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Thursday, November 24, 08:00 - 09:30

Pharm: Opening Ceremony

Room: Mowlana Amphitheater

Thursday, November 24, 09:30 - 10:00

Pharm: Coffee Break 1

Room: Hall

Thursday, November 24, 10:00 - 11:30

Pharm: Keynote Speech 1

Dr. Mohammadreza Hashemi Golpaygani

Room: Mowlana Amphitheater

Thursday, November 24, 11:30 - 12:00

Pharm: ISBME Annual Meeting

Room: Mowlana Amphitheater

Thursday, November 24, 12:00 - 13:30

Pharm: Lunch

Room: Restaurant

Thursday, November 24, 13:30 - 15:30

Pharm: Panel 1

Room: Mowlana Amphitheater

Biomat (Pharm): Biomaterials

Room: Textile Amphitheater B

Chairs: Aliasghar Behnamghader (MERC, Iran), Afra Hadjizadeh (Amirkabir University of Technology, Iran), Mohammad taghi Khorasani (Iran Polymer and Petrochemical Institute, Iran)

Biomat .1 13:30 ***Evaluation of Physical Properties of Semi-thickness Skin, Acellular Dermis and Fascia as Biologic Skin Substitutes***

Farinaz Jonidi Shariatzadeh, Shirin Nour and Davoud Sadeghi (Amirkabir University of Technology (Tehran Polytechnic), Iran); Atefeh Solouk (Amirkabir University of Technology, Iran)

Nowadays, biologic skin substitutes are used extensively in the treatment of skin injuries and burns. These substitutes have many advantages like accelerating the healing process with the acceptable final appearance of the healed skin. Evaluating the physical and mechanical properties of these biological products is important to their clinical success. In this paper, physical and mechanical properties of some biologic skin substitutes including semi-thickness skin allograft, acellular dermis, and fascia were studied. All of the samples showed porous structures and viscoelastic behavior. The results indicate that semi-thickness skin has the highest mechanical strength. On the other hand, acellular dermis and fascia represent good water vapor transmission and water uptake capacity, respectively. In conclusion, the findings suggested that fascia is a more efficient wound dressing for managing wound exudates and the semi-thickness skin can be used for the treatment of high-tension wounds.

pp. 1-6

Biomat .2 13:50 ***Restoring Elastic Properties of Breast Cancer Cells by EGFR Targeting: Atomic Force Microscopy Measurement***

Shohreh Azadi and Mohammad Tafazzoli-Shadpour (Amirkabir University of Technology, Iran); Ramin Omidvar (AmirKabir University Of Technology, Iran); Mahdi Habibi Anbouhi (Pasteur Institute of Iran, Iran)

Loss of mechanical properties and decrease of Young's Modulus is a common characteristic of many cancerous cells. This alteration lead to cancer progression due to relation of cell mechanical properties to important biological activities such as motility and migration. Thus, restoring cell mechanical properties of tumor cells may contribute to controlling cancer cell progression. In this study, we used Lapatinib, a small molecule for inhibiting EGFR over-activity in cancer cells, to treat SKBR3 breast cancer cells. The cancer cell elasticity was evaluated before and after treatment using atomic force microscopy. Results indicated significant increase of Young's Modulus in treated cells. Cytoskeleton analysis also showed an increase in actin cytoskeleton in Lapatinib- treated cells. Our data suggest that restoring cell mechanical properties of cancer cells through change in Young's Modulus and actin cytoskeleton, have potential to control cancer development.

pp. 7-10

Biomat .3 14:10 ***Performance Evaluation of Dopamine Electrochemical Sensor in Presence of Uric Acid, Ascorbic Acid and Serotonin as Interferer Agents***

Hosna Tavakoli (Neuroscience Research Center-Neuroelectromagnetic Section-Baqiyatalah University, Iran); Alireza Montazeri (Faculty Of Basic Sciences, Islamic Azad University, Science and Research Branch Tehran, Iran); Hassan Tavakoli (Neuroscience Research Center-Neuroelectromagnetic Section-Baqiyatalah University Of Medical Sciences, Iran)

Pharm

For evaluation of interferer effect of uric acid, ascorbic acid and serotonin in dopamine measurement, an electrochemical sensor was constructed. For this purpose, a glassy carbon electrode; GCE, was electrochemically oxidized by cyclic voltametry. Cyclic Voltametry was performed in acid sulfuric solution (0.1 mol.l-1 H2SO4), consequently, functional groups were activated on the surface of GCE. At next stage, various concentration of dopamine was measured in presence of constant concentration of interferers. For evaluation of sensor performance, cyclic voltametry was performed and anodic and cathodic peak currents were considered as sensor response. The results were shown that the voltage peaks of dopamine and serotonin were separately happened at 0.54 and 0.34 volts, respectively. As a result, the proposed sensor could successfully determine dopamine and serotonin, simultaneously. In addition according to this study, uric acid and ascorbic acid could not affect the performance of constructed sensor.

pp. 11-15

Biomech 1 (Pharm): Biomechanics

Room: Bahman Amphitheater

Chairs: Farzam Farahmand (Sharif University of Technology, Iran), Mohammad Haghpanahi (Iran University of Science and Technology, Iran), Mehdi Navidbakhsh (Iran University of Science and Technology, Iran)

Biomech 1.1 13:30 ***An Instrumented Electromechanical Apparatus for Mechanical Characterization of Human Hand Palm Soft Tissue***

Behzad Seyfi and Nasser Fatouraee (Amirkabir University of Technology, Iran); Mahdi Alizadeh vaghasloo (Tehran University of Medical Science, Iran); Ehsan Hamidi (Amirkabir University of Technology, Iran)

Pharm

Our hands perform different actions from extremely delicate and accurate actions to heavy labor. While several studies have been conducted for mechanical characterization of different biological tissues, only little information is available on the mechanical properties of human hand palm. In this paper electromechanical apparatus is introduced for mechanical testing of human hand palm based on flat punch indentation approach. The proposed system has capabilities of performing different mechanical experiment procedures such as compression, tensile, stress relaxation and indentation. The flat punch hand palm indentation experiments conducted on twenty objects. The experimental data are fitted to well-known viscoelastic rheological models including double Maxwell-whichert (DMW) and triple maxwell-wichert (TMW) models.

pp. 16-20

Biomech 1.2 13:50 ***The Effects of Pre-Indenting Load on Mechanical Response of Bovine Meniscus***

Behzad Seyfi and Milad Imeni (Amirkabir University of Technology, Iran); Elham Karami (University of Western Ontario, Canada); Nasser Fatouraee (Amirkabir University of Technology, Iran)

Pharm

Indentation test has been accepted as one of the most effective and simple implemented methodologies for mechanical characterization of the different biological tissues. However, there are different challenges in practical implementation of indentation test. Tissue preconditioning is a kind of experimental difficulties which can influence the characterization results considerably. In other words, there is no explicit expression for different preconditioning phenomena such as dynamic loading, loading rate and loading depth in an indentation test. However, indentation test benefits cause to absorb the attention of several research groups with different study fields. This paper presents a structural study to investigate the effect of preload on mechanical characteristics of meniscus tissue. In this regard, bovine medial meniscus sample has been modeled based on meniscus internal structure. Flat punch indentation tests conducted on meniscus samples considering different values for pre-indenting force as a precondition. The experiments procedures are simulated based on axisymmetric finite element model. In order to obtain constitutive parameters, the experimental data fitted to proposed constitutive model.

pp. 21-25

Biomech 1.3 14:10 ***Viscoelastic Behavior of Human Tracheal Cartilage***

Farzaneh Safshekan and Mohammad Tafazzoli-Shadpour (Amirkabir University of Technology, Iran); Majid Abdouss (Amirkabir University Of Technology, Iran); Mohammad B Shadmehr and Fariba Ghorbani (Shahid Beheshti University of Medical Sciences, Iran)

Pharm

The respiratory function of trachea depends on its mechanical performance, being most affected by the mechanical properties of tracheal cartilage, as a rigid tissue which prevents the tracheal collapse in response to negative respiratory pressures. Determining the mechanical properties of trachea and therefore tracheal cartilage would be of great significance for future attempts to fabricate tracheal implants or tissue engineering scaffolds. Unlike the equilibrium mechanical properties of tracheal cartilage which have been well investigated, its viscoelastic behavior has not been previously examined. In this study, after harvesting human tracheal samples from brain-dead patients and subsequent preparation of cartilaginous specimens, the viscoelastic behavior of tracheal cartilage was assessed based on stress relaxation tests at two strain levels of 5% and 10%. Assuming the viscoelastic linearity for tracheal cartilage, 2-, 3- and 4-term Prony series were used to fit the average relaxation data. We also compared the results according to the age and gender of the patients. The 4-term Prony series was selected to describe the relaxation behavior of tracheal cartilage. According to the results, cartilage samples of old patients were stiffer than those of the young cases, however we observed no significant effect of gender of the patients on the stress relaxation behavior of tracheal cartilage. The results of this study can be useful in better understanding the mechanical properties of human trachea and developing treatments for tracheal defects, such as tissue engineering.

pp. 26-29

BIP 1 (Pharm): Biomedical image processing

Room: Textile Amphitheater A

Chairs: Amir Hossein Foruzan (Shahed University, Iran), Mohammad Kayvanrad (Amirkabir University of Technology, Iran), Hamid Soltanian-Zadeh (University of Tehran, Iran)

BIP 1.1 13:30 ***Structural Connectivity of Temporal Lobe Structures Detects Temporal Lobe Epilepsy***

Nayereh Ghazi and Hamid Soltanian-Zadeh (University of Tehran, Iran)

Temporal lobe epilepsy (TLE) is the most common form of adult epilepsy. Detection of TLE from neuroimaging data is a challenging task. In many cases, patients with findings from standard clinical examination do not show any identifiable abnormalities in magnetic resonance imaging (MRI). In this study, we propose a method to detect TLE, using an integration of diffusion tensor imaging (DTI), graph theory analysis, and machine learning tools. To this end, first, we apply probabilistic tractography to extract white matter fibers and generate weighted structural connectivity graphs of 17 TLE patients and 17 healthy control subjects. Machine learning of graph theoretical measures are then used to classify TLE patients and control subjects. Using leave-one-out cross validation, we show that graph theory measures used in logistic regression classifiers achieve an accuracy in the range of 76% to 91% for the classification of the 34 subjects into the TLE and control groups. The results suggest that machine learning of the graph theoretical metrics derived from DTI-based networks may be used for the diagnosis of TLE patients. Such a method may improve diagnostic assessment, especially in patients without obvious abnormalities in the conventional, anatomical neuroimaging examinations.

pp. 30-34

BIP 1.2 13:50 ***Classification of Alzheimer's Disease and Mild Cognitive Impairment: Machine Learning Applied to rs-fMRI Brain Graphs***

Soroosh Golbabaei (University of Tehran, Iran); Amirali Vahid (Uniersity of Tehrran, Iran); Javad Hatami (Tehran University, Iran); Hamid Soltanian-Zadeh (University of Tehran, Iran)

A growing number of studies use resting state functional magnetic resonance imaging (rs-fMRI) to investigate functional alterations in Alzheimer's disease (AD) and Mild cognitive impairment (MCI). In this study, we evaluate the effectiveness of graph theory and machine learning in the diagnosis of AD and MCI at the subject level. Moreover, we explore the effect of different methods of graph construction on the classification accuracy. To this end, the rs-fMRI data from 32 AD, 76 MCI, and 46 healthy elderly subjects are used along with three different connectivity measures: Pearson correlation, bend correlation, and mutual information. Both weighted and binary graphs are created for each subject at different density ranges. Based on each, various graph measures have been extracted. Finally, sequential floating forward selection and support vector machine is utilized. Our results suggest that bend correlation is more effective in the classification of AD and MCI. Moreover, weighted graphs and lower density ranges increase accuracy. Finally, bend correlation along with the weighted graph and density threshold of 10% generate the highest accuracy (93%). This study concludes that rs-fMRI and graph theory may provide a non-invasive means for the diagnosis of AD and MCI.
pp. 35-40

BIP 1.3 14:10 ***Network Based Analysis of Cognitive Related Resting State Networks in Alzheimer's Disease***
Soroosh Golbabaei (University of Tehran, Iran); Javad Hatami (Tehran University, Iran); Hamid Soltanian-Zadeh (University of Tehran, Iran)
Alzheimer's disease (AD) is accompanied by a widespread disruption of neural pathways. This in turn leads to alterations in functional brain networks and a progressive decline in cognitive functions. Despite the success of previous studies in detecting topological alterations in the AD brain, few studies have investigated networks that are related to decline of different cognitive functions in AD, with regard to disconnections and compensatory mechanisms. In this study, we adopted network based statistics (NBS) and resting state functional magnetic resonance imaging (rs-fMRI) in order to find alterations in the functional network and explore networks that are correlated to decline in four cognitive domains. To this end, NBS was applied to the rs-fMRI data and four Montreal cognitive assessment sub-scores of 30 AD patients and 34 healthy subjects. Our results suggest the loss of connections between regions of frontal lobe and two other lobes of temporal and parietal. Moreover, cognitive deficits are in line with changes in the resting state network such as thinning effect and disconnection.
pp. 41-46

BIP 1.4 14:30 ***Improvement of Flexible Design Matrix in Sparse Bayesian Learning for Multi Task fMRI Data Analysis***
Safoura Shahin (Isfahan University of Technology, Iran); Farzaneh Shayegh (Payam-Noor University); Sepehr Mortaheb and Rassoul Amirfattahi (Isfahan University of Technology, Iran)
Detecting the active regions of the brain during cognitive functions is one of the important problems in cognitive neuroscience and disorder diagnosis. One of the promising approaches to solve this problem is to use General Linear Model (GLM) in functional Magnetic Resonance Imaging (fMRI) data. The main difficulty of the GLM method is to determine a flexible design matrix to model mentioned problem appropriately. In this paper, an approach to the critical construction of a flexible design matrix for precise detection of active regions of the brain, according to response in synthetic fMRI data based on GLM is presented. Should the design matrix is accurate, the next detection algorithm can extract a correct response from a very low signal to noise ratio (SNR); therefore, the presented design matrix is flexible to eschew over fitting and capture unfamiliar slow drifts. Using a sparse Bayesian learning method, some specific regressors are selected for flexible design matrix. Results show clearly prominent performance of suggested algorithm rather than conventional t-test methods and other conventional Bayesian analysis of fMRI data.

Presenter bio: I'm a master student in Electrical engineering department of Isfahan University of Technology. My master thesis is defined based on brain modeling and fMRI signal processing.

pp. 47-52

BIP 1.5 14:50 ***Brain Segmentation is More Accurate If Scan Time is Optimized for Quantitative Rather Than Conventional Magnetic Resonance Imaging***
Amin Zeighami and Mohammad Kayvanrad (Amirkabir University of Technology, Iran)
Segmentation of MR brain images into white matter (WM), gray matter (GM) and cerebrospinal fluid (CSF) compartments has many clinical applications from measuring and visualizing these tissues and their pathological changes to surgical planning and image-guided interventions. We introduce a new framework for brain tissue segmentation which benefits from quantitative MRI (qMRI) advantages. We use multi-label graph-cuts algorithm. We use seed pixels provided by the user to construct the regional bias term of the energy function. Photo-consistency energy is defined to prefer a labeling consisting of smoother regions. We segment 11 representative slices of a whole-brain T1 map from one healthy volunteer scan into WM, GM and CSF. We also segment the two conventional images required for computation of the map, using similar photo-consistency and seed formulation. One-sided two-sample t-test demonstrates significant (α=0.05) improvement ($p=0.00001<\alpha$ for WM, $p=0.00002<\alpha$ for GM, and $p=0.00017<\alpha$ for CSF) in Dice Coefficient (DC) achieved for the quantitative maps (DCwm=0.8785, DCgm=0.8582, and DCcsf=0.7709) with respect to the conventional images (DCwm=0.6274, DCgm=0.4545 and DCcsf=0.6245). This justifies the extra scan time required for T1 mapping. Thus, we have shown that if MR scan time is planned for a quantitative acquisition as opposed to conventional weighted imaging, superior brain visualization and segmentation is achieved.

Presenter bio: I have my BS in electrical engineering from Shahid Beheshti University, Tehran, Iran. I am currently a graduate (MS) student of biomedical engineering in Amirkabir University of Technology, working on MR imaging and image processing as a member of the medical imaging lab.

pp. 53-58

BSP 1 (Pharm): Biological signal processing

Room: Fajr Amphitheater
Chairs: Mh Moradi (Amirkabir University of Tech, Iran), Ali Motie Nasrabadi (Shahed University, Iran)

BSP 1.1 13:30 ***Brain Computer Interface Design and Implementation to Identify Overt and Covert Speech***
Milad Amani Arjestan (K-N- Toosi University of Technology, Iran); Mansour Vali and Farhad Faradji (K. N. Toosi University of Technology, Iran)
Brain computer interface based-on silent speech decoding from electroencephalography signal is one of the purposes of this article. Brain computer interface help the patients with locked-in syndrome to communicate with the world around them. In addition to the silent speech decoding from electroencephalography, also overt and semi-overt speech decoding from electroencephalography have been investigated. The collected data includes three syllables (/ka:/, /fi:/ and /su:/), 6 vowels (/æ/, /e/, /au/, /a:/, /i:/ and /u:/) and resting in Persian. Database was collected based on 3 protocols from 5 subjects. The 3 protocols are including overt speech without vibration of the vocal cords, semi-overt speech (vocal track forming without pronouncing) and covert (silent) speech. Feature vectors include empirical mode decomposition combinations with common spatial patterns filters, were extracted from electroencephalography signals. Classification done by non-linear support vector machines. There was a significant difference between the results of extraction 5 feature vectors include energy, variance, zero crossing rate, skewness and kurtosis against the only variance feature vector from the common spatial patterns filtered data (on average and p-value $\leq$ 0.05, about 3% accuracy improvement). There was no significant difference between the results of vowels and syllables databases. There was also no significant difference between the results of three protocols, which indicates adequacy and advantage of the "covert speech" protocol.
pp. 59-63

BSP 1.2 13:50 ***Effective Connectivity Measuring of ERP Signals in Recognition Memory Process by Generalized Partial Directed Coherence***
Mohammad Javad Darvishi Bayazi and Ali Motie Nasrabadi (Shahed University, Iran); Tim Curran (University of Colorado at Boulder, Iran)
Various processes occur in recalling in brain and it is necessary to investigate memory brain function. Dual process theory separates recollection from familiarity in recognition memory. By comparing individuals with respect to normal state and with impairment, one can understand performance of memory. Comparison of two conditions infers that particular brain mechanism is being affected from impairment. In this study, we use the data in which recollection has been affected more than familiarity by midazolam drug. To investigate this difference, connectivity between regions is estimated. Multivariate autoregressive models (MVAR) is used for determination of Granger causality to estimate effective connectivity in time-frequency domain. In this regard, we use GPDC method. Results show specific connectivity between parietal and frontal that is evidence of recollection to continue process and familiarity compensation in failing of recollection.
pp. 64-68

BSP 1.3 14:10 ***Nonlinear Granger Causality Using ANFIS for Identification of Causal Couplings Among EEG/MEG Time Series***
Mona Farokhzadi (School of Electrical and Computer Engineering, University of Tehran, Iran); Hamid Soltanian-Zadeh and Gholam Ali Hossein-Zadeh (University of Tehran, Iran)
Identifying the causal couplings among EEG/MEG time series is an important problem in the neuroscience field. For linear stochastic models, Granger causality (GC) is used as a simple concept to explore such interactions. In this paper, we extend GC concept to a nonlinear version based on the Adaptive Neuro Fuzzy

Inference System (ANFIS) and propose a new effective connectivity measure (ANFISGC) with capability in detecting linear and nonlinear causal information flow between time series. We applied the proposed method to the simulated datasets and compared its performance with the classic Linear Granger Causality (LGC). In a linear (AR) simulation model, LGC performs the same as ANFISGC but in the case of nonlinear models, ANFISGC outperforms LGC.
pp. 69-73

BSP 1.4 14:30 ***Analysis of Brain Connectivity Patterns in Autistic Children During Watching Emotional Faces***
Vida Mehdizadehfar (Amirkabir University Of Technology, Iran); Farnaz Ghassemi (Amirkabir University of Technology, Iran); Ali Fallah (Amirkabir University of Technology & Amirkabir, Iran)
Autism is a neurodevelopmental disorder that changes the normal brain function. Several studies have reported that the patterns of brain connectivity in autistic and healthy individuals are different. In this paper the effective connectivities of autistic and healthy children were measured through Granger Causality and then applied as discriminant features to separate the two groups. To estimate the connectivity, EEG signals of six autistic children and 12 healthy ones (7-10 years old) were recorded in different emotional states (eyes- closed, eyes-open, watching happy, sad and neutral faces). Using the Granger based connectivity features and SVM classifier, the recognition rates in states of eyes-closed, eyes-open, happy, sad and neutral, were obtained 87.6%, 89.4%, 86%, 91.9%, and 83.1%, respectively. Discrimination of autistic and healthy children in different emotional states, is improved using Granger causality-based connectivity features. This is due to consideration of temporal changes of all channels in measuring connectivity between two particular channels. This improvement is more evident in the sad emotional state.
pp. 74-78

BSP 1.5 14:50 ***Spatial Filter Bank Based on Probabilistic Common Spatial Pattern in Motor Imagery BCI Systems***
Asghar Zarei and Farnaz Ghassemi (Amirkabir University of Technology, Iran)
Recently, Motor Imagery (MI) based on Brain Computer Interface (BCI) systems have been noticed for neuro-rehabilitation methods. The challenging key is to correct detection of MI tasks. Probabilistic Common Spatial pattern (P-CSP) is the most recent and effective method for discriminating two classes of electroencephalogram (EEG) from Motor Imagery (MI) Task. P-CSP resolves the overfitting which is the main issue of spatial filters. The accuracy of true detection tasks is related to some initial values, like the number of sources. In this paper, we generate a feature set by extracted features of each unique filter and select discriminant features by sparse dictionary learning method. Optimal sparse regularization parameter is selected by cross-validation on training data and the maximum accuracy with the corresponding parameter is reported for each subject. The performance of the proposed method is evaluated on publicly available BCI Competition IV dataset 2a to detect two pair classes. Our results have been compared with P-CSP, by sweeping the Best number of source and using automatic selection methods. The results show that sparse features selection from feature set outperforms the existing P-CSP in terms of classification accuracy, and reduces the computational time of selecting the best number of the sources by sparse selection.
pp. 79-83

Thursday, November 24, 15:30 - 16:00

Pharm: Coffee Break 2

Room: Hall

Thursday, November 24, 16:00 - 18:00

Pharm: Panel 2

Room: Mowlana Amphitheater

Bioelec (Pharm): Bioinformatics/Bioinstrumentation/ Telemedicine

Room: Textile Amphitheater B
Chairs: Farnaz Ghassemi (Amirkabir University of Technology, Iran), Vahid Reza Nafisi (Research Organization for Science and Technology, Iran)

Bioelec.1 16:00 ***Causal Inference of Gene Expression Data Using a Clustering-based Extension of Kernel-Granger Causality***
Fateme Nateghi Haredasht and Farnaz Ghassemi (Amirkabir University of Technology, Iran); Mh Moradi (Amirkabir University of Tech, Iran)
Detecting causal relationships between time series data has been widely studied in many areas, including biology, neuroscience, economics, and climatology. One of the most popular causality inference methods is Granger causality approach that is a linear regression based model for determining whether one time series is useful in forecasting another, which cannot truly reveal nonlinear effects in the data. Different extensions of Granger causality have been proposed for nonlinear dynamics of the time series data, which have problems in detecting false discoveries. Recently the properties of kernel algorithms have been used to provide nonlinear measures of bivariate Granger causality. Real biological datasets have a significant problem which is about the big numbers of genes. However, the time steps in the dataset are very short. Due to this problem, the most algorithm in inferring nonlinear causal relationships would fail. In this paper, we propose a new method that deals with this high dimensionality problem and reduces the size of data. In this method, we cluster the hole data using hierarchical clustering with Euclidian Distance measure. Afterwards, we apply Kernel-Granger causality to a reduced real biological dataset (yeast metabolic cycle gene expression data) to infer causal network.
pp. 84-88

Bioelec.2 16:20 ***Contribution of Reflex Hyper-excitability to Muscle Stiffness in Children with Cerebral Palsy***
Shokoofeh Parvin, Meysam Mansouri, Saba Amiri and Hengameh Marzbani (Tehran University of Medical Sciences, Iran); Mohamad Reza Kharazi (Azad Islamic University of Science and Research Branch, Iran); Mehdi Mirbagheri (Tehran University of Medical Sciences, Iran)
We aimed to investigate the contribution of reflex hyper-excitability to muscle stiffness in children suffering from cerebral palsy. To address this major controversial clinical issue, we studied the relation between the sonoelastography image and the Hoffman reflex (H-reflex) of lower limb muscles in fifteen children with spastic hemiplegic cerebral palsy. Muscle stiffness was quantified using the sonoelastography images of the affected ankle plantar-flexor muscles. The major parameters were autocorrelation, variance, difference entropy, energy, and histogram ratio. Hyper-excitability of stretch reflexes was evaluated using H-reflex responses of the ankle plantar-flexors. The important features were peak-peak amplitude of maximum H response, maximal M-wave, H/M ratio, latency of H, M, the time interval between H and M, and the stimulus intensity elicited max-H and max-M. The correlations between the major parameters quantifying sonoelastography images and H-reflex responses were calculated using Pearson-correlation analysis. The correlation analysis showed a relation between two features of sonoelastography images (i.e. autocorrelation and variance) and the maximal H/M ratio of the H-reflex response. These findings indicate that an abnormal increase in muscle stiffness, which typically occurs in CP patients, is at least partially due to hyper-excitability of reflexes. The clinical implication is that abnormal reflex responses may play a significant role in neuromuscular abnormalities, which are caused by spasticity in children with cerebral palsy.
pp. 89-92

Bioelec.3 16:40 ***A Low Cost, Efficient Method for Chip Fabrication in Cell Analysis***
Ali Rahmani, Aliasghar Mohammadi and Hamidreza Kalhor (Sharif University of Technology, Iran)
In recent decades, dielectrophoresis due to its high efficiency has been exploited widely in separation and manipulation of bioparticles. In the present work, a simple, low-cost, and efficient procedure for fabrication of microfluidic chips applied in medicine and biochemistry has been presented. In this method, electrodes are not in direct contact with biological samples which results in elimination of difficulties with conventional systems. Efficiency of the designed system has been evaluated by injecting samples containing yeast and Ecoli cells into the system and analyzing their trajectory. Experimental results demonstrate that precise adjustment of voltage and frequency can lead to the desired separation in this system.
pp. 93-96

Bioelec.4 17:00 *A Novel Microfluidic Design for Blood Plasma Separation*

Sajad Razavi Bazaz, Ali Abouei Mehrizi and Alireza Zabihi Hesari (University of Tehran, Iran)

one of the most crucial materials used in detection and diagnosis field is blood. The effects of blood components on the diagnosis process are significant. To avoid the disturbance of the experiments, the first step of blood analysis is to separate plasma from blood. Two dominant factors influence on this procedure are blood plasma skimming and Zweifach-Fung effect. In order to evaluate the separation device, two major criteria including separation and purity efficiency are introduced. The main drawback of these two factors is that they have reverse effect on each other which means that correcting one of them have destructive effect on the other one. Therefore, a trade-off between them should have happened. In this study, a novel microfluidic separation device is designed based on momentum definition and acceleration-deceleration effect. The computational CFD package, Ansys Fluent is used to simulate and solve this study. The Lagrangian approach is utilized for particle trajectory and the effect of the forces acting on each blood cell is considered. The results are then analyzed and shown that by using momentum and acceleration-deceleration effects, the purity efficiency would be increased by 15% with the same separation efficiency as before which was 70% on the average flow rate of 100 µl/min, approximately and it is completely providing for future use of this kind of device.

Presenter bio: Biomedical engineering in Tehran University

pp. 97-101

Bioelec.5 17:20 *Towards Smart eHealth in the Ultra Large-scale Internet of Things Era*

Fadi M. Al-Turjman (Middle East Technical University, NCC, Turkey)

Recent research endeavors are capitalizing on the real-time facial disorders detection (RFDD) to utilize available privet/public cameras installed at hospitals' entrances and smart-city streets. These cameras can take images of the infected faces and process it over the free WiFi services which are available everywhere in the Internet of Things (IoT) era. Identifying facial disorders is often subjective and currently done by expert dermatologists. However, with the advances in the IoT enabling technologies and image processing techniques, it is now possible to quantify facial skin disorders using digital photographs in real-time applications. In this paper, we propose a novel real-time approach for abnormal facial regions detection and segmentation over the IoT technology. Achieved results assure our approach superiority in identifying abnormal regions in comparison to existing classical (traditional) approaches. It outperforms traditional approaches in terms of accuracy and time complexity, which makes it a potential candidate for online emergency/urgent cases.

Presenter bio: Fadi Al-Turjman is associate professor at METU University, Northern Cyprus Campus. He is working in the area of wireless networks architectures, deployments, and performance evaluation. Dr. Al-Turjman obtained his Ph.D. in Computer Science from Queen's University in 2011. He received his bachelor (honors) and master (honors) degrees in computer engineering from Kuwait University in 2004 and 2007, respectively. Since 2011, he is a research and teaching associate at Queen's University. He has authored and/or co-authored more than 60 reputable journal and international conference papers, in addition to chairing a number of workshops in international symposia and conferences; including the IEEE WLN in LCN 2012 and 2013, and the IEEE G-IoT in GLOBECOM 2012.

pp. 102-105

Biomech 2 (Pharm): Biomechanics

Biofluid Mechanics

Room: Bahman Amphitheater

Chairs: Nasser Fatouraee (Amirkabir University of Technology, Iran), Malikeh Nabaei (Amirkabir University of Technology, Iran)

Biomech 2.1 16:00 *The Effect of the Ureterovesical Junction on Urinary Peristaltic Flow*

Atabak Eghbal (Amirkabir University Of Technology, Iran); Aisa Rassoli (Amirkabir University of Technology); Nasser Fatouraee (Amirkabir University of Technology, Iran)

Pharm

Vesicoureteral reflux (VUR), or the reversed flow of urine from the bladder into the ureter, is an anatomic and functional disease that can result in serious misery, both from intense infection and from sequelae of reflux nephropathy. Therefore a valve mechanism is created to defend the flow from retrograding. The objective of this study was to inspect the response of the ureteric flow to the closure of ureterovesical junction (UVJ) with the aim of explicating the valve mechanism of UVJ anti reflux. In this study the navier-stokes equations were used for the fluid domain. Also the peristaltic motion was constructed using a moving obstruction on the wall which was assumed to be rigid. This model was solved by varying the minimum lumen cross-section (orifice opening) area, the pressure difference between the bladder and the renal pelvis, and the average velocity of the peristaltic wave. The results corresponding to the anti-relflux ureteral valve mechanism exhibited that its existence was essential, and therefore the pelvis was secured of the reflux. Also the results demonstrated that the ureteropelvic reflux decreased as the bolus became larger.

pp. 106-110

Biomech 2.2 16:20 *Urine Concentrating Mechanism Modelling in Rat Kidney Inner Medulla*

Soroosh Sanatkhani (Sharif University of Technology, Iran); Mohammad Said Saidi (Department of Mechanical Engineering, Sharif University of Technology, Iran); Mohamad Hosein Banazadeh (Sharif University of Technology, Iran)

Pharm

Physicians use charts that are prepared by experiments on animals or humans to prescribe drug dosage for patients. This method requires some precious amount of time by the Ministry of Health to approve new drugs to be used in health-care centers. Three-dimensional modeling of the inner medulla by considering the known physiological features help us to predict the distribution of a drug or any minerals in the kidney. In this study we present modeling of the important species distribution including Na¬¬¬+ and urea in the rat inner medulla that influence the urine concentrating mechanism. We use a C++ code to develop the inner medulla geometry based on physiological data to better capture the concentrating mechanism. Features such as tubules variable diameters, pre-bend length and tubules' lateral distance relations have been considered in generating the geometry. Next, a CFD study is done to simulate the concentration of urea and Na¬+ along the corticomedullary axis using boundary conditions from the previous study on outer medulla for the inner medulla base. Results show a dramatic increase in concentration of the collecting ducts near the tip of the papilla. Concentration of urea and Na+ in the interstitium along the corticomedullary axis at different segments demonstrate an analogous pattern to the three-dimensional position of the different types of tubules with respect to each other that indicates the significance of the three-dimensional modeling in this simulation.

pp. 111-116

BIP 2 (Pharm): Biomedical image processing

Room: Textile Amphitheater A

Chairs: Hamid Abrishami Moghadam (in K.N.Toosi University of Technology, Iran), Abbas Nasiraei moghaddam (Amirkabir University of Technology, Iran)

BIP 2.1 16:00 *Estimation of Brain Tumour Volume Using Expanded Computed Tomography Scan Images*

Hayder Saad Abdulbaqi (Universiti Sains Malaysia (USM) & University of Al-Qadisiya, Malaysia); Mohd Zubir MatJafri and Kussay N. Mutter (Universiti Sains Malaysia, Malaysia); Zuhair Al-Khafaji (Al Diwaniya Teaching Hospital Iraqi Ministry of Health, Iraq)

A brain tumour is a growth of cells in the brain that multiplies in an abnormal and uncontrollable way. The estimation of brain tumour volume is important for diagnosis and treatment process. The computed tomography is one of the most important devices used for detection, diagnosis, and volume estimation of the brain tumour. The most common disadvantage of this device is the high radiation dose that the patients expose to. Therefore, this paper presents a new method to expand the number of slices based on creating a new slice using the mean between two successive slices. Then the volume of the brain tumour has been estimated depending on the proposed method. The last stage is the validation of the results using two methods rely on the same sample (validated slices), as well as the use of the statistical method using texture feature. The result shows that the average correlation between the original slice and the created slice is 93%.Thus, the proposed method reduces the patients' exposure to radiation dose, as well as reduces time, energy and cost.

Presenter bio: Hayder Saad Abdulbaqi was born in 1974, and grew up in Iraq. He earned degrees in Physics from Tikrit University, and he has worked as a lecturer since 1998. In 2012 came to Malaysia to study PhD in School of Physics in USM university

pp. 117-121

BIP 2.2 16:20 ***Retinal Optic Disk Segmentation and Analysis in Fundus Images Using DBSCAN Clustering Algorithm***

Golnoush Hamednejad (Najafabad Branch, Islamic Azad University, Iran); Hossein Pourghassem (Islamic Azad University Najafabad Branch (IAUN), Iran)

The Optic Disk (OD) detection as an important part of the retinal images are considered for diagnosing the some diseases such as diabetic retinopathy, high blood pressure and hemorrhages also for exudes analyzing. In this paper, a novel method for optic disk detection and segmentation is proposed based on the modified clustering algorithm. In our method, at first step by applying the masking procedure on the image, the candidate of ROI for region of optic disk is obtained. This ROI is improved with the combinational filtering. The improved sub image for convenient presentation is converted to the LAB color space. The Density-Based Spatial Clustering of Applications with Noise (DBSCAN) algorithm is used. In this clustering method with employing the square kernel with optimized parameters, the modified DBSCAN clustering is attained for the OD segmentation and recognition. Finally, for evaluating the proposed algorithm, several measures based on the structural content, similarity criterion and MSE of segmented images are computed. With this algorithm, the OD is finally segmented with the precision rate of 87.58% and the averaged variance of 0.0206 for the segmentation errors.

pp. 122-127

BIP 2.3 16:40 ***Automatic Zone Identification in Blood Smear Images Using Optimal Set of Features***

Mostafa Jahanifar and Meisam Hasani (NRP company, Tehran, Iran); Seyed Jamal Khaleghi (NRP Company, Tehran, Iran)

Visual assessment of peripheral blood smears is an important diagnostic approach in the hematology. The first step in such analysis is to identify the appropriate regions on the slide for screening. However, observing numerous samples of blood slides under the microscope by a hematologist is a very slow, inconsistent and exhausting job that raises the error possibility. Digital microscopes with the help of image processing techniques can do this procedure automatically. We proposed an algorithm to automatically classify smear images into "Good", "Clumped" or "Sparse" regions. We first segment the cells using an adaptive thresholding technique and then extract their central zone using two different approaches, then a total of 24 features is extracted from the segmented regions, three of them are newly introduced to better quantify the cell spreading and clumping. Unlike the other studies, to elevate the classification results we select an optimal subset of features through feature selection experiments. The experimental results on 2400 blood smear images show average classification accuracy of 98.5%. Also, sensitivity and specificity for finding "Good" working areas are gained to 97.6% and 99.0%, respectively. In comparison with the most state-of-the-art algorithms, our approach improves the evaluation measures and computation time dramatically.

pp. 128-133

BIP 2.4 17:00 ***A General Algorithm for Automatic Lesion Segmentation in Dermoscopy Images***

Neda Zamanitajeddin and Babak Mohammadzadeh Asl (Tarbiat Modares University, Iran)

Melanoma is one of the most dangerous types of skin cancer and causes thousands of deaths worldwide each year. Recently dermoscopic imaging systems have been widely used as a diagnostic tool for melanoma detection. The first step in the automatic analysis of dermoscopy images is the lesion segmentation. In this article, a novel method for skin lesion segmentation that could be applied to a variety of images with different properties and deficiencies is proposed. After a multi-step preprocessing phase (hair removal, illumination correction, etc.), a robust histogram-based thresholding technique is used to obtain an initial mask of the lesion. The initial mask is used to sample the lesion's color and drive a contour propagation algorithm. A color probability map of the image is calculated based on sampled pixels and Bayesian classification. Using this probability map and image gradient, a novel dual-component speed function is constructed to improve the performance of propagation model. The proposed algorithm has been tested on the ISIC dataset of 900 dermoscopy images, and gained high values for evaluation metrics e.g. Dice and Jaccard coefficient values of 0.89 and 0.79, respectively. Also, the proposed algorithm ranked 5th in the ISBI melanoma segmentation challenge.

pp. 134-139

BIP 2.5 17:20 ***Quantifying Mental Workload of Operators Performing N-Back Working Memory Task: Toward fNIRS Based Passive BCI System***

Nima Hemmati Berivanlou (University of Tehran, Iran); Seyed Kamaledin Setarehdan and Hosein Ahmadi (School of ECE, College of Eng., University of Tehran, Tehran, Iran)

Functional near infrared spectroscopy (fNIRS) as a relatively new brain imaging technique is increasingly being used for functional brain assessment. This however, needs robust hemodynamic features to be extracted in an appropriate time interval from proper brain's location. In this research, we performed a statistical analysis to evaluate the effect of such parameters as chromophore type, hemisphere, position of the recording channel and workload level on hemodynamic derived features during an n-back working memory task. In continue, the performance of three different classifiers, together with three feature ranking algorithms in classifying user's current cognitive state from single trial of hemodynamic signals were evaluated. The results revealed that a reliable change in brain oxygenation as a function of workload level was observed in dorsolateral prefrontal recording sites. In addition, maximum classification accuracy of 63.7% was achieved in classification between three workload levels. Finally, the time interval of 4 to 34 seconds after the task onset was found to be the most effective time window for feature extraction.

pp. 140-145

BSP 2 (Pharm): Biological signal processing

Room: Fajr Amphitheater

Chairs: Ali Maleki (Semnan University, Iran), Babak Mohammadzadeh Asl (Tarbiat Modares University, Iran), Mohammad Pooyan (Shahed University, Iran)

BSP 2.1 16:00 ***An Improved Algorithm for Heart Rate Tracking During Physical Exercise Using Simultaneous Wrist-Type Photoplethysmographic (PPG) and Acceleration Signals***

Mahdi Boloursaz Mashhadi (Author, Iran); Mahmoud Essalat, Mohammad Ahmadi and Farokh Marvasti (Sharif University of Technology (SUT), Iran)

Causal Heart Rate (HR) monitoring using photoplethysmographic (PPG) signals recorded from wrist during physical exercise is a challenging task because the PPG signals in this scenario are highly contaminated by artifacts caused by hand movements of the subject. This paper proposes a novel algorithm for this problem, which consists of two main blocks of Noise Suppression and Peak Selection. The Noise Suppression block removes Motion Artifacts (MAs) from the PPG signals utilizing simultaneously recorded 3D acceleration data. The Peak Selection block applies some decision mechanisms to correctly select the spectral peak corresponding to HR in PPG spectra. Experimental results on benchmark dataset recorded from 12 subjects during fast running at the peak speed of 15 km/hour showed that the proposed algorithm achieves an average absolute error of 1.50 beats per minute (BPM), which outperforms state of the art.

pp. 146-149

BSP 2.2 16:20 ***Prediction of Mortality in Patients with Sepsis Using Detrended Fluctuation Analysis of Heart Rate Variability***

Peyman Ghasemi (University of Tehran, Iran); Mohammad Reza Raoufy (Tarbiat Modares University, Iran)

Sepsis is one of the common causes of mortality in critical care units. In the present study, we compared the last 25 hours of heart rate dynamics of survived and non-survived patients with sepsis admitted in ICU. We calculated the RR-interval time series of patients and detrended fluctuation analysis (DFA) was performed on each 30 minute periods of data sets. The difference of scaling exponent (α) between the two groups was significant from 9 hours before the death. In deceased patients, the scaling exponent of RR-intervals decreased along the time approaching the death from values close to 1 (in healthy states) toward 0.5, indicating a qualitative change in the fractal-like structure of the heart rate series which makes it different from a physiologically relevant 1/f dynamics.

Presenter bio: Student who thinks to the intersection point of the mathematics and biology.

pp. 150-154

BSP 2.3 16:40 ***A Novel Method for R-peak Detection in Noisy ECG Signals Using EEMD and ICA***

Amirhossein Safari (K. N. Toosi University of Technology, Iran); Hamed Danandeh (Khaje nasir University of Technology, Iran); Maryam Mohebbi (K. N. Tossi University of Technology, Iran); Farhad Faradji (K. N. Toosi University of Technology, Iran)

In this paper, we present a novel algorithm for R-peak detection in noisy ECG signals using ensemble empirical mode decomposition (EEMD) and independent component analysis (ICA). First we decompose ECG signal into several Intrinsic Mode Functions (IMFs). Preprocessing is performed by selecting a certain range of IMFs. These IMFs are used as a set of mixed signals for ICA algorithm. Because the QRS complex is usually the strongest component in ECG signal, the ICA output is set to one source signal. So it will mainly contain QRS complexes. Finally, Pan-Tompkins algorithm is applied to the ICA output for R-Peaks detection. QT database is used for evaluation of algorithm performance in different noise levels. The results exhibit 96.11% detection accuracy with mean absolute error

of 0.066-4.6 samples (0.2-18ms), average mean squared error of 3.025 samples (12ms) and average variance error of 1.2 samples (4.8ms) compared with manually annotated beats.
pp. 155-158

BSP 2.4 17:00 ***Categorizing Visual Objects; Using ERP Components***
Armita Faghani (Amirkabir University of Tech, Iran); Banafsheh Shafiei (Amirkabir University of Tech Iran, Iran); Mh Moradi (Amirkabir University of Tech, Iran)
Paying attention to different pictures is related to complex information processing in the brain. Categorizing visual objects using the electroencephalogram (EEG) signal of subject along with paying attention to pictures, is properly possible. The aim of this paper is to analyze the mental signal in order to show the differences in cognitive patterns during paying attention to sets of different pictures. For this purpose, EEG signals which were recorded from 45 people were used. Brain signals are recorded over the on head using 8 active electrodes and based on standard 10-20. After the pre-processing, ERP signals were extracted into two classes according to attention to the human face and fruit images. Firstly, 4 types of features has been extracted from N170, P200, N200 and P300 components: (1) time features, (2) non-linear features, (3) statistical features and (4) frequency features. Then dimension of Properties were reduced by using different algorithms. New and innovative work in this paper is using various algorithms for reducing feature dimension such as t-test, t-SNE and kernel t-SNE and comparing their results with each other. Classification of 2 classes were done in order to recognize the differences using SVM and KNN classifiers. Secondly we reexamined this process by using combined features from multiple ERP components and obtained best result in this condition by t-SNE and SVM classifier with 85.5% accuracy.
pp. 159-164

Friday, November 25

Friday, November 25, 08:00 - 10:00

Pharm: Panel 3

Room: Mowlana Amphitheater

Biomech 3 (Pharm): Biomechanics

Room: Bahman Amphitheater
Chairs: Nabiollah Abolfathi (Amirkabir University of Technology, Iran), Mahmood reza Azghani (Sahand University Of Technology, Iran)

Biomech 3.1 08:00 ***A Real-Time Stable Volumetric Mass-Spring Model Based on a Multi-Scale Mesh Representation***
Sepide Farhang and Amir Hossein Foruzan (Shahed University, Iran); Yen-Wei Chen (Ritsumeikan University, Japan)
Pharm
Representation of soft tissues in virtual reality environments has been focused by researchers with application including training medical students and surgeons, treatment planning, monitoring and telesurgery. A major challenge of current modeling schemes such as Boundary Element, Finite Element, and Mass-Spring Models is to deal with volume preserving. Another challenge is the complexity of a model which results in a more realistic visualization; however, it increases computational cost. In this paper, we propose a Mass-Spring model to represent liver volume. It contains a series of multi-scale surface meshes with interconnections between the models and therefore it is considered as a volumetric mesh model. To preserve the volume of the gland, an external force is transmitted from the surface to internal meshes. By designing a specific data structure to hold coordinates of mesh points, we are able to render mesh movement in real-time using conventional CPU architectures. Localization of the external force is adjusted by the penetration depth parameter. Qualitative evaluation of the results revealed the promising performance of the proposed model. The model was run in nearly real time using conventional hardware structure. The stability of our Mass-Spring model under large deformation is another novelty of our method too.
pp. 165-169

BIP 3 (Pharm): Biomedical image processing

Room: Textile Amphitheater A
Chairs: Hamid Behnam (Iran University of Science and Technology, Iran), Ali Khadem (K. N. Toosi University of Technology, Iran)

08:00 ***Coronary Artery Curvature Extraction Using Physic-based Model in Intravascular Ultrasound Image Sequence***
Ali Kermani (Iran University of Science and Technology, Iran); Ahmad Ayatollahi (IUST, Iran); Arash Taki (Technical University Of Munich, Germany)
Three-dimension reconstruction of intravascular ultrasound (IVUS) images allows to study atherosclerotic treatment in longitudinal views and to study dynamical artery features. Vessel curvature extraction is the main step to reconstruct volumetric coronary artery. Unfortunately, IVUS pullback image sequence has the lack of three-dimensional information due to vessel motion around the IVUS catheter and exterior factors such as heart pumping and breathing. It typically needs an additional external approach, such as angiography, to overcome the problem. In this paper, a physic-based model is proposed to extract vessel curvature without any external information. The vessel tissue is determined by an iterative method for each frame. Considering the movement of the tissue mass center, the displacements of IVUS frames are calculated. Finally, external terms are removed by applying the appropriate filters in the frequency domain. The extracted curvature is validated with an IVUS-Angiography data. The obtained vessel curve has mean difference of 0.033 mm^(-1) parametric curvature in comparison with the curve achieved by fused IVUS-Angiography data.
pp. 170-175

08:20 ***Artifact Suppression in Freehand Ultrasound Elastography Using Multiscale Principal Component Analysis***
Ali Khadem (K. N. Toosi University of Technology, Iran)
Ultrasound elastography is a noninvasive technique for mapping the elasticity of soft tissues as an image called elastogram (axial-strain image). Applying a small axial pressure on the tissue surface is the main requirement of ultrasound elastography. If this pressure is applied manually by the ultrasound probe the technique is called "freehand ultrasound elastography". Non-ideal manual compressions lead to emergence of undesired artifacts in the elastograms which degrade their quality and restrict their clinical applicability. In this paper we propose a method based on Multiscale Principal Component Analysis (MSPCA) to suppress the elastographic artifacts and yield refined elastograms with better Elastographic Signal to Noise Ratio (SNRe) and Elastographic Contrast to Noise Ratio (CNRe). We applied our proposed method to a freehand elastographic dataset of a phantom which mimicked a hard tumor in a soft background tissue. The results showed significant improvements in average SNRe and CNRe as evaluated by paired sample t-test ($p<0.001$). Also, it was shown the proper selection of mother wavelet and the number of wavelet decomposition levels is very important to prevent the emergence of undesired patterns called Zipper-like artifacts in the refined elastograms.
pp. 176-181

08:40 ***Tissue Second Harmonic Ultrasound Imaging Using Huffman Sequence***
Zahra Mardi and Ali Mahloojifar (Tarbiat Modares University, Iran)
This paper proposes an approach to use Huffman sequence in second harmonic imaging as coded excitation to improve the transmitted energy. An appropriate matched filter is applied to the Huffman sequence for compression and separation of the second harmonic components. The results show that the Huffman sequence has better performance than Chirp excitation in both second harmonic and conventional imaging. Around 50% improvement in axial resolution and 50 times improvement in energy of received signal is reported for Huffman sequence compared with Chirp. The simulations carried out by K-Wave Matlab toolbox.
pp. 182-186

BSM (Pharm): Biological system modeling

Room: Textile Amphitheater B

Chairs: Fariba Bahrami (University of Tehran & ISBME, Iran), Amir Homayoun Jafari (Tehran University of Medical Sciences-School of Medicine, Iran)

BSM.1 08:00 ***A Macroscopic Chaotic Model of Visual Perception***

Maryam Beigzadeh (Amirkabir University of Technology & Amirkabir University of Technology, Iran); Seyyed MohammadReza Hashemigolpayegani (Amirkabir University of Technology, Iran)

A macroscopic chaotic model for visual perceptual dynamics is presented which is based on coupling of chaotic maps. The proposed model uses the theories of nonlinear dynamical systems and chaos, in order to illustrate some phenomenological aspects of dynamics observed in the brain. We especially concentrate on these dynamics during visual perception, such as multi-stability and transitions between periodic and chaotic attractors.

pp. 187-192

BSM.2 08:20 ***Quantifying One's Mechanical Ability to Control Upright Balance Based on the Probability of Recovery***

Mohammad Hadi Honarvar (Yazd University, Iran)

Control of balance is an inherent objective in human whole-body movements. It is essential for movement researchers as well as clinicians to quantitatively know how good the balance is at a body posture or at every moment during a task. In this research we suggest a method to quantitatively assess one's upright stability at a given body state, which assigns a value to a pair of person-state, based on the probability of avoiding a fall initiation. State space is, first, mapped into the stabilizer-input space taking advantage of stable manifolds, and then the probability of a stabilizer input to be applicable by a specific person is obtained based on strength data and kernel density estimation method. This probability is defined as a metric for upright balance for a person-state. It, therefore, describes how possible the control of balance is, or how safe being at that state is, for the specified person. We also compare our new metric to the conventional one, the so called margin of stability.

pp. 193-198

BSM.3 08:40 ***A Computational Model to Investigate Astrocyte Glutamate Modulation Effect on Tripartite Synapse and Neuronal Network State***

Mohammad Mohammadi (University of Tehran, Iran); Fariba Bahrami (University of Tehran & ISBME, Iran); Mahyar Janahmadi (Shahid Beheshti University of Medical Sciences & Medical School, Iran)

Astrocytes, most numerous glial cells in brain, respond to neural activities by provoking calcium waves and releasing transmitters to adjacent synapses and consequently, modulate neural activities. Here, we used leaky integrate and fire (LIF) neuron and a minimal functional astrocyte models with detailed synaptic mechanism to investigate astrocyte modulation impact on firing of tripartite synapse and network firing states. We assumed astrocyte facilitates and depress synapses by D-serine acting on N-methyl-d-aspartic acid (NMDA) receptors in post-synaptic neuron, and glutamate acting on metabotropic glutamate receptors (mGluRs) in pre-synaptic terminal. The model predicted that in the presence of astrocyte, a tripartite synapse exhibited bi-stable activity in the terms of pre-and post- synaptic neural firing rate; and neural population with bi-stable characteristic exhibited more stability on high firing rates, and impaired astrocyte function lead to less stable network activity.

pp. 199-204

BSM.4 09:00 ***Improving Stabilization of Passive Walking Using Chaos***

Saeed Montazeri, Moghadam (Amirkabir University of Technology); Ali Niaty and Farzad Towhidkhah (Amirkabir University of Technology, Iran)

Passive walking is defined as walking down a shallow slope without using any muscular contraction as an active controller. Based on this definition, which was made to present the simple possible models of human gait, some knee-less models have been proposed. These simple passive models have the ability to show several different dynamics such as periodic and chaotic behaviors. Previously, the periodic behavior has been studied and considered as the only stable response, but recent dynamical analysis on human locomotion characteristics such as stride length exhibit that this process has chaotic behavior. The purpose of this paper is to demonstrate that the knee-less passive-dynamic models has the ability to show chaotic behavior as a stable and acceptable answer using a chaotic function in heel strike condition. Represented chaotic model's parameters have been examined and compared concluding that the novel model is robust to trivial changes of slope or initial conditions.

pp. 205-210

BSM.5 09:20 ***Steps Towards an Integrated Platform for Computational Microdosimetry: From Realistic Cell Shape Modeling to Electric Field Distributions***

Elham Sharifi, Amir Hossein Buchali Safiee and Mehrdad Saviz (University of Amirkabir, Iran)

Computation of electric fields and its distribution in biological tissues is one of the growing research fields in biomedical engineering because of its application in biological impedance measurements and cell-scale bioelectromagnetic research in microdosimetry. Every tissue has individual cells with specific structure and orientation and every cell in turn has in a lower scale, organelles with important function in cell signaling and metabolism. Therefore a realistic geometrical model of cells and their organelles can be of great significance in calculation of field distribution and estimating tissue impedance. Computational estimation of the effect of changes in the cell structure or electrical properties in the final impedance read-out can be an important step towards noninvasive detection of diseases. In this paper one step is taken from realistic cell modeling to field simulation. in other words a realistic geometrical model for basal cell type of the skin is created with organelles such as the nucleus, mitochondria, ribosomes, lysosomes, golgi bodies and their membranes, and their electrical properties are found and assigned. The model is saved in voxel format and simulated by matlab and hspice softwares and the impedance and electric field in each organelle is computed. The results are in agreement with known experimental results and our method can be a good option to perform field simulation with subcellular resolution.

pp. 211-214

BSP 3 (Pharm): Biological signal prosecing

Room: Fajr Amphitheater

Chairs: Mohammad Ali Khalilzadeh (Biomedical Engineering Dept., Islamic Azad University Mashhad Branch, Iran), Mh Moradi (Amirkabir University of Tech, Iran), Seyyed Ali Seyyedsalehi (Amirkabir University of Technology, Iran)

BSP 3.1 08:00 ***Eigen-Seizure for Signal Core Modeling Using PCA-RSF and Circular Mapping Distance Classifier in Automated Epileptic Seizure Detector***

Morteza Behnam (Najafabad Branch, Islamic Azad University, Iran); Hossein Pourghassem (Islamic Azad University Najafabad Branch (IAUN), Iran)

The computerized analysis of the epileptic seizure EEG signal is essential approach for pediatric patients monitoring and presurgical decision making. In this paper, an offline automated epileptic seizure detector algorithm is proposed. After preprocessing stage, a training seizure subset is arranged. This layout is employed a novel hybrid method based on Principle Component Analysis (PCA) and Real Schur Form (RSF) using Implicit QR Iterations. With this iterative algorithm in Eigen-Space, the seizure eigenvectors based on the optimal eigenvalues are represented. These orthonormal basis functions are called Eigen-Seizure for modeling the signal core and expanding the EEG time series in the Seizure-Space. Meanwhile, a novel detector that is called Circular Mapping Distance (CMD) classifier is presented. In this scenario, by projecting the signals into the Seizure-Space, a trigonometric mapping onto unit circle is applied on the projected seizure signals, the projected original and reconstructed test signals. Then, by computing three distance-based similarity measures between static and rotational mapped signals based on the givens rotation technique, a Minkowski 2-D pattern adaptation is applied to find the maximum correlation and to select the optimal weights for signal descriptor. Ultimately, by defining a framework of decision making methodology, the CMD classifier finally recognizes the seizure and non-seizure classes with the averaged accuracy rate of 92.38%, precision rate of 94.74% and false detection rate of 0.022 h-1 on different folds of dataset.

pp. 215-220

BSP 3.2 08:20 ***Synchrosqueezing Transform: Application in the Analysis of the K-complex Pattern***

Zahra Ghanbari (Amirkabir University of Technology, Iran); Mh Moradi (Amirkabir University of Tech, Iran)

K-complex is a pattern which appears in the sleep EEG and characterizes the second stage of the NREM sleep. According to the underlying role of studying this pattern, we propose using synchrosqueezing transform (SST) for the purpose of analysis and automatic detection of K-complex. SST is an EMD-like time-

frequency algorithm for signal analysis. Our idea is based on the robust properties of the SST and its previous satisfactory results on biomedical signals, especially those with specific patterns. We successfully applied SST on 10 segments of 30 minutes sleep EEG signals which contain K-complexes labeled by two experts. Results illustrate that SST representation is able to detect this pattern at the right time and frequency locations in the time frequency plane, which are in consistency with the standard definition. Comparison with the continuous wavelet demonstrates the superiority of SST especially in finding K-complexes at the right places, reducing the blurredness and mistakenly detecting other part of the signal as K-complex.
pp. 221-225

BSP 3.3 08:40 ***Ictal EEG Signal Denoising by Combination of a Semi-Blind Source Separation Method and Multiscale PCA***
Elnaz Pouranbarani (Islamic Azad University, Science and Research Branch, Tehran, Iran); Sepideh Hajipour Sardouie and Mohammad Bagher Shamsollahi (Sharif University of Technology, Iran)
Contamination of ictal Electroencephalogram (EEG) signals by muscle artifacts is one of the critical issues related to clinically diagnosing seizure. Over the past decade, several methods have been proposed in time, frequency and time-frequency domain to accurately isolate ictal EEG activities from artifacts. Among denoising approaches Canonical Correlation Analysis (CCA) and Independent Component Analysis (ICA) are widely used. Denoising based on Generalized EigenValue Decomposition (GEVD) is one of the Semi-Blind Source Separation (SBSS) methods which has been recently proposed. In the GEVD-based method, a couple of time-frequency covariance matrices are used. These time-frequency (TF) covariance matrices are calculated in the time-frequency domain using a special time-frequency mask. This time-frequency mask is extracted based on the time-frequency signature corresponding to the time-frequency spectrum of an ictal source obtained by CCA. In this paper, we use MultiScale Principal Component Analysis (MSPCA) in order to extract the time-frequency mask. To this end, a novel SBSS method, called CCA-MSPCA-TF-GEVD, is proposed and the efficacy of CCA-MSPCA-TF-GEVD compared with that of CCA, ICA and CCA-TF-GEVD is presented. The simulation results using simulated data validate the superiority of the proposed method compared with other methods. In addition, the applicability of the proposed denoising method for source localization is evaluated.
pp. 226-231

BSP 3.4 09:00 ***Classification of EEG Signals Using the Spatio-Temporal Feature Selection Via the Elastic Net***
Shahryar Noei, Pooya Ashtari and Mehran Jahed (Sharif University of Technology, Iran); Bijan Vosoughi Vahdat (Sharif University of Technology & Bisipl Laboratory : Biological Signal Processing Lab, Iran)
Effective classification of motor imagery electroencephalograph (EEG) data is an important challenge. Spatial filtering such as Common Spatial Pattern (CSP) and its variants are commonly used for this task. However, CSP effectiveness depends on the subject-specific frequency band. Even by optimally selecting a subject-specific frequency band, this method still fails for some subjects. On the other hand, some studies suggest that temporal features may discriminate classes more efficiently. This work proposes a hybrid method based on elastic net and Least Absolute Shrinkage and Selector Operator (LASSO) to optimally select between spatial and temporal features. This algorithm uses joint spatial and temporal features followed by an optimal combined feature selection scheme for each subject. Results show significant improvement for subjects whose spatial features failed to produce acceptable results and overall improvement over the combined data.

Presenter bio: M.sc student of Sharif University of Technology

pp. 232-236

BSP 3.5 09:20 ***Enhancement of Complex Auditory Brainstem Response to a Voiced Stop Consonant-Vowel Syllable, by Using LMS-based Adaptive Filter***
Zahra Shirzhiyan, Elham Shamsi, Ahmadreza Keihani and Morteza Farahi (Tehran University of Medical Sciences (TUMS), Iran); Amir Homayoun Jafari (Tehran University of Medical Sciences-School of Medicine, Iran)
The complex auditory brainstem response to voiced stop consonant-vowel syllables is a newborn biopotential which is going to be a powerful biological marker for diagnosing central auditory processing disorders, and reflects training, learning and aging phenomena in the auditory system; However, this response is deeply buried in the background EEG signals. In other words, signal-to-noise ratio (SNR) of this response is very low. The most common method for signal enhancement is the coherent ensemble averaging, which needs a large number of trials, and is very time-consuming. In this study, we used LMS-based adaptive filter to enhance the responses while decreasing the number of required trials for achieving an acceptable SNR. This method was tested on 15 subjects` complex auditory brainstem responses. The results show that LMS-based adaptive filter can enhance the SNR of complex auditory brainstem responses to about 56.2% with respect to coherent ensemble averaging.
pp. 237-241

BSP 3.6 09:40 ***Human Identification with EEG Signals in Different Emotional States***
Amirali Vahid (Uniersity of Tehrran, Iran); Ehsan Arbabi (Iran, Iran)
This paper investigates human identification by using EEG signals. It has been shown that Electroencephalogram (EEG) can be used as a trait for biometric systems. Previous studies have reported proper channels and features in resting states and mental tasks. However, since EEG signal is sensitive to emotion, the stability of reported features during emotional states is not well verified. Our goal is to investigate channels and features which have stable results regardless of emotional states. To this end, three experiments were designed: 'training' and 'testing' an identification system with 1) mixture of emotional states; 2) the same specific emotional states; 3) different emotional states. 1728 features were extracted which later construct the feature vector of each subject and then Support Vector Machine (SVM) was used to classify the subjects. After selecting 5 best features, the Correct Classification Rate (CCR) is in the range of 88% to 98% for 3 experiments. Moreover, we found that features extracted from Gamma frequency band in Left-Posterior quarter of the brain have more stable and reliable information for human identification, regardless of emotional states, comparing to other features.
pp. 242-246

Friday, November 25, 10:00 - 10:30

Pharm: Coffee Break 3

Room: Hall

Friday, November 25, 10:30 - 11:15

Pharm: Keynote Speech 2

Room: Mowlana Amphitheater

Friday, November 25, 10:30 - 12:00

Pharm: Poster

Room: Textile Hall

#1 ***Changes in Effective Connectivity Between Motor and Sensory Regions in Finger Movement Task***
Fatemeh Ebrahiminia and Gholam Ali Hossein-Zadeh (University of Tehran, Iran)
A challenging question lies in how brain distant regions are integrated into an orderly unity in a movement task. Integration of Electroencephalography (EEG) and functional Magnetic Resonance Imaging (fMRI) data yields the possibility of studying the temporal dynamics of brain network involved in visumotor task. The aim of this paper is to investigate the brain dynamic sensory-motor network associated with finger movement. To this end we modeled brain activity by combining fMRI and EEG using fMRI-driven EEG analysis approach. The EEG and fMRI data was obtained from two healthy subjects during a key pressing task. Dynamic Causal Modeling (DCM) was employed to extract connectivity changes between sources. According to fMRI analysis, significant activation was detected in primary motor cortex, somatosensory, cerebellum, precuneus and visual areas. Comparisons of 18 models showed that precuneus and cerebellum receive

the visual information directly from visual cortex. Dynamic changes of effective connectivity demonstrated 6 times increase in exertion of cerebellum on the primary motor cortex in left hand movement in relative to non-movement period. According to the best model interactions between somatosensory area and precuneus decreased during finger movement period. Connectivity strength between visual and precuneus had no changes.
pp. 247-251

#2 A Novel Glucose Biosensor Based on Immobilization of Glucose Oxidase in Iron Oxide Nanoparticles/Poly(vinyl Alcohol) Nanocomposite Film

Niuosha Sanaeifar (Amirkabir University of Technology, Iran); Mohammad Rabiee (Amirkabir University, Iran); Mojgan Abdolrahim (Amirkabir University of Technology, Iran); Amirhossein Monfared (Materials and Energy Research Center, Iran)

This report describes an electrochemical biosensor for the detection of glucose. Iron oxide nanoparticles were prepared via co-precipitation method. Synthesized nanoparticles were dispersed in poly(vinyl alcohol) (PVA) solution to fabricate PVA-Fe3O4 nanocomposite. Glucose oxidase (GOx) was immobilized by physical adsorption in PVA-Fe3O4 nanocomposite for the construction of glucose biosensor. X-ray diffraction (XRD) pattern of synthesized Fe3O4 nanoparticles illustrated reflection planes, which are exactly similar to the standard pattern for Fe3O4 nanoparticles. The crystal size of Fe3O4 nanoparticles calculated using Debye-Scherrer formula is obtained about 3 nm. The PVA-Fe3O4 and PVA-Fe3O4/GOx nanocomposites were characterized using Fourier transform infrared (FTIR) spectroscopic and Field emission scanning electron microscopy (FESEM) techniques. Results showed that Fe3O4 nanoparticles were almost uniformly dispersed in the PVA matrix with minimum aggregation and GOX was successfully immobilized on the PVA-Fe3O4 matrix. The electrochemical measurement was carried out by cyclic voltammetry (CV). GOx showed excellent catalytic activity to glucose. The presence of Fe3O4 nanoparticles in modified electrode enhanced the electron transfer between enzyme molecule and the electrode surface. This GOx/PVA-Fe3O4/Sn bioelectrode can estimate different concentration of glucose from 30-400 mg dL-1.
pp. 252-256

#3 A Novel Soft Computing Method Based on Interval Type-2 Fuzzy Logic for Classification of Celiac Disease

Azam Najafi, Abdollah Amirkhani and Karim Mohammadi (Iran University of Science and Technology, Iran); Azar Naimi (Isfahan University of Medical Sciences, Iran)

This study proposes a method for automatic classification of medical data on celiac disease (CD) using an interval type-2 fuzzy logic system (IT2FLS). Due to the high uncertainty in the medical data, IT2FLSs are able to consider many linguistic uncertainties in the type-2 framework, and considering the uncertainty in the membership functions, they can raise the accuracy of the fuzzy system. To improve the performance of IT2FLS, fuzzy C-means (FCM) clustering algorithm is used to determine the membership functions centers in the fuzzy rules. For the purpose of comparison, other classification models based on fuzzy sets, such as type-1 fuzzy logic system (T1FLS) and IT2FLS without using FCM are also proposed. Experiments are performed on a dataset of Poursina Hakim Research Institute with the real samples of patients with different grades of celiac. Accuracy of 83.33%, 87.88% and 93.75%, respectively, was achieved when determining the grades of A, B1 and B2 by IT2FLS-FCM. This demonstrates the superiority of this model over the other fuzzy models. Considering the uncertainty in type-2 fuzzy sets and as well as FCM clustering algorithm, improved system performance in the classification of CD.
pp. 257-262

#4 On the Contribution of Normal Modes of Elastic Network Models in Prediction of Conformational Changes

Reza Soheilifard and Cyrus Ahamdi Toussi (Hakim Sabzevari University, Iran)

Conformational changes of proteins during binding to other biomolecules play a vital role in many biological processes in a living body. There have been a lot of efforts to predict the conformational changes using normal modes of various elastic network models. In all the studies, usually a single or a few lowest modes are considered. In this study, we consider the contribution of all normal modes on the unbound structure of protein to predict the bound form. The results show that low frequency normal modes are not sufficient for describing these motions and there are contributing normal modes even in the high frequency range. The results also indicate that high decaying and low cutoff radii network models show similar behavior in their prediction of the conformational changes
pp. 263-266

#5 A New Hybrid Face Recognition Algorithm Based on Discrete Wavelet Transform and Direct LDA

Seyyed Amir Ziafati Bagherzadeh (Islamic Azad University, Mashhad Branch, Iran); Ali Reza Noei Sarcheshmeh (Ferdowsi University of Mashhad & Communication and Computer Research Center, Iran); Seyed Hassan Ziafati Bagherzadeh (Islamic Azad University, Mashhad Branch, Iran); Mohammad Mahdi Khalilzadeh (Islamic Azad University of Mashhad, Iran)

Face recognition (FR) has received significant attention as one of the most successful applications of image analysis and understanding, during the past several years and is an active yet challenging topic in computer vision applications. Also potentially will help in identifying ultra-rare and developmental disorders. Linear discriminant analysis (LDA) has been widely used for feature extraction in face recognition. However, the main deficiency of LDA-based algorithms is small sample size (SSS) problem, which makes between-class scatter matrix incomputable. Since the zero eigenvalues in within-class scatter matrix contains significant discriminatory information, a direct LDA (DLDA) based algorithm is proposed to save the possible useful information. In this paper, a new hybrid FR algorithm proposed using discrete wavelet transform (DWT) with third-level of Haar filter, DLDA method for dimensionality reduction, and a support vector machine with second-order polynomial kernel. The obtained recognition results show that this approach significantly outperforms recognition using proposed algorithm. For the ORL face database, the averaged recognition accuracy is over 95%.
pp. 267-270

#6 Size-Tunable Alginate Nanoparticles Synthesis Using T-junction Microfluidic Chip

Laleh Mahmoodi, Sajad Razavi Bazaz, Javad Mohamadnejad and Ali Abouei Mehrizi (University of Tehran, Iran); Masoud Soleimani (Tarbiat Modares University, Iran)

Pharm
nanoparticles have manifold applications in the disease detection, diagnosis, and drug delivery. The precise control of an amount of particle that delivers on each organ depends on the size of the particle and its residual time. Microfluidic has a major rule on the control size of the nanoparticles. Usually, a T-junction microchip is used for the synthesis of the nanoparticles by changing the related velocity between the core and shear flow. In this experimental study, alginate solution in water uses as the core flow and an efficient cross-linker which is CaCl2 uses as the shear flow. The different related velocity of core flow to shear flow is examined. The range of these two streams varies from 0.2 to 0.01. It should be noted that decrease of the velocity rate between two streams leads to decrease in the size of the nanoparticles. Therefore, it is shown that the smallest nanoparticle is made on the least relative stream which is 0.01. By scanning electron microscope and image processing techniques, it is found that the nanoparticle with 97 nm is produced during this process. Due to the various application fields of nanoparticles, this experimental procedure could be a promising one for the biologist in the future.

Presenter bio: Biomedical engineering in Tehran University

pp. 271-275

#7 A Novel Microfluidic Two-Level Droplet PCR for DNA Amplification

Mina Mollajan (Univesity of Tehran); Ali Abouei Mehrizi and Sajad Razavi Bazaz (University of Tehran, Iran)

polymerize chain reaction (PCR) is a process for DNA amplification and has numerous applications in the other fields such as clinical diagnosis, genetic sequencing, and infectious disease detection. In this study, a novel droplet PCR in micro scale is introduced and evaluated. First of all, effective parameters are identified and ranges of them for optimum function are investigated. In order to superlative performance, the amount of the heat that should be provided by heaters is specified. The computational fluid dynamic (CFD) is used to simulate the process. For this numerical study, the commercial CFD package, COMSOL, is used. The analyses of the numerical results are then shown in the temperature-time diagrams. It is found that the smallest droplet among all PCR devices is provided by this device and designed droplet PCR remains consistent with ideal one at the same conditions.

Presenter bio: Biomedical engineering in Tehran University

pp. 276-280

#8 An Inexpensive 3D Printed Amperometric Oxygen Sensor for Transcutaneous Oxygen Monitoring

Yassaman Djafari (Amir Kabir University of Technology, Iran); Nabiollah Abolfathi (Advisor, Iran)

Noninvasive and wearable sensing methods are becoming more preferable in clinical settings. Transcutaneous oxygen monitoring is a noninvasive and standard method for oxygen partial pressure measurement. Oxygen partial pressure indicates the hypoxic/hyoeroxic condition of the tissue and is vital in clinical examinations. Transcutaneous oxygen tension is suggested as an alternative for measuring the partial pressure of arterial blood oxygen (PaO2). Although relation between the PaO2 and transcutaneous oxygen (PtcO2) depends on cardiac output and oxygen-hemoglobin dissociation curve, PtcO2 is considered as a reliable indication of oxygen partial pressure in tissue. The gold standard in transcutaneous measurement is amperometric measuring system. The relation between the current and oxygen tension is linear in neonatals and it shifts by a constant factor in adults since a part of oxygen is consumed by epidermis layer. The current paper focuses on designing an amperometric cell to measure the PtcO2 accurately. Flexibility, wearability and small size are the key factors considered in this design. Here, 3D printing is employed as a low cost and reliable method to satisfy the expectations. Using ECG electrodes as working electrode is another aspect of this design. In-vitro evaluations show that this design works properly and is ready to be evaluated on human skin.
pp. 281-284

#9 *A Mathematical Modeling for in Vitro Skeletal Muscle Behavior in Shear Deformation Modes*
Sanaz Saadatmand Hashemi (K. N. Toosi University of Technology); Masoud Asgari (K. N. Toosi University of Technology, Iran); Akbar Rasoulian (Young Researchers and Elite Club, Tabriz Branch, Islamic Azad University, Tabriz, Iran)
Pharm
skeletal muscles simulation remains a controversial topic as a result of its complex anatomical structure and mechanical characteristics such as nonlinear material properties and loading conditions. Most of the current models in the literature for describing the constitutive equations of skeletal muscles are based on Hill's one-dimensional, three element model. In this paper a 3D constitutive model which is based on the non-linear hyper elastic behavior of skeletal muscle and energy function has been presented. By using the derivatives of such energy function for defining the Second Piola and Cauchy stresses, we are able to describe the inactive behavior of skeleton muscles. The applied constitutive equations are an efficient generalization of Hamphury's model for the inactive behavior of skeletal muscle. In this paper by using a 3D model, different modes of deformations of skeletal muscle in the shear tests has been investigated and material properties constants for each modes of deformation has been optimized by Genetic algorithm. Finally the results of the model simulations of each mode are compared with those obtained from experimental tests.
pp. 285-289

#10 *Electrowetting Based Actuation of Droplets with PDMS Dielectric*
Alireza Ghaffari, Yousef Hojjat, Hesam Sadeghian and Mohammad Mokhtari (Tarbiat Modares University, Iran)
Pharm
Both properties of the used dielectrics in electrowetting actuators - i.e. thickness and layer material - play an important role in their functionality. In this paper, in order to optimize dielectric layer's thickness, equivalent circuit method has been used. Then, PDMS polymer was used instead of common materials for insulation. Common insulation materials like SiO2 are deposited by methods like PECVD which are time-consuming and costly. Unlike such methods, PDMS deposition is done by spin coating which is considered to be a simple method indeed. Afterwards, the actuator was fabricated according to the optimized thickness. Finally, it was proved that the actuator functionality was fairly appropriate regarding the dominating theoretical equations and the ability to move droplets on the surface.
pp. 290-294

#11 *Investigation of Boundary Condition Effects on Flow Rate Distribution in a Human Upper Respiratory Tract*
Yusuf Binabaji (University of Tehran, Iran); Bahman Vahidi (Faculty of New Sciences and Technologies, University of Tehran, Iran)
Pharm
Investigation of airflow behavior and distribution in the human respiratory tract has recently drawn the attention of researchers to study the particle movement and deposition in aerosol therapy and inhalation toxicology applications. Therefore, in this paper the steady-state flow behavior during inhalation in a human lung model has been numerically investigated. A three dimensional asymmetric and non-planar bifurcation model of trachea-bronchial airway was used in the present study. Computations were performed for two different boundary conditions: (a) the same flow rate for all the outlets and (b) the same static gauge pressure equal to zero for all the outlets. Reynolds numbers were chosen in the range of 1000 to 4000, corresponding to the breathing rates of 12-48 l/min. Detected reverse flow zones and the flow rate distribution were presented. Estimation of the flow rate distribution in the right (upper, middle and lower) lobes when using the second boundary condition was more accurate compared to the true distribution in the lungs. With increasing the inlet flow rate, flow rate distribution changed in cases where the second boundary condition was used but it was negligible. Reverse flow zones occurred more frequently when using the first boundary condition.
pp. 295-300

Friday, November 25, 11:15 - 12:00

Pharm: Keynote Speech 3

Room: Mowlana Amphitheater

Friday, November 25, 12:00 - 13:30

Pharm: Lunch 2

Room: Restaurant

Friday, November 25, 13:30 - 15:30

Pharm: Keynote Speech 4

Room: Mowlana Amphitheater

Pharm: Panel 4

Room: Textile Amphitheater A

Biomech 4 (Pharm): Biomechanics

Sports/Robotics
Room: Bahman Amphitheater
Chairs: Saeed Behzadipour (Sharif University of Technology, Iran), Alireza Hashemi Oskoei (Sahand University of Iran, Iran), Mostafa Rostami (Faculty of Biomedical Engineering, Amirkabir University of Technology, Iran)

Biomech 4.1 13:30 *Kinematic and Kinetic Analyses of the Wing Chun Straight Punch*
Reza Abazari and Hossein Ehsani (Amirkabir University of Technology, Iran); Mostafa Rostami (Faculty of Biomedical Engineering, Amirkabir University of Technology, Iran)
Pharm
The main purpose of this study was to identify factors that may affect the performance of Wing Chun straight punch. Seven male professional subjects participated in the experiment. They were asked to perform the straight punch while standing in front of a wall mounted force plate. Impact force data were collected with the force plate and upper extremity kinematics was recorded using a high-speed camera. Significant relationship was found between impulse and effective mass ($r = 0.81$, $p < 0.0001$) while no significant relationship was observed between impulse and impact velocity ($r = 0.20$, $p = 0.36$). The effective mass was inversely related to impact velocity ($r = -0.72$, $p < 0.0005$). Significant relationship was observed to elbow peak angular velocity for impact velocity ($r = 0.44$, $p < 0.05$), impact acceleration ($r = 0.66$, $p < 0.002$), impulse ($r = -0.43$, $p < 0.05$) and effective mass ($r = -0.58$, $p < 0.01$). The results indicated that the effective mass was the only variable in improving the effectiveness of the straight punch. Additionally, high values of the loading rate, as a sign of hand overuse injuries, was observed.
pp. 301-305

Biomech 4.2 13:50 ***Quantitative Evaluation of Parameters Affecting the Accuracy of Microsoft Kinect in GAIT Analysis***

Zahra Jamali (FDA of IRAN, Iran); Saeed Behzadipour (Sharif University of Technology, Iran)
Pharm

To date various commercial systems have been used in the GAIT analysis. These systems have some difficulties for clinical use, such as interfering with normal movement and high prices. The possibility of utilization of Kinect as a sensor for GAIT analysis has been studied in this research. The accuracy of Kinect in calculation of GAIT parameters such as lower limb joint angles, stride time, and stride length were computed during normal walking. The effects of the sensor's position and direction relative to the walkway was also investigated. The Kinect sensor was installed at different positions toward the motion path. In each position the data was recorded by both Kinect and a commercial motion capture system. After data recording and noise filtering, GAIT parameters were calculated. According to the results, the best position for the Kinect sensor is in front of the subject. In this arrangement, the error of stride time and stride length were 1.4% and 5.2% respectively. The root mean square errors of knee and hip joint angles in this position were 4.5° and 4.4°, respectively. The error of ankle joint angle was higher than the acceptable amount for clinical applications.

pp. 306-311

Biomech 4.3 14:10 ***Effect of Attentional Focus on Muscles Activations and Their Recruitment During Learning a Balance Task***

Naser Taleshi, Mansour Taleshi and Sedigheh Dehghani (University of Tehran, Iran); Fariba Bahrami (University of Tehran & ISBME, Iran); Ali Jamshidi (University of Medical Sciences, Iran)

In this pilot study we investigated the effects of external and internal focus of attention on motor learning and performance during learning a balance control task. Pilot experiments were conducted by instructing two groups of healthy students (right footed), each comprising of three individuals. Each group performed the balance controlling task consistently only under one condition, which was assigned to them randomly. In the external-focus condition, performers were conducted to focus on a marker on the wall in front of them whereas in the internal focus condition, participants were instructed to focus on their feet so as to keep the balance board horizontal w.r.t. ground. Participants performed a total of five trials on the balance board per session for five days as every two other days. In both of the foregoing conditions, muscle activations (EMG signals) of both sides of each participant were recorded. The vertical displacements of the balance board in the frontal plane were also recorded with a camera. The data obtained from these two groups were analyzed within the groups and then compared between two groups. In this study two indices were introduced. External focus Index (EfI) and Internal Focus Index (IfI). EfI is defined as the difference between RMS values of EMG signals of the right (dominant) and left side of the body, while IfI is defined as the difference between RMS values of EMG signals of the left (non-dominant) and right side of the body. Our preliminary results indicate that the balance controlling skill is positively correlated with EfI in the external focus group and with IfI in the internal focus group. These results indicate that balance control strategy that each group applied to increase balance control skill on Medio-lateral balance board may depend on the use of dominant or non-dominant side of the body. Furthermore, the balance skill in external focus group is more than internal focus group, but vice versa for muscle activation. This result clearly indicates that external focus of attention is more effective compared to internal one.

pp. 312-315

Biomech 4.4 14:30 ***Exploring the Effect of Training on Muscle Synergies and Kinematics of a Task***

Mansour Taleshi, Naser Taleshi and Sedigheh Dehghani (University of Tehran, Iran); Fariba Bahrami (University of Tehran & ISBME, Iran); Farzad Towhidkhah (Amirkabir University of Technology, Iran)

In this preliminary study we aim to extract muscle synergies in spiral tracking task when performed with the non-dominant hand, and investigate the effect of training on muscle synergies. Three young subjects who were university students (all Females, 21 ± 1 years old, right-handed) volunteered to participate in this study. The subjects were healthy with no history of neuromuscular disease. Each subject performed one of the three tasks chosen randomly in five sessions. The tasks were to track either a circle in a limited time, or a circular spiral or a square spiral. During the task, the trajectory of the pen and EMG signals from eight muscles of the non-dominant hand were simultaneously recorded. Afterwards, the EMG signals were factorized using the Non-Negative Matrix Factorization (NMF) method and spatial and temporal modules were extracted. While extracting muscle synergies using NMF, we used the Variance Accounted For (VAF) criteria in order to determine the optimized number of modules. Three synergy modules were determined as the optimum number for the primary EMG signals reconstruction. The P index was introduced to compare the changes in muscle synergies during the training. This index stands for the correlation between the muscle synergies of the trials of each session with the average of muscle synergies in the same session. The results show that mean square error between the desired and the actual trajectories, regardless of the type of training, has decreased for all three subjects. This indicates that the subjects have learned the task during the training sessions. Moreover, changes in the P index correspond noticeably with subjects' tracking skill. In addition, this index can be adjusted during training and there have been noticeable changes in its value between the sessions. The results convey that central nervous system (CNS) adjusts muscle synergies defining given motor behaviors to the desired synergy space, which is the average of synergies, during the training.

pp. 316-320

Biomech 4.5 14:50 ***Speed Influences on Complicated Kinetic, Kinematic and Electromyographic Gait Data of Lower Extremities Among Healthy Subjects***

Ghazaleh Soleimani, Mehran Emadi Andani and Hamid Reza Marateb (University of Isfahan, Iran); Fariba Bahrami (University of Tehran & ISBME, Iran)

Previous studies suggested that increasing speed has an effect on human walking features such as joints and muscles range of motion, related spatio-temporal parameters and muscles activation patterns. However, the effect of speed on more complicated indices like muscle synergies, minimum angular jerk and cross correlation between different types of biomechanical gait data has not been studied by large number of healthy subjects. We investigated the effect of walking speed changes on such criteria. Thirty-two healthy subjects (aged 6-72 y, 59% female) participated in this study. Kinetic, kinematic and electromyographic (EMG) data were recorded during over ground walking at five following walking speed categories as: very slow, slow, medium, fast and very fast. The results showed a significant correlation between investigated indices and gait speed ($p < 0.05$), among which cadence ($r = 0.749$) and synergy coordination index ($r = -0.463$) had the highest and lowest correlation. It could be concluded that speed plays an important role in gait characteristics. It could change central nerves system commands, decrease walking smoothness and lower limb contributions. Consequently, most probably there is a relationship between the proposed indices and other speed dependent features like walking dynamic stability which need long-term data recording and it should be studied with long-term gait data.

pp. 321-326

BSP 4 (Pharm): Biological signal processing

Room: Fajr Amphitheater

Chairs: Fariba Bahrami (University of Tehran & ISBME, Iran), Mohammad Bagher Shamsollahi (Sharif University of Technology, Iran)

13:30 ***Recognition of Two Emotional States of Joy and Sadness Using Phase Lag Index and SVM Classifier***

Zahra Tabanfar (Amirkabir University of Technology, Iran); Farzane Yousefipoor, S. Mohammad P. Firoozabadi, Zeynab Khodakarami and Zeinab Shankayi (Tarbiat Modares University, Iran)

Due to the preceding studies in recent years, emotion recognition has not been done only by using local features of a single channel. Since the process of hearing and understanding it requires the cooperation of different brain regions, it is expected that investigation of brain connectivity among channels can be an appropriate tool for emotion recognition beside the local analysis of each channel. The aim of this research was to evaluate the possibility of recognition of two music induced emotional states, joy and sadness, using functional connectivity features extracted from EEG signals. To achieve this goal, phase lag index (PLI) features of every channel pairs (6 features) and support vector machine (SVM) algorithm were used. Based on the results, among all extracted features, the most distinction between the emotional states of joy and sadness was obtained using the connectivity features of channel pair C3-F3 and also channel pair C4-F4 with the classification accuracies of 68.18% and 54.55%, respectively. According to the fact that these two features are related to the connectivity of two similar channels in two hemispheres, it seems that the inter-hemispheric connections are more related to the emotional states of joy and sadness rather than the intra-hemispheric connections. Furthermore, the classification precision was higher when using 6 features simultaneously (80%). This result represents the importance of brain network analysis.

pp. 327-330

13:50 ***Recognizing Subjects Who are Learned How to Write with Foot From Unlearned Subjects Using EMG Signals***

Jalal Alizadeh (University of Tehran, Iran); Amirali Vahid (Uniersity of Tehrran, Iran); Fariba Bahrami (University of Tehran & ISBME, Iran)

In this paper we report the preliminary results of recognition of learned subjects from unlearned ones during foot writing process using electromyogram (EMG) signals recorded from thigh and shank muscles. For proof of idea, three subjects were asked to write seven letters with foot. We recorded and analyzed the data to study the learning process in five sessions. Since previous studies have shown that pressure of pen and stiffness of hand are inversely related to the learning level, we considered the pressure applied by a magnetic pen on a digital tablet during foot writing as one of the main features to represent the learning level. Pressure analysis demonstrated that the pressure on the tablet is decreased during successive task accomplishments. Statistical analysis of pressure indicates

that the fourth day can be considered as the frontier of the learning process. The EMG signal was also recorded from eight leg muscles and for each of them 28 features were extracted. Several classification methods including Support Vector Machine (SVM), Linear Classifier, Naive Bayes and K Nearest Neighbor (KNN) were used in order to classify the recorded data. With 10 superior features chosen by Sequential Floating Forward Selection (SFFS) algorithm for each classifier, the accuracy of corresponding classifiers was in the range of 72%-95%. Moreover, we found out the SVM classifier, and the two Tibialis Anterior (TA) and Medial Gastrocnemius (MG) muscles could distinguish between learned and unlearned subjects most properly. The accuracy of features Mean frequency (MNF), Modified Mean Absolute Value (NMA V2) and Third spectral moment (SM3) belonging to TA and Willison Amplitude (WAMP) and Root Mean Square (RMS) belonging to MG was 90 and 85 percent, respectively. This preliminary study suggests that EMG signals can be effectively used to determine when the learning procedure is converging (or starting to converge) to its steady and ultimate level.
pp. 331-335

14:10 ***Ensemble Methods Combination for Motor Imagery Tasks in Brain Computer Interface***
Masoume Rahimi, Asghar Zarei and Ehsan Nazerfard (Amirkabir University of Technology, Iran); Mh Moradi (Amirkabir University of Tech, Iran)
The correct recognition of Motor Imagery task in Brain-Computer Interface (BCI) systems has been an important issue in recent researches. In this study, we proposed a classification framework based on ensemble methods to handle spectral and special EEG signal characteristics. A mixture of two ensemble classifiers has been used for combining multiple information sources. The performance of the proposed classifier has been evaluated on a two-class problem (right and left hand) from the BCI Competition IV dataset 2a. The used features for the training data are the selected features by Mutual information-based Best Individual Feature from the output of the Filter Bank Common Spatial Pattern. The results show that proposed method can reach an accuracy of 90.27% with just 7 features, while other methods have lower accuracy and a higher number of features.
pp. 336-340

14:30 ***Learning Fuzzy Cognitive Map with PSO Algorithm for Grading Celiac Disease***
Hosna Nasiriyan-Rad and Abdollah Amirkhani (Iran University of Science and Technology, Iran); Azar Naimi (Isfahan University of Medical Sciences, Iran); Karim Mohammadi (Iran University of Science and Technology, Iran)
Celiac disease (CD) is a complex disorder whose development is affected by genetics (HLA alleles) and gluten ingestion. Its diagnosis is very difficult due to clinical manifestations complexity, latent period, and similarity to other diseases. Studies show that a high percentage of CD patients remain undiagnosed. The celiac patients who are not treated are at a high risk of cancer, malignant lymphoma, and small-bowel neoplasia. Therefore, CD diagnosis and grading is of paramount importance. This paper presents a new method for grading CD based on the combination of fuzzy cognitive map (FCM) and support vector machine. To improve the efficiency and increase classification ability of FCM, particle swarm optimization (PSO) algorithm is applied to adjust FCM weights. In this study, the newest method of grading A, B1, and B2 is used. The empirical results show that the main advantage of PSO algorithm is its speed of convergence and the ability to obtain faster possible schedules. The proposed method is tested on 89 patients. The simulation results prove the superiority of the proposed method compared with Bayesian networks based on the rules and other procedures set forth in the literature. These results show the percentages of 87%, 86%, and 84% for three grades of A, B1 and B2
pp. 341-346

Friday, November 25, 15:30 - 16:00

Pharm: Coffee Break 4

Room: Hall

Friday, November 25, 16:00 - 18:00

Pharm: Closing Ceremony

Room: Mowlana Amphitheater

2016 23rd Iranian Conference on Biomedical Engineering and 2016 1st International Iranian Conference on Biomedical Engineering (ICBME)

Poster

Bioelec: Bioinformatics/Bioinstrumentation/ Telemedicine

Biomat : Biomaterials

Biomech 1: Biomechanics

Biomech 2: Biomechanics

Biomech 3: Biomechanics

Biomech 4: Biomechanics

BIP 1: Biomedical image processing

BIP 2: Biomedical image processing

BIP 3: Biomedical image processing

BSM: Biological system modeling

BSP 1: Biological signal processing

BSP 2: Biological signal processing

BSP 3: Biological signal prosecing

BSP 4: Biological signal processing