new data acquisition sequence will start but this time on a second buffer leaving the first buffer available for any real time data processing thereby creating a kind of background task. The limiting frame rate of the camera is 100 Hz; while with the 18 MHz PC resulting images are obtained at 33 Hz. The processed images are 64 gray level black-and-white or pseudocolored images. Black-and-white images were used to focus on the target cells. Pseudocolored ones will be used to relate the light intensity to a local analyte concentration.

Thesis No.: 65 A Data Acquisition system for Auditory Evoked Potential Monitoring During Anaesthesia.

Name: Coşkun Aydoğdu, Year: 1992

Advisor(s): Halil Özcan Gülçür

Abstract: A microcontroller based instrumentation and data acquisition system is developed for evoked potential measurements. The system is intended for incorporation into systems for improving safety of anesthesia delivery and requires an IBM compatible PC. The study involves the design and implementation of a bipolar, high CMRR, low-noise and low cost isolated bio potential amplifier for EEG and EP measurements and a microcontroller card with Intel N87C196KR for data acquisition, audio-stimulus generation, filter selection and amplifier controls. The system has two selectable analog low-pass filter settings, a 50 Hz notch filter and also has a 1 kHz audio signal generator.

Thesis No.: 64 Detection of Fetal ECG Using the SVD Technique.

Name: Murat Gönen, Year: 1992

Advisor(s): Yekta Ülgen

Abstract: In this thesis, a multi-channel instrumentation system was designed to record both maternal and fetal ECGs. Three thoracic and two abdominal signals were sampled and stored by a data acquisition software program using the macADIOS system. Before recording the data in the hospital, some experiments were done to find the optimal location of the maternal electrodes. The data was processed, and separated into its components by the software using the SVD technique. Clear fetal ECG patterns were detected by the data sets of two subjects who were at 36 weeks of their pregnancy.

Thesis No.: 63 Estimation of Body Fluid Losses During Abdominal Surgery and Haemodialysis by Impedance Measurement Technique.

Name: Günnur Çakmak, Year: 1992

Advisor(s): Yekta Ülgen

Abstract: In this study a portable, easy to use instrument is designed to detect body fluid loss in patients undergoing haemodialysis and abdominal surgery. Electrical impedances of the arm, the leg and the trunk are measured separately from the right side of the body at the frequency of 50 kHz (1 mA rms) before and after the process. The tetra polar (current drive-voltage sense) measurement technique is used with disposable ECG electrodes. Electrical impedance changes are correlated with weight changes actually measured. Electrical impedance measurements are performed on the patient, at intervals of 15 minutes, during abdominal surgeries, to detect the instantaneous body fluid losses. The experimental results strongly support the clinical usefulness of this technique in determining body fluid losses, especially during surgeries.

Thesis No.: 62 Design of a Serial Data Collection System for Electrical Impedance Tomography.

Name: Adnan Güler, Year: 1992

Advisor(s): Yekta Ülgen

Abstract: This thesis is concerned with the design and implementation of electronic hardware of a serial data collection system for electrical impedance tomography. The actual design uses the current injection -voltage measurement technique with 16 electrodes. The electrodes are multiplexed through 4 multiplexers. A current drive of 2 mA at 45 kHz is multiplexed to adjacent pairs of electrodes and peripheral potential differences are recorded by serially stepping around adjacent electrode pairs. 208 voltage measurements are made for one complete set of projections. The measured values are transmitted to the computer where they are digitized and stored in array form. These data can be used to reconstruct the image of the body with an appropriate algorithm. Both the current injection and voltage measurement circuits are isolated from each other as well as from earth ground to comply with the safety requirements.

Thesis No.: 61 Comparison of ECG Data Compression Methods.

Name: Mustafa Dost, Year: 1992

Advisor(s): Yekta Ülgen

Abstract: A broad spectrum of techniques have been proposed to reduce the digital ECG data volume for storage and transmission. These techniques are essential to a wide variety of applications ranging from diagnostic to ambulatory ECGs. Due to the diverse procedures that have been employed, choosing of ECG compression methods is a major problem. Present evaluation methods preclude any direct comparison among existing ECG compression techniques. The aim of this thesis is to compare the direct ECG data compression techniques such as AZTEC, Turning-point, SAPA1, and SAPA2 and implement them off-line on a PC, using the Turbo C (Version 2.0). For this purpose the ECG compression techniques have been applied to identical ECG data. Among the ECG compression techniques, SAPA2 algorithm yields best reconstructed signal with minimum percent rms difference.

Thesis No.: 60 External Multiprogrammable Pacemaker.

Name: Ümit Gökşen, Year: 1992

Advisor(s): Necmi Tanyolaç

Abstract: In this thesis, regarding the new developments in pacemaker technology, a microprocessor controlled "External DDD pacemaker" has been designed. The goal was to guide the doctors for choosing the wright pacemaker type for implantation. This device will also be helpful in electrophysiological studies in Medical centers, laboratories, Biomedical and Medicine departments of faculties. The designed DDD (pacing and sensing in both atrium and ventricle) multiprogrammable external pacemaker includes ten pacing modes and nine pacing parameters which can be selected by the user. For that purpose Intel 8085 microprocessor and its peripherals are chosen. The hardware consists of six input/output ports, two DACs (digital to analog converter), two ADCs (analog to digital converters) in addition to 8085 peripherals. The physiological signals occurring in heart chambers are first amplified and filtered, before the analog signals are converted to digital data in ADCs. Then this data is processed in microprocessor and necessary pacemaker impulses are emitted or not, considering the pacing mode and parameters which are both selectable by using the keyboard.

Thesis No.: 59 Computer Simulation of Cardiac Muscle Based On Contraction and Relaxtion Experiments.

Name: Lale Özer, Year: 1992

Advisor(s): Yekta Ülgen

Abstract: The object of this study is to simulate the mechanical properties of cardiac muscle for both contraction and relaxation phases with a computerized simulation technique. Mechanical representation is needed in order to describe the mechanical properties of cardiac muscle. The mechanical model introduced in this study is based on the Hill's three-element model. While the elastic elements of the model are well-defined by stress-strain characteristics, contractile element can not be uniquely defined. So that, the representation of contractile element is required. Predefined representation of contractile element with a non-linear viscous damper and displacement generator in series, is used for simulation of contracting muscle and, the model is modified in order to simulate the mechanical properties of relaxing cardiac muscle. Proposed modification is elaborated by disregarding the displacement generator, which depends on the cardiac muscle intrinsic characteristic of returning back to the initial conditions after contraction. Simulations of both contraction and relaxation phases of cardiac muscle are based on the performed and published experiments. Mechanical properties of contraction and relaxation processes are studied and the active state concept is also analyzed in terms of the simulated results.

Thesis No.: 58 EEG Modelling Using Neural Network and Enhancement Averaging of Brain Evoked Potentials.

Name: Masoud Madani, Year: 1992

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis, a new parametric model for Evoked Potential (EP) estimation has been developed and implemented. It is assumed that pre-stimulus EEG data can be modeled by an implicit nonlinear autoregressive (NAR) model. The NAR model has been realized using a multilayered neural network having a single hidden later and a single output neuron. The conventional back propagation learning law has been applied to estimate the parameters of the network. The model obtained using pre-stimulus data has been used to forecast post-stimulus signals. The forecast errors have been interpreted as the EPs. The EPs thus obtained have been compared favorably with those obtained using conventional averaging methods which require considerably more trials. To test the validity of the model the autocorrelation of the prediction error was computed. This error should be white if the model is adequate. The software implementing the proposed method is developed on IBM PC/MS DOS environment using "Turbo C 2.0" programming language.

Thesis No.: 57 Observation, Parametric Modelling and Classification of Respiratory Sounds.

Name: E. Çağatay Güler, Year: 1992

Advisor(s): Yasamin Kahya

Abstract: Auscultation is a widely used method in the diagnosis of pulmonary diseases and in the analysis of respiratory sounds. The characteristics of respiratory sounds show differences in pathological cases from normal cases. The object of this study is, to observe the characteristics of respiratory sounds in both cases, to analyze them in time and frequency domain and to distinguish a normal case from a pathological case. To achieve mentioned goals, respiratory sounds heard over the chest wall from the specific locations were recorded. The flow signal was also recorded by a flow meter to synchronize on the inspiration and expiration phases, because the characteristics of respiratory sounds may change from phase to phase. An AR modeling was applied to obtain a parametric representation of the sounds. The analysis of respiratory sounds was performed after they were distinguished to inspiration and expiration phases. Mahalanobis distance measure, and minimum distance classification method is used to classify respiratory sounds into appropriate classes. Experiments showed that the suggested classifier can distinguish the normal case from a pathological case if and only if a large database of lung sound is available. The classification method was also compared with Itakura distance measure and k-nearest neighbor classification method which was performed in a previous study. The abrupt changes (crackles) in the respiratory sound waveforms of pathological cases were observed and a new method is suggested to detect them because they have a special importance in the diagnosis of some pulmonary diseases.

Thesis No.: 56 Three-Dimensional Imaging in Medicine Development of a Software Library.

Name: Mehmet V. Tazebay, Year: 1991

Advisor(s): Ertuğrul Yazgan

Abstract: Advances in 3-D imaging now provide the surgeon, radiologist and physician the ability to create 3-D models of any part of the human body. The major area of clinical applications of 3-D imaging has been in Radiation Therapy Planning, Computer Assisted Surgery, Brain Analysis and Orthopaedics. This thesis presents a developed software library for 3-D imaging on a workstation. With the volume data represented in terms of voxels, the main tasks are determination of the object in the tomographic volume (segmentation), determination of the visible parts of this object at a desired orientation and 3-D display of the resulting data on a 2-D monitor. The technical aspects of 3-D imaging and segmentation process are discussed and the results are illustrated in relation to their clinical applications. The developed software library has a modular structure for future developments.

Thesis No.: 55 Mechanical Behavior of Skin Grafts.

Name: Mustafa Altunbaş, Year: 1991

Advisor(s): Sabri Altuntaş

Abstract: In this study, the directional dependence of mechanical properties of skin grafts of various thicknesses are investigated in two directions: longitudinal and transverse according to Langer's lines of cleavability. The specimens were tested and evaluated in terms of mechanical properties such as tensile, load-cycling and stress relaxation properties. The shrinkages of the actual skins were also measured shortly after cutting. Histological sections were examined to relate the results with the microstructure. The overall results of the study reveal that the human skin shows an anisotropy of three dimensions; i.e. its mechanical properties vary with both directionality and thickness.

Thesis No.: 54 Odor Measurement of Different Fungi by Using the Electro-Odocell.

Name: Şehsuvar Şişmanoğlu, Year: 1991

Advisor(s): Necmi Tanyolaç

Abstract: In this thesis, a method for the qualification of the pathogenous fungi species has been studied. The aim of this method is to be able to identify miscellaneous fungi types by sampling and analyzing their odor characteristics with the E.O.C., an instrument sensitive to odor molecules. The first point of the study involves the determination of appropriate conditions for the measurement. Then, the standard set-up has been constructed. The fungi types to be tested has been incubated in equal environmental conditions. The analysis of the odors of specific fungi has been performed using the E.O.C. in the test room, in which the temperature has been kept constant and the relative humidity is regularly controlled. The results have been plotted on an X-Y plotter in milivolts versus time and the graphics obtained have been evaluated with respect to their characteristics.

Thesis No.: 53 Restoration of Function of the Paralyzed Eyelid by Electrical Stimulation.

Name: Teksel Öztürk, Year: 1991

Advisor(s): Halil Özcan Gülçür

Abstract: Functional neuromuscular stimulation refers to a wide collection of techniques for restoring the lost functions of the paralyzed limbs and organs by electrical stimulation of the excitable tissues. It is a relatively new and developing subject and little is known about its life improving effects in the medical environments. It challenges and probably would substitute several surgical and conventional medical rehabilitative methods. The first part of this thesis is a comprehensive review of what has been done so far in this area. A first attempt to restore the function of the paralyzed eyelids is described in order to prevent dry eye syndrome and blindness due to eventually developing keratitis, inflammation of the cornea. For simultaneous closure of eyelids, it has been suggested that the EMG activity of the intact eyelid may provide necessary control signals. Without significant delay a stimulator is activated and hence the paralyzed eyelid is stimulated. The applicability of this method is discussed.

Thesis No.: 52 An Image Processing System for Radiologic Data on Convention Computers.

Name: N. Murat Yalçın, Year: 1991

Advisor(s): Yusuf. P Tan

Abstract: This thesis work is aimed at the building of an image processing software, to be realized on a conventional digital computer. Although special and expensive equipment is usually required for such an image processing system, such equipment is avoided as much as possible, except the data acquisition part. By the construction of an image processing system on such a widely known hardware basis, sharing and availability to common usage of original or processed image data is targeted. After examining the mathematics of most important and widely used basic image processing algorithms, different implementational issues is evaluated in order to include best solutions to a given image processing problem into the software. Different software techniques are used to approach the implementational problems of a given task in order to improve the total effectiveness of the image processing software. The implemented algorithms are classified into groups and subgroups in an effort to help understanding of different algorithms that can be executed on a given image data sequentially and the most important and most widely used algorithms from each main group have been given more attention. Also efforts have been spent for the main user interface of the image processing software to provide a consistent and menu-driven system and interactive usage. This approach leads to ease of learning and use. Although the data acquisition section of such a study is not directly implemented in this thesis work, an example of such an interface within the data resource and the constructed image processing system is also dealt with. For this purpose, an eight inch diskette driver is used and a disk drive controller to act as an interface between this device and the host computer is constructed. Thus it is made possible to read the data which was saved on these diskettes on computerized tomography devices as storage data previously

Thesis No.: 51 Design of a Microcontroller based ECG Monitoring System.

Name: Değer Solakoğlu, Year: 1991

Advisor(s): Yekta Ülgen

Abstract: In this thesis, a microcontroller based ECG monitoring system is designed and implemented, for continuously displaying the ECG waveform on an oscilloscope screen. The ECG signal from surface electrodes, attached to the chest of the patient, is amplified and ground isolated, with the amplification factor and the dc offset controlled through the software. The ECG front and uses common-mode feedback and provides a CMRR better than 120 dB at mains frequency. An 8-bit A/D Converter digitizes the ECG signal at a sampling rate of 250 Hz. Tachycardia and Bradycardia alarm limits are manipulated through the software. It is also possible to use the system for direct blood pressure monitoring, with the built in dc pressure amplifier.

Thesis No.: 50 Analysis of EEG_EP Variabilitied A Parametric Approach.

Name: Tamer Demiralp, Year: 1991

Advisor(s): Halil Özcan Gülçür

Abstract: An user friendly Evoked Potential (EP) analysis software is developed, which includes data processing procedures relevant to both basic EP research and routine clinical applications. The program allows analysis of data in time and frequency domains by means of parametric and nonparametric signal analysis methods. All the parameters of the applied techniques can easily be accessed by the user through the menu driven user interface. A method based on parametric modeling of prestimulus EE period and post stimulus EEG-EP period of evoked potential data, is developed to find out the descriptors of a combined EEG-EP model explaining the trial-by-trial variability of EPs to the repetitions of the same stimulus. The application of the proposed method to real EP data revealed a close relationship between the characteristics of the prestimulus EEG and EP which made it possible to estimate single EPs by clustering single sweeps according to their prestimulus EEG characteristics. The method is tested for the bias of the estimates and its application to pathological clinical cases is discussed.

Thesis No.: 49 Development of a System for Determination of Different Types of White Blood Corpuscle (Leucocyte) in Dried Blood Smear.

Name: Gülay Büyükaksoy, Year: 1991

Advisor(s): Halil Özcan Gülçür

Abstract: The networks which are composed of tightly connected simple processing elements and try to mimic the characteristics of the human brain such as massive parallelism, fault tolerance and learning from the experience, are called artificial neural networks. In this thesis artificial neural networks were examined and a software for recognizing the white blood corpuscle was developed by using the Kohonen's Self Organization Future Map (S.O.F.M.) and perception algorithms. The S. O. F. M algorithm imitates the ordering of sensory pathways and the high level of organization created during learning in the human brain. In the present thesis digital white blood corpuscle images were processed by this algorithm and a feature vector is inputted to a single layer perceptron to train it's weights. After the training, the weights of the two algorithm was linked to make a final classification.

Thesis No.: 48 Instrumentation for EEG and EP Data Acquisition.

Name: Burak Reis Arslan, Year: 1991

Advisor(s): Yekta Ülgen

Abstract: In this thesis, a computer based instrumentation system is developed and presented for the evoked potential measurement. The study involves the design and implementation of a bipolar, high CMRR, low noise, low cost isolated biopotential amplifier suitable for the EEG and EP applications. Data acquisition and stimulus generation is performed on a Macintosh 11 CX computer through MAcAdios 11 A/D card. The system has a minimum of two anolog low- pass filter settings and a 50 Hz notch filter, leaving most of the signal conditioning to the digital computer. The amplifier comprise an electrode impedance check facility to ensure better signal acquisition. It also involves a stimulus generator output to a variety of modalities by programming. This is not a complete EEG system but it has the options such as real time data collection and monitoring real time filtering and averaging and off line data processing. In this thesis the conventional visual evoked potential in response to flashes and auditory evoked potentials are measured as example studies.

Thesis No.: 47 The Establishment of an Embryo Laboratory Complex for Assisted Reproduction.

Name: Nora Cümbüşyan, Year: 1991

Advisor(s): Necmi Tanyolaç

Abstract: Fertilization of human oocytes in vitro is increasingly recognized as an important clinical method for the alleviation of infertility. After the preliminary observations of Edward et al. In 1969. the studies on this subject were intensified and following the first successful birth in 1978. this technique has bee applied in many clinics, giving rise to multiple alternative approaches and innovations in field. The objective of this thesis is to propose and optimum model of a complex for assisted reproduction in Turkey, which can be adapted to future innovations. Therefore the details of different phases of in vitro fertilization, embryo transfer and of the related innovations are supplied, the current status of assisted reproduction in Turkey is specified, the future trends are discussed, a detailed description of the equipments used in an embryo laboratory complex is presented , and the necessary specifications of these equipments are investigate, together with the major manufacturer companies in the world. Additionally, the necessary environmental prerequisites and optimal design characteristics that should be considered during the establishment of an embryo laboratory complex are discussed. As result of these investigations, a model for an Embryo Laboratory Complex is proposed, where the environmental prerequisites and design characteristics are specified and the available equipments are evaluated for the optimal selection

Thesis No.: 46 Lasers in Ophthalmology and Effect of some Laser Wavelengths on Ocular Tissues.

Name: Murat A. Karaçorlu, Year: 1990

Advisor(s): Yusuf. P Tan

Abstract: The proportion of the electromagnetic spectrum concerned with ophthalmology ranges from the ultraviolet portion through the visible wavelength and the near and far infrared areas. In addition to the tunable dye laser, which can produce wavelengths room the ultraviolet into the infrared portion of the spectrum, other lasers have provided ophthalmologist with fixed wavelength emissions that have become enormously important in the treatment of various diseases. The interaction of a specific laser emission or wavelength with various ocular tissues can be divided into six distinctly different tissue changes associated with: 1-Photocoagulation therapy, 2- Photodynamic therapy, 3-Photovaporization therapy, 6- Phototherapy. Nd-Yag Laser permits the "noninvasive "incision of intraocular structures. Results of this study support the hypothesis that a one stage filtering procedure can be performed solely with the Nd-Yag laser. But, because of the required high energy levels, complications or distant effects of the YAG shock may occur in living human eye.

Thesis No.: 45 Mechanical Properties of Cancellous Bone at Human Femoral Head.

Name: Acarhan Yiğit, Year: 1990

Advisor(s): Hikmet Üçışık

Abstract: Mechanical properties of cancellous bone was studied using specimens from human femoral heads obtained during surgery. Microphotographs of cancellous bone specimens were taken and they were examined whether if there was any relation between microstructure and mechanical properties. Microhardness measurements of cancellous bone demonstrated values varying between 16 and 67 D. P. H. with an average of 29.8 D.P.H. Penetration tests utilizing an 78.5 mm^2 indenter produced the penetration strength values changing between 1.99 MPa and 35.91 MPa with an average of 7.39 MPa for cancellous bone. High correlation coefficients between CT values and penetration strength (r=0.733) have encouraged for in vivo estimation of cancellous bone properties using quantitative computed tomography which may become an useful tool in certain clinical applications.

Thesis No.: 44 Ergonomics and Safety in Dentistry.

Name: Faik Nüzhet Oktar, Year: 1990

Advisor(s): Necmi Tanyolaç

Abstract: Ergonomics and safety are important factors to be considered in engineering applications. Because of their complex nature, however these factors are not adequately known in dental applications and therefore not followed by dentists and dental equipment manufacturers. Exact ergonomical applications will ease the job of the dentist. On safety side; sterilization, mercury contamination and radiation comes first to mind. Other subjects are not enough known. Standards are tied to ergonomics and safety. the right applications of standards will improve the quality of dentistry in Turkey.

Thesis No.: 43 Design and Implementation of Computer Based Electrocardiography System.

Name: Hakan Zorlu, Year: 1990

Advisor(s): Halil Özcan Gülçür

Abstract: A personal computer based ECG system is designed and presented for the recording of ECG waveforms of patients in their living environment(at home, in offices, etc.). The system offers computer facilities to ECG recording. The ECG system designed is inexpensive, easy to use, safe and can be connected to an IBM PC compatible computer. The software developed detects heart rate in real time and generates alarm if it can no find an heart beat in a predetermined time interval. The ECG data can easily be recorded on floppy diskettes when required. The system can also be used as a cardiological diagnostic tool since it can automatically detect the P, Q, R, S and T waves and calculate time intervals and determine waveform levels.

Thesis No.: 42 Spectral Analysis of Biomedical Signals with Special Emphasis on the EEG.

Name: E. Mehmet Yusuf, Year: 1990

Advisor(s): Sabih Tansal

Abstract: In the 1980's, especially in second half of the decade, spectral analysis of the EEG revolutionized the interpretation of this laboratory tool. It would not be prophecy to foresee that Fourier Transform Analysis (FFTA, as called by the American Medical Association -AMA-) would be among the classical tools of the electrophysiologists in the 1990's. Equipment supplied with this option is scarce prices are prohibitive. This study supplies a through review of the work in this field and suggests an inexpensive access to FFT analysis of the EEG using the system the clinician already owns, with the addition of an inexpensive computer system. It is possible to use a Commodore 64 computer with a disk drive, and a single chip A/D converter like the National Semiconductor ADC 0804, controlled by the software written in the 'C' programming language for speed and portability to more able computers, perhaps already available, to obtain results similar in format to those published by the leading electrophysiology researchers of the world. This system is detailed and review of the system components are also included where appropriate.

Thesis No.: 41 Design of A Clinical Chemistry Spectrophotometer.

Name: Orhan Murat Köseoğlu, Year: 1990

Advisor(s): Yekta Ülgen

Abstract: In this thesis, a clinical chemistry instrument has been realized, to quantitate substrate concentrations, and enzyme activities in human blood. The phometric technique senses color changes in the sample solution proportionally to the concentration. The prototype photometer is designed as a monochromatic instrument at a fixed wavelength of 492 nm, with the bandwidth limited to 10 nm, by means of interference filters. In order to evaluate the prototype device for accuracy and sensitivity, the results are compared with those obtained from the commercial ones, and found to be in good agreement, in terms of accuracy and sensitivity

Thesis No.: 40 An Optical Scanner and Character Recognition System.

Name: Yıldırım Bahadırlar, Year: 1990

Advisor(s): Halil Özcan Gülçür

Abstract: This thesis work has aimed an Optical Character Recognition (DCR) system. The system has been handled in two parts. The first part is design and implementation of an optical page scanner and the second is development of character recognition software. The implemented scanner can digitize the text image on an A4-sized standard paper and it utilizes a photosensitive sensor constructed with phototransistors. The preamplifier and computer circuits obtain a digitized data from this sensor. A microprocessor (M6802) based controller circuitry accomplishes data communication with a host computer (IBM PC) and controls X-axis and Y-axis motor s in the scanner. The sc and density of 85 data per inch in both horizontal and vertical directions is supported by the scanner. The character recognition software are developed an IBM PC XT computer using TURBO PASCAL compiler. One of them communicates with scanner and acquires digitized data from scanner. The others deal with the character isolation from page image and simulation of two types of linear machine for the recognition purposes. Some experiments using this software were done on the image data from the scanner. The last sections of the thesis cope with these works and give their results.

Thesis No.: 39 Intraoperative Cardiac Mapping System.

Name: Cem İ. Koçak, Year: 1990

Advisor(s): Yekta Ülgen

Abstract: An intraoperative cardiac mapping system is designed for guidance in arrhythmia surgery. An instrumentation unit (amplification, isolation and filtering) is designed and combined with a computer based data acquisition system to obtain electro physiologic data from epicardium. The system is capable of recording data from fourteen bipolar pairs of band electrodes and two bipolar pairs of surface electrodes. Real time monitoring for up to eight channels is also possible. The software is designed to allow user to examine data as soon as acquired, in compressed or normal forms, with ability to select different channels to be displayed in one screen. The software is user friendly and can be manipulated with mouse, no experience or programming skill is necessary.

Thesis No.: 38 Principles of Magnetic Resonance Imaging Resonance Imaging and Evaluation of Different Modalities.

Name: Talat A. Pekelman, Year: 1990

Advisor(s): Necmi Tanyolaç

Abstract: Nuclear Magnetic Resonance Imaging is an imaging modality which produces cross-sectional transaxial, coronal and sagittal tomographic images to those of X-Ray computed tomography (CT), and also, it is non-ionizing, non-invasive and without known risk. Certain atomic nuclei that have an odd number of protons or neutrons possess a characteristic known as 'spin' and they behave like small bar magnets and tend to align with external magnetic field. Actually they process about the axis of the external magnetic field at a frequency that depends on the strength of the field. The object in the external field is said to be temporarily magnetized. If the magnetized object is then exposed to a short burst of RF energy at exactly the same frequency as that of processing nuclei, the nuclei start processing and emit a coherent signal. This RF signal, FID (Free Induction Decay), is detectable by the nearby RF coil and contains information on the object by means of having two relaxation parameters; T1 and T2. By applying different RF pulse sequences, it is possible to obtain different contrast and resolution levels. In this work, basic issues related to NMR Imaging phenomenon; such as, principles of NMR, relaxation processes, relaxation times, special pulse sequences and techniques, gradient fields, phase encoding, frequency encoding, instrumentation, safety, economics, and design considerations of a magnet are discussed in a comprehensive manner, and several conclusions are made.

Thesis No.: 37 Estimation of Single-Evoked Visual Potentials by means of Parametric Modeling and Kalman Filtering.

Name: Ahmet Ademoğlu, Year: 1990

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis, for the investigation of stimulus evoked visual potentials (EP's) in single trial EEG recording, a method has been studied and implemented which will separate the measured activity into its evoked and spontaneous parts. A compound state-space model trying to incorporate the observable properties of both parts has been adopted on the basis of additivity of two components. Within this model, spontaneous activity, EEG has been described system. Based on the state-space representation of the model, a Kalman Filter for the observation of the system's state have been utilized which yields optimal estimates for both activities. The properties of the proposed method has been tested by application to simulated data, in which the present EP's are added to measured spontaneous EEG segments.

Thesis No.: 36 A Study on the Activities and Facilities of the 24 District Health Centers of İstanbul in 1989.

Name: Cemil Örgev, Year: 1990

Advisor(s): Necmi Tanyolaç

Abstract: In this study, the activities of the 24 district health centers of Istanbul have been investigated. In the first part, the basic duties of the Ministry of Health and the major principles of the Socialization of Health Services Law No. 224 were studied. In the second part, the provincial structure of the Ministry of Health the formation of health centers, the provincial health Councils was studied. In the third part, the personnel, building and managerial structure of health centers were studied. In the fourth part, the health services of the health centers according to the Directive No. 154 of the Ministry of Health were studied. In the fifth part, the reconsolidations on health policy of a country are presented. In the sixth part, the services of each 24 district health centers are compared and the Suggestions to improve the quality and quantity of health services of the 24 district health centers are presented.

Thesis No.: 35 Implementation and Evaluation of Three Compression Methods for Diagnostic Images.

Name: Aylin Erçil, Year: 1990

Advisor(s): Yorgo İstefanopulos

Abstract: In radiology, as a result of the increased utilization of digital imaging modalities, such as computed tomography (CT),ultrasonography and magnetic resonance imaging (MRI), over a third of the images produced in a typical radiology department are currently in digital form, and this percentage is steadily increasing. Image compression provides a means for the economical storage and efficient transmission of these diagnostic pictures. The aim of this thesis is to present three major data compression algorithms and implement them for radiological images on a PC, using the MS DOS (Version 3.3) operating system and the Turbo PASCAL (Version 5.0). The original and reproduced images have been displayed on a TV monitor by using a graphics display card. Huffman coding and Run-length coding algorithms are discussed as error-free compression techniques. Huffman coding algorithm is based on an optimal, variable length code word design methexi. Run-length coding is based on the repeatability of adjacent pixels in an image data. By using these algorithms, compression ratios of 2: 1 have been achieved with 64 Kbytes, 256 gray level diagnostic images. At the end of decoding process, perfect image reconstruction has been obtained. An adaptive fast discrete cosine transform coding system is also introduced, yielding compression ratios in the range from 4: 1 to 16: 1. At the end of decoding process, some degradation has been occurred in the reproduced images, depending on the compression ratio and the number of quantization levels used.

Thesis No.: 34 Electrode Scanning System for Electrical Conductivity Imaging.

Name: Bülent D. Surijon., Year: 1990

Advisor(s): Yekta Ülgen

Abstract: To map out the change with respect to conductivity differences as in Electrical Conductivity Imaging Method, is the basic concept in this research study. Current injection / voltage sensing technique is utilized where the current is supplied from a constant current source and the potential evoked by the current across the electrodes are amplified and digitized for further processing using a image reconstruction algorithm. Bipolar guarded electrode configuration is sleeted, and by using 32 electrode elements, 16 guarded electrodes are formed in a cylindrical pattern. The electrode system is embedded into a saline solution tank for simulating a conductivity medium. Image processing is realized by utilizing digital subtraction and summation methods sequentially. A summation matrix is created to visualize the high impedance points.

Thesis No.: 33 Investigation and Evaluation of Clinical Laboratories of Hospştal in İstanbul in Terms of Analysis Devices.

Name: Nilgün S. Polat, Year: 1990

Advisor(s): Necmi Tanyolaç

Abstract: Clinical laboratory is one of the important parts of a hospital. Its importance is based on performing qualitative and quantitative analyses on patient's substances. The results of these analyses assist the doctors in the diagnosis of diseases. For this reason, the tests must be performed as accurately as possible. To achieve accurate and precise results requires the use of standard analytical methods and good instrumentation. After the introduction, in the second chapter, Clinical laboratory techniques, procedures and instruments along with their principles are explained. The study results of clinical laboratories of thirty-one hospitals in Istanbul are mentioned in the third chapter. These results consist of summarized information about each hospital, the existing analysis devices in the clinical laboratories of these hospitals and the conditions of these instruments. In the fourth chapter, information obtained during the study on the clinical laboratories is evaluated comparatively according to the groups of hospitals. Finally based on the investigation of clinical laboratories and the evaluation of the study results, precautions for the proper and efficient use of clinical equipments are determined. In addition, hospitals are grouped according to their work intensities and sizes, and for the optimal clinical laboratories, available analysis devices are recommended.

Thesis No.: 32 Applications and New Developments in Cardiac Pacing.

Name: Yurtkan Yurt, Year: 1989

Advisor(s): Necmi Tanyolaç

Abstract: In this thesis, applications and new developments in cardiac pacing are presented. In the first chapter, the heart and specificity rate and rhythm, which are the most important points in considering the ECG for determining whether cardiac pacing is required, are studied. In the second chapter, pulse generator types, power sources, leads and electrodes of cardiac pacemakers, their comparisons and new applications are discussed.Pacemaker implantation techniques, reuse of cardiac pulse generators, infection after implantation and a new method for transvenous lead explanations are handled in the third chapter. The following chapter gives statistical information about the implanted cardiac pacemakers in the world and Turkey, and their follow-up procedures from the point of view of timing, method and used instruments. If there is a problem found in the follow-up, appropriate troubleshooting and correction procedures must be done. These are presented in the fifth chapter. The following three chapters comprise new developments which are rate-responsive and antitachycardia pacemaker types and automatic implantable cardioverter defibrillator.

Thesis No.: 31 ESICIAB An Expert System for Identification of Clinically Important Aerobic Bacteria.

Name: Mehmet Göral, Year: 1989

Advisor(s): Halil Özcan Gülçür

Abstract: EICIAB is an expert system created to be used in the clinical microbiology laboratory or the identification clinically expensive alternative to fully computerized automated systems which are replacing conventional methods for the identification of bacteria in the modern microbiology laboratory. Such systems are faster than the classical methods but they are also quite expensive for most of the microbiology laboratories in our country. PROLOG has been used as the programming tool in developing the system because it is much more powerful and efficient than most other well-known programming languages. The user enters the results of conventional tests into the computer and the system searches its database to make a final conclusion. This database can easily be modified and expanded. Presently it includes about 170 aerobically growing bacteria and covers almost all of the clinically important cases. While choosing the bacteria and the tests used for the identification of these bacteria. Bailey and Scott's Diagnostic Microbiology textbook has been used as a reference. The system is designed to be user friendly and menu driven, so that it would be easy to use for the microbiologists who do not have any prior computer experience. We believe that this system will help reduce the burden of a microbiologist working without an expensive automated system

Thesis No.: 30 Expert Systems in Diagnostic Medicine.

Name: Dilek Bishku (Aykul) , Year: 1989

Advisor(s): Halil Özcan Gülçür

Abstract: This thesis is a critical survey of the current expert systems applications in medical diagnosis. The emphasis is given to the accomplishments of such systems as aid to the medical practitioner, rather than as achievements of the computer scientist. For this purpose, following a brief introduction of general principles, major expert systems in use are described. The information comes from the latest articles on the subject, conference notes and papers published by the developers of the systems. The systems are reviewed in an order that demonstrates the evolution of the methods they employ for imitating the decision-making mechanism of human experts. The outcome of this survey points at the unique qualities of medical field and physicians that prevent the routine and extensive usage of such programs.

Thesis No.: 29 Visual Evoked Potential Estimation with the Extended Kalman Filter.

Name: Alev Erdi (Kutan), Year: 1989

Advisor(s): Halil Özcan Gülçür

Abstract: In this thesis, a new method for extraction of single evoked brain potential (VEP) is presented. In the proposed model for VEP, it is assumed that the measured signal is the summation of a spontaneous part, corresponding to background EEG activity and an evoked part. Both parts are modeled as autoregressive processes with different unknown parameters. These parameters are estimated using Extended Kalman Filtering (EKF). EKF algorithm seemed attractive because the algorithm used, gives the estimate for the evoked signal simultaneously, without requiring extra computations. To test the results, a VEP data acquisition set up was realized. This set-up consisted of a physiograph, an IRM PC/AT compatible computer, a data acquisition card. A data acquisition software was developed to acquire the VEP data. The acquired data was averaged to obtain averaged VEP. This averaged VEP was used to check the results of the algorithm. Our initial results on the model has not been very satisfactory due to the lack of information concerning noise statistics. In fact, studies on the EKF algorithm showed that EKF is very sensitive to initial estimates and apriori statistical information. The success of our approach is therefore dependent on extensive statistical collection. It is hoped that the facilities provided by this work will be used by other researchers to "fine-tune" the proposed model and the method so that extraction of VEP will be facilitated and the physiology of the brain will be better perceived.

Thesis No.: 28 Lesion Detectability in Nuclear Medicine.

Name: Turgut Turoğlu , Year: 1989

Advisor(s): Albert Güveniş

Abstract: In the thesis various parameters affecting lesion detectability in nuclear medicine imaging were investigated. Namely the effects of information density, object contrast, film/chemistry gamma were analyzed using the ROC technique. Verification of the experimental results consistent with Whitehead's mathematical model of lesion detectability was sought

Thesis No.: 27 Programming A Microprocessor Controlled Speech Synthesizer.

Name: Leyla Şensoy (Kaya) , Year: 1989

Advisor(s): Ömer Cerit

Abstract: This thesis work combines a Turkish word processor and a microcomputer controlled speech synthesizer. Utilizing the system presented in this thesis, one can write documents in Turkish using the word processor and listen to what is written using the speech synthesizer. Research has been conducted in Turkish spelling and the pronunciation of Turkish syllables to create the best results in programming the speech synthesizer and obtaining an urıderstandable speech output.

Thesis No.: 26 Hospital Information Systems.

Name: Emre Yusuf Erdi, Year: 1988

Advisor(s): Yekta Ülgen

Abstract: In this thesis a basic hospital information program is written with a personal computer using the dBASE III plus program, for future use in Taksim Hospital. The use of the program in the hospital beyond the scope of this study, however a suggestion is made for requirements of a personal computer based network. The program has three main features: i) It is simple compared to other existing softwares ii) It is written in Turkish, therefore, anyone in the hospital may use it quite easily iii) It can be adopted to any other Public Hospitals of Ministry of Health By using this computer program the user can-store and make changes of patient records. - get information about services, personnel and hospital. get information about medicine groups. - control the medicine stocks' of hospital. see expiration dates of all medicines. - get examination results and request radiology and biochemistry laboratory. see incomes and expenses at the accounting section.

Thesis No.: 25 Effects of Pulsed Electromagnetic Noise Fields in Treatment of Fresh Fractures in Canine Rabits.

Name: Mustafa Sakallı, Year: 1988

Advisor(s): Necmi Tanyolaç/Yekta Ülgen

Abstract: In recent decades electromagnetic fields have received a wide attention for its accelerative effects on the healing process of fractured bones. In this thesis, theory and design considerations of electromagnetic fields are discussed. A pulsed low-frequency electromagnetic noise field (PEMF) generator is designed. The low-frequency electromagnetic noise field (EMNF) has a lif shape over the frequency range from 10 Hz to 1 kHz, and pulsed at a rate of 15 Hz. The EMNF is inductively coupled to the left leg of canine rabbits, for increasing of healing mechanism in fresh fractures and histological results of experiments are evaluated.

Thesis No.: 24 3D Medical Imaging of Internal Organs on an IBM PC.

Name: Aykut Sümer, Year: 1988

Advisor(s): Albert Güveniş

Abstract: The aim of this thesis is to show the feasibility of developing a law eost system for 3D imaging of internal organs using an IBM PC. The developed software package can display 256 x 256 CT/NMR slice data in a 3-D form. User interaction is assured by a menu driven system. The system is meant to be used off-line since image generation is slow. Data from a SOMATOM DR-H CT Scanner have been used in generating sample 3-D images. The modular structure of this package allows further expansion. The hardware used in this project is an IBM PC and a graphics card which drives a TV monitor with 256 gray levels.

Thesis No.: 23 Cardiac Parameters Estimation by Simultaneous Solution of Hemodynamics Equation Using the 6800-Microorocessor.

Name: Mehmet Kılavuz, Year: 1987

Advisor(s): Yekta Ülgen

Abstract: The mathematical analysis of circulatory system is studied by assuming the arterial system as a thin elastic tube. Classical Navier Stokes equations and the continuity equation are used to evaluate the analytical solution of the pulsating flow of blood through arteries. Using the polynomial approximations to the modified Bessel's functions, numerical values for velocity profiles, volume discharge and stroke volume are calculated. Dynamic measurements of arterial blood pressure or electrical conductance in a portion of human body are necessary in order to simulate the mathematical model by means of a microprocessor system, especially designed for this purpose. Physiological parameters for the system simulation are obtained from the literature and from a patient simulator.

Thesis No.: 22 Design and Implementation of a Microprocessor Controlled Image Terminal.

Name: Ahmet Ulubilgen, Year: 1987

Advisor(s): Ömer Cerit

Abstract: The system presented in this thesis work is designed and implemented to provide an interface between a computer and a TV monitor to display image information and if possible process the information. The information is displayed using raster scan technique and forming the image as a 256x256 dot matrix. Each dot may have 256 distinct gray scale levels. Although the system is designed mainly as an image terminal, several attributes, such as page rolling, are provided. New features may be included by updating the system software only.

Thesis No.: 21 A Computer Simulation of The Human Cardiovascular System.

Name: N. Serdar Uçkun, Year: 1987

Advisor(s): Yorgo İstefanopulos

Abstract: In this study, a systems analysis of the human cardiovascular system in terms of arterial pressure regulation was prepared and a computer simulation running on an IBM PC was developed using the Turbo Pascal programming language. The simulation is especially designed to use as an educational tool for physiological classes of medical schools. A brief introduction to computer simulations in physiology is followed by a discussion about the different types of control systems of arterial pressure in the human body, and their usefulness. A systems analysis providing the core of the simulation is developed. The related algorithms and procedures are discussed. The user interface of the program is explained and the obtained results and future applications are discussed.

Thesis No.: 20 Design and Implementation Of a Microprocessor Controlled Speech Synthesizer.

Name: Sibel Yılankıran, Year: 1987

Advisor(s): Ömer Cerit

Abstract: The system presented in this thesis work is designed and implemented to provide an interface between a word processor and the speech synthesizer. An eight bit microprocessor is thought to be suitable for the application for a number of reasons including the ability to easily interface to most current speed synthesizer chips. The memory units are designed to be sufficient for writing a sophisticated text-to-speech algorithm. Suggestions for research topics on text-to-speech algorithm are made.

Thesis No.: 19 3D Display Of Organs Using CT Data: Implementation on an IBM PC.

Name: Mutlu Hüner, Year: 1987

Advisor(s): Albert Güveniş

Abstract: Three dimensional display of organs using CT data-Implementation on an IBM PC. This thesis presents a low cost system for the three dimensional display of organs using an IBM microcomputer. First existing 3D display techniques and their application in medicine are given. Then the particular algorithm selected for implementation is described and considerations pertinent to this specific implementation are discussed. The boundary detection algorithm used is the one developed by G.T. Herman et.al. Standard computer graphics methods are used for displaying 3D objects. A grid technique is introduced when performing the scan conversion. Same of the results obtained by using mathematical phantoms are presented and discussed. The results indicate that by increasing the grid resolution, image quality can be improved at the expense of increased computational time. Aliasing effects are reduced by using a low pass filter.

Thesis No.: 18 High Frequency Ventilation and Design Of Supplementary Units to Fresh Fractyres in Rabbits.

Name: Tanju Öngür, Year: 1987

Advisor(s): Yekta Ülgen

Abstract: This study encompasses the entire aspects of the High Frequency Ventilation (HFV) in three categories; HFPPF (High Frequency Positive Pressure Ventilation), HFJV (High Frequency Jet Ventilation), HFO (High Frequency Oscillation). These categories will be, separately, investigated in terms of their experimental results and the clinical applications. The consequences of the studies performed in several labs and, hospitals, all over the world, will comparatively be presented. Some special ventilators developed will be shown in the study, explaining the technical considerations and clinic applications. The last chapter of the thesis involves the design and function of the supplementary units of a high-frequency jet ventilator, currently in use at Cerrahpaşa Hospital. The device, including heater and humidifier and the control units, will be used on the patients in the intensive care, to eliminate the discomforting effects of the cold air and the possibility of damaging the lung tissue with dry air

Thesis No.: 17 Effect Of Low Frequency Electromagnetic Fields in Treatment Of Fresh Fractures in Rabbits.

Name: O. Uğur Sezerman, Year: 1987

Advisor(s): Necmi Tanyolaç

Abstract: The use of electromagnetic fields in fracture healing has received wide attention in the recent decades.In this thesis a historical background of the studies is given. The structure of bone is described at different techniques that are used in this field are explained. Design considerations of the magnetic noise field generator are given. Results of the animal experiments are reported.

Thesis No.: 16 A Computer Aided Analysis System For Studying Asymmetries in Normal Human Brain.

Name: F. Can Koçak, Year: 1987

Advisor(s): Yusuf. P Tan

Abstract: Left and right hemispheres of human brain have differently localized centers, such as talk, vision and motor functions. This functional asymmetry has been studied since the 19th century in order to understand which part of the brain is controlling which part of the body. Split brain patients are used in most of the brain asymmetry studies because their corpus callosum has been cut and they actually have two separate brains which gives far less complicated results for easy interpretation. Similarly, the asymmetry studies can be made on non-split brain patients. This thesis aims the computer based study of brain asymmetry in non-split brain patients for brain asymmetry. For this purpose a computer program has been developed for processing the electrical activity of the brain, measurement and comparing visual responses of each hemisphere.

Thesis No.: 15 Basic Standards Of Radiation Protection in Nuclear Medicine.

Name: B. Haluk Sayman Sayman, Year: 1986

Advisor(s): Necmi Tanyolaç

Abstract: In this study, the basic standards of radiation protection during routine examinations of Nuclear Medicine or in case of any accident that can happen are explained The precautions in safe handling of radioisotopes and methods of use of radioactive sources and as well as their storage and transportation are outlined to lower the exposure of radiation to a minimum. The specifications of Radiopharmaceuticals used in Nuclear Medicine practice and their standards are overviewed in the next section. As a case study, a performance test of a scintillation camera approved by AAPM is added to emphasize the importancy of quality control in Nuclear Medicine.

Thesis No.: 14 Improving Medical Diagnostic Information Through Better Usage Of Film Technology, 1986.

Name: Vahit Kongur, Year: 1986

Advisor(s): Albert Güveniş

Abstract: Photographic Quality Assurance is an important element of the quality assurance programs as applied in medical diagnostic imaging centers. This thesis addresses the problem of optimizing image quality in Turkey with respect to X-ray film management procedures. First a sensitometric study has been conducted in 32 diagnostic centers in İstanbul in order to find out the major problems encountered in darkrooms and processors. Then a quality assurance programme has been implemented in a private clinic for a period of one month. Both studies indicate a need for quality assurance programmes in Turkey in order to increase diagnostic image quality and decrease unnecessary radiation dose to the patient. Film purchasing policy in Turkey and its potential effects on film quality have also been discussed in this thesis.

Thesis No.: 13 Estimation Of Cardiac Parameters Using the Thin Elastic Tube Model for Arteries.

Name: Mustafa Bodur, Year: 1986

Advisor(s): Yekta Ülgen

Abstract: Mathematical analysis of cardiovascular system is reviewed by considering the arterial segment as a thin plastic tube. Combination of fluid mechanics theory of elasticity are applied to the pulsating flow of blood thorough arteries. The flow is assumed to be laminar and axially symmetric. Classical Navier Stokes equations then enable us to derive the Bessel equation, so that the analytical solutions are easily accessible.With the help of polynomial approximations to the modified Bessel's functions, numerical values for velocity profiles and volume discharge, and finally cardiac pacemakers such as stroke volume, cardiac output, cardiac index, vascular resistance evaluated. Continuous measurement of blood pressure variations and electrical impedance are the necessary and sufficient data for running the computer program developed in chapter VI. Data obtained from a patient simulator is used to simulate the cardiac parameters on the computer.

Thesis No.: 12 A Computer Aided Biofeedback System.

Name: Melih Aybey, Year: 1986

Advisor(s): Albert Güveniş

Abstract: Biofeedback devices, unlike other medical devices, are not used in order to monitor a disordered physiological function. They are aimed to be used in training work to gain control over any physiological variable which may have no direct relation with the symptoms of the illness. This thesis reviews the theory and applications of biofeedback and presents an original design of a computerized biofeedback system (DBMI. The digital biofeedback monitor is a system which enables the therapist to analyze the data obtained during and after a biofeedback session by means of a digital computer. It can also be used by the patient for any kind of biofeedback treatment. Collected data related to the session can be stored onto a floppy disk for future references and analyses.

Thesis No.: 11 Applications Of Infrared Diode Laser in Medicine.

Name: M. Orhan İkiz, Year: 1986

Advisor(s): Selim Şeker

Abstract: The extensive therapeutic applications of infrared diode laser exposure have been known for several years. At first, there were attempts to use this new energy form in the most diverse pathological situations, acute or chronic, local or systemic, degenerative or inflammatory and in an almost infinite variety of medical fields from rheumatology to dentistry, from neurology to dermatology, from angiology to ear, nose and throat treatment. Recently, however, the therapeutic limitations of the infrared diode laser have been more precisely understood, while at the same time new prospects for its utilization have appeared. As we gradually come to understand its action mechanism, the laser beam have been applied more rationally to certain specific conditions.

Thesis No.: 10 EMG Pattern Classification Based on AR Modelling.

Name: Zeynep Erim, Year: 1986

Advisor(s): Bülent Sankur

Abstract: Myoelectric control of powered prostheses is a field of rehabilitation engineering that has received wide attention in the recent decades. In this thesis a historical perspective of the studies in the field is given. The physiological properties of muscles are reviewed. The linear models, algorithms for identifying model parameters, and basic pattern recognition considerations are outlined. A scheme to extract motion information from a single surface EMG channel is discussed. The results obtained in performance tests are given. Suggestions for future research topics are made. Major computer programs used are given in the appendix.

Thesis No.: 9 Magnetic Resonance in Medicine and Posibilities in Turkey.

Name: Hakan Zeytinoğlu, Year: 1985

Advisor(s): Necmi Tanyolaç

Abstract: Magnetic Resonance is a new diagnostic imaging method in medicine, although it has been used for a long time in other fields, including biology, chemistry and biochemistry. Magnetic Resonance Imaging or shortly MRI is based on the different behaviors of various atomic nuclei in the human body. A static magnetic field and a changing radio-frequency field are applied to the body of the patient. By using the echo signal from the tissues and processing it properly, one can obtain the image of the body on a given plane. Due to the metabolic structure of the tissues, different signals are obtained which are dependent on certain parameters like relaxation times T1 and T2. These acquired signals are then processed and developed to MR images by using different imaging methods. MR offers very good images with a very high resolution and the possibility of direct imaging from transaxial, coronal and sagittal planes which are not easily achieved in other imaging techniques. MR replaces Computed Tomography, conventional X-ray, nuclear imaging methods and others in many cases. Furthermore, the patient is fortunately protected from hazardous effects of those examination techniques. The installation of an MR system brings some difficulties that do not appear for other medical diagnosis systems. The solutions to these problems, however, are available to a target extend. MR can be made economically feasible although it has a fairly great overall cost including the capital and operational expenses. In this thesis, MR imaging is studied from different points of view. Its physical principles are given. Different measurement and image reconstruction techniques are discussed. The known medical applications of MR are also listed. A comparison between MR and other diagnostic modalities is done. Finally, a case study involving an eventual installation of an MR system in Turkey is presented. The feasibility of such a project is discussed.

Thesis No.: 8 Inventory Control in Clinical Engineering.

Name: Derya Göbelek, , Year: 1985

Advisor(s): Necmi Tanyolaç

Abstract: The purpose of the Equipment Control programming Biomedical Engineering is to optimize the safety, effectiveness, efficiency and economy of diagnostic, therapeutic and support equipment used for patient care. In this study, the concept of the Inventory Control, a subprogram of the Equipment Control Program, is investigated. An Inventory Control method, to be applied to the Ministry of Health and Social Aid (S.S.Y.B) hospital is determined. Finally, this method has been applied to the Şişli Etfal Hospital, İstanbul.

Thesis No.: 7 A Database Management System for Nuclear Medicine.

Name: Selim Dentes, Year: 1985

Advisor(s): Neil Miller

Abstract: The purpose of this thesis is to develop a databank of Nuclear Medicine activities in Turkey. Until recently, no databanks existed in any field in Turkey. This was because the available technology was insufficient to establish such databanks. As a result, obtaining specific information about a subject in any field was time consuming and expensive. However, today, the facilities exist to construct databanks and extensive work has been done to computerize and establish databanks of birth certificates, police records and other information. The purpose of this thesis is to establish such a databank in Nuclear Medicine. This system is meant to be used by all physicians (both Nuclear Medicine physicians and non- Nuclear Medicine ones), Nuclear Physicists, chemists, University Biomedical students and staff, equipment suppliers and government agencies. Primarily, it will be most helpful to physicians in the eastern part of Turkey, where Nuclear Medicine centers are not available and for physicians who can not follow the recent developments taking place in this field in Turkey. This thesis consists of two parts. The first describes the field of Nuclear Medicine. It has three sections. The first is a detailed description of the gamma camera, the second describes the isotopes and radiopharmaceuticals used in Nuclear Medicine imaging, and the third, Nuclear Medicine studies. The second part of the thesis describes the database manager program, PC-FILE III, used to organize the data collected from Nuclear Medicine centers. It also has three sections. The first section describes how the database was designed, i.e. file definitions, data collection and distribution between them are given. The second section discusses the use of the database manager, and the last provides a detailed report derived from the database. The thesis is concluded with examples of how the system is used, how it can be extended for future needs and the advantages and disadvantages of the system.

Thesis No.: 6 Establishing Biomedical Equipment Maintenance Programs for Hospitals in Turkey.

Name: Gülsüm Erdim, Year: 1985

Advisor(s): Neil Miller

Abstract: The function of a hospital is to meet the acute health needs of the community it serves. Biomedical instrumentation maintenance programs have been established to help hospitals meet these needs through the effective use of technology. These programs can be provided by both outside and in-hospital service organizations. In this study, the elements of an effective biomedical instrumentation maintenance program are presented, and various service options are discussed. In addition, data from service carried out in selected hospitals and original equipment manufacturer's representatives in Turkey are provided. In Turkey, there are fewer engineers and technicians in biomedical engineering discipline than are presently needed. There is only one Biomedical Engineering Institute at Boğaziçi University graduating Biomedical Engineers. Keeping this fact and the findings of the survey in account, "model" biomedical instrumentation maintenance programs for small, medium-sized and large hospitals in Turkey are developed. A case study related to establishing an in-hospital biomedical engineering department in Şişli Etfal Hospital is also presented. The proposed "model" biomedical instrumentation maintenance programs will help to provide safe, high quality medical care and effective cost control of this care.

Thesis No.: 5 Standards Of BM Devices in Foreign Countries and Turkey.

Name: Korhan Eryolalan, , Year: 1985

Advisor(s): Necmi Tanyolaç

Abstract: In this study, the standards and standardizing organizations of biomedical devices which are very important in healthcare are investigated. The regulations of biomedical devices in U.S.A, Canada and Europe countries are described briefly. In Turkey, T.S.E (Turkish Standards Institute) which is the only organization in standardization is described. The topics for Health Preparatory Group in 1985-1986 of T.S.E and the relevant standards until 1984 are investigated. The biomedical devices and the hospital equipment manufacturers are investigated. T.S.E Standards related to medical devices are given in tables. Finally, testing procedure on medical devices produced in Turkey and for imported ones are recommended.

Thesis No.: 4 Mechanoelectric Transduction: A review and Methodologic Approach to Explain the Phenomena.

Name: Mustafa Karamanoğlu, Year: 1985

Advisor(s): Yusuf. P Tan

Abstract: The phenomena of mechanical to electrical transduction is a common response of nervous tissue. In gathering information from environment these tissues are specialized to respond in a fashion like mechanical to electrical transducer. However, it has been demonstrated that this phenomena is related with the intrinsic behavior of membrane itself and observed in different membrane preparations. In this thesis a review of the phenomena and models proposed by other investigators is made and a model which seems to explain it is proposed. In order to test the predictions of model, an experimental setup and a methodological approach to conduct the experiment is presented and suggestions are made for future work on this subject.

Thesis No.: 3 Design and Instrumentation Of A Coronary Care Unit.

Name: Ari Kireçyan, Year: 1985

Advisor(s): Yorgo İstefanopulos

Abstract: In this study, the main principles that must be obeyed in the design and equipment selection of a coronary care unit are investigated along with the architectural steps which could be used in the establishment of such a unit. Information is given about the bedside monitors, central console monitors and other assisting devices which must be present in an optimal coronary unit (CCU). The operation principles of these devices are explained by means of block diagrams. The computerized forms of these units which are widespread in developed countries and their advantages are also explained. The characteristics that the hospital's electrical network must have in order for the desired CCU to be realized and the precautions to ensure patient, user and visitor safety are described. The coronary care unit in the Eftal Hospital, the Cerrahpaşa Hospital, the Haydarpaşa Göğüs Cerrahisi Hospital and in the Medical University of İstanbul Çapa Hospital which are functioning in İstanbul are investigated. Information is given about the existing design and some suggestions to solve the problems that arise are offered. In short, the major purpose of this thesis is to built up a source of information on how to realize a CCU design at optimal usefulness and efficiency, taking the economy and technical conditions of the country into consideration.

Thesis No.: 2 Biotelementry Systems and the Design Of a Low Cost Microprocessor Controlled Radiotelemetry System.

Name: M. Fatih Çolgar, Year: 1985

Advisor(s): Avni Morgül

Abstract: In this thesis, Biotelemetry systems are presented in general, with various coding systems that send different physiological signals. After that, a special Biotelemetry system is designed, to demonstrate how different methods are employed to solve problems, and the implementation of different blocks of a Biotelemetry system. As it can be seen on the following pages, the system designed for demonstration has different approaches to some well known subjects

Thesis No.: 1 Microprocessor Based Automated Arrythmia Monitoring System.

Name: Cüneyt Gemicioğlu , Year: 1984

Advisor(s): Yusuf. P Tan

Abstract: Heart disease is a major cause of death; therefore patients with heart problems, i.e. those who had myocardial infarction are kept under medical observation. Most commonly used method for such observations is the Holter method, which is a 24 hour continuous recording of the electrocardiogram. These recordings are later analyzed by cardiologists or computers, and the results obtained guide therapy applied to the patient. In this thesis a microcomputer based system which analyses electrocardiogram continuously, and records only the cardiac arrthymias detected. This system supplies immediate information to the cardiologist as well as being less expensive than other methods.