2014 Middle East Conference on Biomedical Engineering (MECBME)
February 17-20, 2014, Hilton Hotel, Doha, Qatar

Swarm-based Extreme Learning Machine for Finger Movement Recognition

Khairul Anam, *Student Member, IEEE* and Adel Al-Jumaily, *Senior Member, IEEE*

***Abstract*— An accurate finger movement recognition is required in many robotics prosthetics and assistive hand devices. The use of a small number of Electromyography (EMG) channels for classifying the finger movement is a challenging task. This paper proposes a novel recognition system which employs Spectral Regression Discriminant Analysis (SRDA) for dimensionality reduction, kernel-based Extreme Learning Machine (ELM) for classification and the majority vote for classification smoothness. Particle Swarm Optimization (PSO) is used to optimize the kernel-based ELM. Three hybridizations with three kernels, radial basis function (SRBF-ELM), linear (SLIN-ELM), and polynomial (SPOLY-ELM) are introduced. The experimental results show that SRBF-ELM significantly outperforms SLIN-ELM but not too much different compared to SPOLY-LIN. Moreover, PSO is able to optimize the three systems by giving the accuracy more than 90% with the highest accuracy is ~94%.**

I. Introduction

In modern life, the finger movement is extremely important to perform complex and intricate tasks such as typing keyboard, tapping a tablet, operating a smartphone, and many other activities. The disability in the finger functionality will decrease the person's quality of life. Such disabilities can be caused by either loss of limb or limb impairment. Inevitably, motor function recovery must be taken into action through rehabilitation.

Surface Electromyography signal (sEMG) of the human's forearm has promised much benefit for rehabilitation therapy. It provides information about the user's intended finger movement which is detected in advance of the movement occurred. This user's intention is very important in enhancing the human-machine interaction by reducing the delay time of the rehabilitation devices in response to the user intention. The processing of the sEMG to detect the user's intention in advance can be done by using a pattern recognition method.

Finger-motion pattern recognition has been attracted some researchers to deal with. Tenore et al classified ten classes of the individual finger movements using Multi-Layer Percepteron as a classifier with accuracy of ~ 90%. The features from up to 32 sEMG channels are extracted using time domain feature extractions [1]. An improved performance was achieved by Khusaba et al [2], by using only two channels, they succeeded in recognizing ten class finger movements, individual and combined motions, with accuracy of ~ 92 %. Time domain extractions were used to extract the features and then the extracted features were reduced its dimensionality using Linear Discriminant Analysis (LDA) before being feed to the classifier which was Support Vector Machine. In addition, a high accuracy performance of 98 % has been achieved by Al-Timemy et al [3] in which 15 individual finger movements were classified using six sEMG channels. Time Domain Autoregressive feature, Fuzzy Neighbourhood Dimensionality Reduction and LDA are used as a feature extraction, dimensionality reduction and classification method, respectively.

The challenging task in finger motions detection is to use fewer numbers of electrodes without compromising the classification accuracy. Fewer channels means less information provided and it demands an effective classification system. Inevitably, the classification accuracy greatly depends on the feature extraction [4] and the classification method [5]. Therefore, the recognition system selection will be critical in dealing with these challenging. Up to our knowledge, the least number channels used so far for finger motion recognition is two channels which was done by Khusaba [2] and Anam [6]. They used time domain feature extraction method plus Autoregressive (AR) parameters which were proved in some results [2, 5] have an excellent performance and robust to the electrode shift.

In classification, LDA has been used widely because its simplicity. However, its performance is not as accurate as a well-known Support Vector Machine (SVM). SVM has promised a satisfactory classification performance. Another new promising classification which is fast and has similar performance to SVM is Extreme Learning Machine (ELM) [7]. ELM is generalized" single-hidden-layer feedforward networks (SLFNs) whose hidden layer does not need to be tuned. It needs fewer optimization constraint, has better generalization functioning and faster learning time than SVM [7]. Like SVM, ELM can be extended into kernel ELM such as radial basis function, polynomial, liner and wavelet kernel. Different from node based ELM which is no need to tune in the hidden layer parameters; the kernel-based ELM needs a parameter tuning.

This paper propose a novel finger motion recognition system which consists of the time domain and AR features, Spectral Regression Discriminant Analysis (SRDA) [8] and kernel-based ELM for the feature extraction, dimensionality reduction and classification method respectively. For optimizing the parameters of kernel-based ELM, a the

Khairul Anam is with the University of Jember Indonesia. Now he is PhD student at University of Technology Sydney, P.O. Box 123 Broadway, NSW 2007 Australia (Phone: (+61)295147962; fax: - ; e-mail: Khairul.Anam@student.uts.edu.au

Adel Al-Jumaily is Associate Professor with School of Electrical, Mechanical and Mechatronic Systems, University of Technology, Sydney (e-mail: Adel.Al-Jumaily@uts.edu.au).

particle swarm optimization (PSO) have been employed [9]. PSO is a population-based stochastic optimization method inspired by the social interactions of animals, such as bird flocking and fish schooling. It has been widely used in optimization of intelligent system such as fuzzy system [10], artificial neural network [11], and support vector machine [12, 13]. To refine the classification result, the majority vote [14] is used along with the hybridization of PSO and ELM.

II. METHOD

A. Proposed method

The proposed recognition system consists of two stages i.e., a tuning of ELM parameters and an offline classification stage. In the both stages, the EMG signals were acquired by a data acquisition device from eight subjects. The filtering and windowing were applied to the collected data before being extracted using a time domain feature set. To reduce the dimension of the features, SDRA was employed. Afterwards, the optimization process was done using PSO with the goal is to find out the best ELM parameters which minimize the classification error. Based on the parameters obtained in the tuning stages, the offline classification was carried out. The classification outputs were refined by using the majority vote. Statistical Analysis was performed to validate the result.

B. Experiment procedures

The data used in this work were acquired from eight subjects, two females and six males aged 24-60 years old. All subjects were normally limbed with no muscle disorder. To avoid the effect of position movement on EMG signals, subject's arm was supported and fixed at certain position as used in [2].

The FlexComp Infiniti™ System from Thought Technology was used to acquire the signals from two EMG MyoScan™ T9503M Sensors which were put on the subject's forearm as seen in the figure 1. The acquired EMG signals were amplified to a total gain of 1000 and sampled at 2000 Hz.

The collected EMG signals were processed in the Matlab 2012b installed in the Intel Core i5 3.1 GHz desktop computer with 4 GB RAM running on Windows 7 operating system. The signals were filtered by a band pass filter between 20 and 500 Hz with a notch filter to remove the 50 Hz line interference. Finally, the EMG signals were down sampled to 1000 Hz.

Fig. 2 shows ten classes of the individual and combined finger movements consisting of the flexion of individuated fingers, i.e., Thumb (T), Index (I), Middle (M), Ring (R), Little (L) and the pinching of combined Thumb–Index (T–I), Thumb–Middle (T–M), Thumb–Ring (T–R), Thumb–Little (T–L), and the hand close (HC).

The classification was performed based on the data from the data acquisition. In this stage, the subjects asked to perform a certain posture of finger movement for a period of 5 seconds and then take a rest for 5 seconds. Each movement

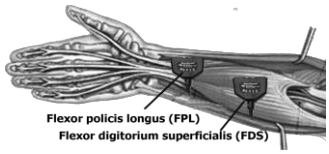

Fig. 1. The placement of the electrodes

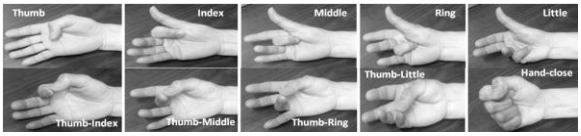

Fig. 2. Ten different finger movements

was repeated six times. The data collected were divided into training data and testing data by using 4-fold cross validation.

C. Feature Extraction

The features were extracted from a time domain feature set which consists of Waveform Length (WL), Slope Sign Changes (SSC), Number of Zero Crossings (ZCC), and Sample Skewness (SS). In addition, some parameters from Hjorth Time Domain Parameters (HTD) and Auto Regressive (AR) Model Parameters were included. All features were extracted by using myolectric toolbox [14] and Biosig toolbox [15]. The AR model parameters have been proven to be stable and robust to the electrode location shift and the change of signal level [16].

The all features were concatenated and reduced using SRDA. SRDA is an extension of LDA which can deal with a singularity and a large data set. The 100 ms window length was applied to the signal to comply with the real time application along with a 100 increments.

E. Extreme learning Machine

ELM is a learning scheme for single layer feedforward networks (SLFNs). While the network parameters are tuned in classical SLFNs learning algorithms, most of these parameters are analytically determined in ELM. The hidden parameters can be independently determined from the training data, and the output parameters can be determined by pseudo-inverse method using the training data. As a result, the learning of ELM can be carried out extremely fast compared to the other learning algorithms [7].

The output function of ELM for generalized SLFNs (for one output node case) is:

$$f_L(x) = \sum_{i=1}^{L} \beta_i h_i(x) = \mathbf{h}(\mathbf{x})\boldsymbol{\beta} \qquad (1)$$

where $\boldsymbol{\beta} = [\beta_1, ..., \beta_L]^T$ is the vector of the output weight between hidden layer of L nodes and the output node, $\mathbf{h}(\mathbf{x}) = [h_1(x), ..., h_L(x)]$ is the output vector of hidden layer. The objective of ELM is to minimize the error and the norm of weight:

$$\text{Minimize}: \left\|\mathbf{H}\boldsymbol{\beta} - \mathbf{T}\right\|^2 \text{ and } \left\|\boldsymbol{\beta}\right\| \qquad (2)$$

where $\mathbf{T}$ is the target. For classification purpose, the output function of ELM in equation (1) could be modified to be:

$$f(x) = \mathbf{h}(\mathbf{x})\boldsymbol{\beta} = \mathbf{h}(\mathbf{x})\mathbf{H}^{T}\left(\frac{1}{C}+\mathbf{H}\mathbf{H}^{T}\right)^{-1} T \qquad (3)$$

where

$$\mathbf{H} = \begin{bmatrix} \mathbf{h}(x_1) \\ \vdots \\ \mathbf{h}(x_N) \end{bmatrix} = \begin{bmatrix} h_1(x_1) & \cdots & h_L(x_1) \\ \vdots & \vdots & \vdots \\ h_1(x_N) & \cdots & h_L(x_N) \end{bmatrix} \qquad (4)$$

as C is a user-specified parameter and N is the number of the training data. In the equation (3), h(x) is a feature mapping (hidden layer output vector) which can be :

$$h(x) = \left[G(a_1, b_1, x), \ldots, G(a_L, b_L, x)\right] \qquad (5)$$

where G is a non-linear piecewise continuous function such as sigmoid, hard limit, Gaussian, and multi quadratic function.

If the feature mapping h(x) is unknown to the user, a kernel function can be used to represent h(x). Then, the equation (3) would be:

$$f(x) = \mathbf{h}(\mathbf{x})\mathbf{H}^{T}\left(\frac{1}{C}+\mathbf{H}\mathbf{H}^{T}\right)^{-1} T = \begin{bmatrix} K(x, x_1) \\ \vdots \\ K(x, x_N) \end{bmatrix}\left(\frac{1}{C}+\Omega_{ELM}\right)^{-1} T \qquad (6)$$

where

$\Omega_{ELM} = \mathbf{H}\mathbf{H}^{T} : \Omega_{ELM i,j} = h(x_i).h(x_j) = K(x_i, x_j)$ and K is a kernel function as shown in Eq 7-8.

$$\text{Radial basis function} : K(\mathbf{x}_i, \mathbf{x}_j) = \exp\left(-\gamma \left\|\mathbf{x}_i - \mathbf{x}_j\right\|^2\right) \qquad (7)$$

$$\text{Linear} : K(\mathbf{x}_i, \mathbf{x}_j) = \mathbf{x}_i \cdot \mathbf{x}_j \qquad (8)$$

$$\text{Polynomial} : K(\mathbf{x}_i, \mathbf{x}_j) = \left(\mathbf{x}_i \cdot \mathbf{x}_j + a\right)^{d} \qquad (9)$$

F. Particle Swarm Optimization (PSO)

In the PSO, a swarm of interacting particles move in a *n*-dimensional search space of the problem's possible solution. Four elements which are a position $\vec{x}_i$, a velocity $\vec{v}_i$, the best previous (local) position $\vec{p}_i$ and the best global position $\vec{g}$ represent a particle in the swarm. Some generations are generated to update the particle's positions and velocities. The particles explore the promising domain to find the best solutions which spread throughout the swarm. The parameter adaptations are given by:

$$\vec{x}_i(t+1) = \vec{x}_i(t) + \vec{v}_i(t+1) \qquad (10)$$

$$\vec{v}_i(t+1) = \varphi\vec{v}_i(t) + c_1 \cdot r_1 \cdot (\vec{p}_i(t) - \vec{x}_i(t)) + c_2 \cdot r_2 \cdot (\vec{g}(t) - \vec{x}_i(t)) \qquad (11)$$

where *t* represents the generation. φ is inertia weight, and c_1 and c_2 are acceleration constant which are weighted by r_1 and r_2, a random function in the range of [0- 1]. Based on [12], total number of c_1 and c_2 should exceed 4 to assure the convergence. In this work, the c_1 and c_2 are set at 2.05 while φ is 0.9. In addition, the optimization was done until 150 generations with 30 particles in each generation.

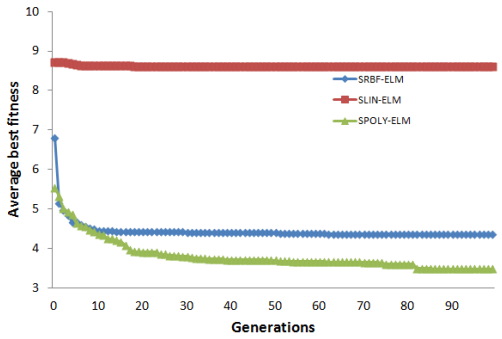

Fig 3. The average fitness functions for different kernels across eight subjects using 3-fold cross validation.

The objective of the optimization using PSO is to find the best kernel-based ELM parameters which minimize the classification error of the finger motion recognition. A 3-fold cross validation was employed to measure the error. Thus the fitness function of particle $\vec{x}$ is defined by

$$f(\vec{x}) = Err_{val}(\vec{x}) \qquad (12)$$

The optimization was implemented in three kernels and it forms three hybridizations of PSO and ELM i.e., a swarm-based radial basis function ELM (SRBF-ELM), a swarm-based linear ELM (SLIN-ELM) and swarm-based polynomial ELM (SPOLY-ELM). The ranges of parameters values of the PSO are $C \in [2^{-5}, 2^{5}]$, $\gamma \in [2^{-4}, 2^{10}]$, $a \in [2^{-4}, 2^{10}]$ and $d \in [1, 50]$.

F. Majority Vote

To smooth the classification results, the majority vote [14] was applied. It employs the results from the *n* present state and *m* previous states and makes a new classification result based on the class which comes out most frequent. In this research, $n = 0$ and $m = 4$ were used. The higher *n* or *m* votes could be possibly used if the overlapped windowing is utilized. This research employs the disjoint windowing thus the high *m* or *n* votes will delay the classification output.

III. Result and Discussion

In the first part of the experiments, an evaluation of the convergence of PSO for different kernels across eight subjects took part. As shown in the fig. 3, all fitness outputs converge to the optimum value. SPOLY-ELM achieves the minimum error compared to other kernels. However, the fitness output may be possible to change with more generations were generated. In other hand, the SLIN-ELM shows different trends. Its fitness gets constant quicker than other two but it keeps staying at the highest error compared to the other two. Meanwhile, the SBRF-ELM shows a moderate behaviour.

TABLE I. The Optimal Parameter Optimized by a Swarm Technique

Type of ELM	Optimal Parameters			
	C	γ	a	d
SLIN-ELM	1.56	-	-	-
SRBF-ELM	24.75	0.82	-	-
SPOLY-ELM	14.75	-	430.27	4.38

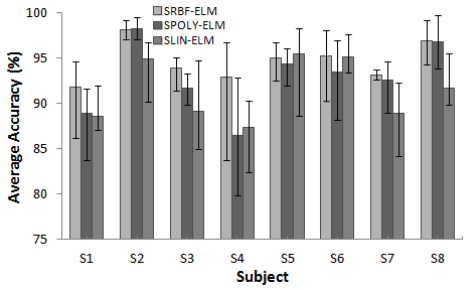

Fig 4.The classification accuracy of the optimized ELM averaged from eight subjects

The next experiment is the evaluation of the classification performance using the optimal parameters optimized by PSO as tabled in table 1. Fig. 4 depicts accuracies of all systems over eight subjects. SRBF-ELM outperforms other two systems especially compared to SLIN-ELM but not too much compared to SPLOY-ELM. It is clear that by averaging the accuracy over eight subjects as shown in Table 2, SRBF-ELM achieved the highest accuracy.

TABLE II. THE AVERAGE CLASSIFICATION ACCURACY ACROSS EIGHTS SUBJECT

Type	Average Accuracy
SRBF-ELM	94.62 ± 3.70
SLIN-ELM	91.43 ± 5.61
SPOLY-ELM	94.16 ± 3.70

The performance of the systems in recognizing the finger movements is also investigated. As described in fig. 5, SRBF-ELM outperforms SLIN-ELM and has similar performance as SPOLY-ELM. In addition, all systems recognize individual motions better than combined motions as can be noticed, the accuracy of individual motions are mostly higher than the combined ones except the little finger (L) which is the most difficult motion to recognize.

Besides two previous experiments, the statistical test using Analysis of variance (ANOVA with significance values set at 0.05) is performed as well, as described in table 3. The p-values in table III indicates that there is no significant performance between SRBF-ELM and SPLOY-ELM ($p>0.05$). Thus both systems have same performance. Meanwhile, the performance of SRBF-ELM and SLIN-ELM are significantly different ($p<0.05$). In addition, SPOLY-ELM and SLIN ELM are not significantly different ($p>0.05$).

IV. CONCLUSION

The paper proposes the combination of PSO and ELM in the way of optimization of ELM's parameters by using PSO. Among three hybridizations, SRBF-ELM outperforms SLIN-ELM but not too much different compared to SPOLY-LIN. This is also indicated by the p-values in which SRBF-ELM and SPOLY-ELM have similar performance. Moreover, PSO is able to optimize the three systems by giving the accuracy more than 90% with the highest accuracy is ~94%.

TABLE III. P-VALUES RESULTING FROM A-PAIR WISE COMPARISON OF CLASSIFICATION ACCURACY

	SPOLY-ELM	SLIN-ELM
SRBF-ELM	0.72	0.04
SPOLY-ELM		0.09

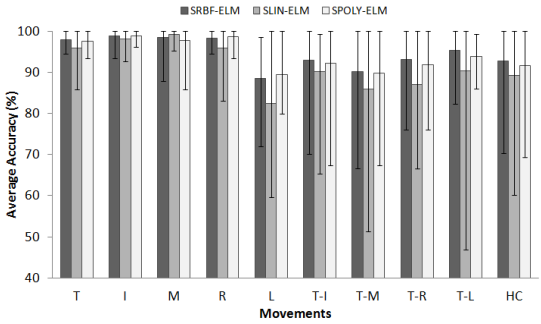

Fig 5.The classification accuracy of the optimized ELM averaged from eight subjects

REFERENCES

1. Tenore, F.V.G., et al., *Decoding of individuated finger movements using surface electromyography.* IEEE Transactions on Biomedical Engineering, 2009. **56**(5): p. 1427-1434.
2. Khushaba, R.N., et al., *Toward improved control of prosthetic fingers using surface electromyogram (EMG) signals.* Expert Systems with Applications, 2012(0).
3. Al-Timemy, A.H., et al., *Classification of Finger Movements for the Dexterous Hand Prosthesis Control With Surface Electromyography.* Biomedical and Health Informatics, IEEE Journal of, 2013. **17**(3): p. 608-618.
4. Phinyomark, A., P. Phukpattaranont, and C. Limsakul, *Feature reduction and selection for EMG signal classification.* Expert Systems with Applications, 2012. **39**(8): p. 7420-7431.
5. Oskoei, M.A. and H. Huosheng, *Support Vector Machine-Based Classification Scheme for Myoelectric Control Applied to Upper Limb.* Biomedical Engineering, IEEE Transactions on, 2008. **55**(8): p. 1956-1965.
6. Anam, K., R.N. Khushaba, and A. Al-Jumaily. *Two-channel surface electromyography for individual and combined finger movements*. in *Engineering in Medicine and Biology Society (EMBC), 2013 35th Annual International Conference of the IEEE*. 2013. IEEE.
7. Huang, G.B., et al., *Extreme learning machine for regression and multiclass classification.* IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics, 2012. **42**(2): p. 513-529.[Online]. Available:http://www.ntu.edu.sg/home/egbhuang/elm_codes.html.
8. Cai, D., X. He, and J. Han, *SRDA: An efficient algorithm for large-scale discriminant analysis.* IEEE Transactions on Knowledge and Data Engineering, 2008. **20**(1): p. 1-12.
9. Parsopoulos, K.E. and M.N. Vrahatis, *Recent approaches to global optimization problems through particle swarm optimization.* Natural computing, 2002. **1**(2-3): p. 235-306.
10. Zhao, L., et al., *Automatically extracting T–S fuzzy models using cooperative random learning particle swarm optimization.* Applied Soft Computing, 2010. **10**(3): p. 938-944.
11. Lin, C.-J. and M.-H. Hsieh, *Classification of mental task from EEG data using neural networks based on particle swarm optimization.* Neurocomputing, 2009. **72**(4): p. 1121-1130.
12. de Souza, B.F., et al. *Multiclass SVM model selection using particle swarm optimization*. in *Hybrid Intelligent Systems, 2006. HIS'06. Sixth International Conference on*. 2006. IEEE.
13. Nuryani, N., S.S. Ling, and H. Nguyen, *Electrocardiographic signals and swarm-based support vector machine for hypoglycemia detection.* Annals of Biomedical Engineering, 2012. **40**(4): p. 934-945.
14. Chan, A.D.C. and G.C. Green. *Myoelectric control development toolbox*. in *Proceedings of 30th Conference of the Canadian Medical & Biological Engineering Society*. 2007.
15. Schlogl, A. and C. Brunner, *BioSig: a free and open source software library for BCI research.* Computer, 2008. **41**(10): p. 44-50.
16. Tkach, D., H. Huang, and T.A. Kuiken, *Study of stability of time-domain features for electromyographic pattern recognition.* Journal of NeuroEngineering and Rehabilitation, 2010. **7**(1): p. 21.

Welcome from the MECBME 2014 General Chairs

Dear Friends and Colleagues,

On behalf of the Organizing Committee, it is our pleasure and privilege to welcome you to the 2014 edition of the Middle East Conference on Biomedical Engineering (MECBME'14), the premier international bioengineering conference in the region. This year we are fortunate to have among us very high caliber researchers and scholars with national and international reputation.

The setting for this year's conference is in one the fastest growing cities in the world, Doha, Qatar. As some of you know, Qatar has become a major player in many fields of research, thanks to the vision and support of Her Highness Sheikha Mozah Bint Nasser Al-Missned, Chairperson of the Board of Directors for Qatar Foundation for Education, Science and Community Development. Over the past few years, the Research and Development branch of Qatar Foundation (QF R&D) has been the catalyst for some of the most exciting collaborations between research institutions in Qatar and well-known academic and industrial institutions around the world. We anticipate that MECBME'14 will be a forum where new collaborative opportunities in bioengineering and nanomedicine will be seeded and new research initiatives could be launched.

MECBME'14 covers a broad spectrum of topics in biomedical engineering and healthcare technologies, including medical and clinical applications. The pre-conference day, February 17, features two tutorials in the medical applications of Virtual and Augmented Reality and various techniques of Brain Monitoring. The conference will open officially on Tuesday, February 18, with an address delivered by Dr. Thomas Zacharia, Executive Vice-President of QF R&D, followed by a keynote lecture by Dr. Chad Mirkin, Professor and Director of the International Institute for Nanotechnology at Northwestern University. Four additional plenary addresses will be delivered by Dr. Mimoun Azzouz, Professor and Co-Director of Sheffield Institute of Translational Neuroscience, Dr. Mustafa Khammash, Professor of Control Theory and Systems Biology in the Department of Biosystems Science and Engineering at ETH- Zurich, Dr. Hicham Fenniri, Professor and Scientific Director at Qatar Biomedical Research Institute, and Dr. Curtis L. Lowery, Chairperson for the University of Arkansas Medical Sciences Department of Obstetrics and Gynecology. We are also very pleased to invite all the conference participants to a gala dinner on Wednesday 19 February during which we will have an opportunity to further network with regional researchers as well as international experts.

Our scientific program includes 126 presentations from 26 countries. All accepted papers have been reviewed rigorously by a panel of highly qualified experts to ensure that scientific standards are met and that the latest exciting new advances in the field of biomedical engineering from all over the world are presented in this forum.

Besides the great science planned for you during this conference we also hope that you will take the time to enjoy the local culture and beautiful landscapes of this wonderful country!

Welcome to Doha and welcome to MECBME'14.

Professor Reza Tafreshi, Ph.D., Chair
Mechanical Engineering Program
Texas A&M University at Qatar

Professor Hicham Fenniri, Ph.D., Chair
Biomedical Engineering Research
Qatar Biomedical Research Institute

Conference Committees

Conference Organizing Committee

Conference Chairs

Reza Tafreshi, Texas A&M University at Qatar
Hicham Fenniri, Qatar Biomedical Research Institute

Technical Chairs

Mohamed Nounou, Texas A&M University at Qatar
Hazem Nounou, Texas A&M University at Qatar

Technical Co-Chairs

Hasan Al-Nashash, American University of Sharjah
Halima Bensmail, Qatar Computing Research Institute

Sponsorship, Finance and Registration

Chair:
Othmane Bouhali, Texas A&M University at Qatar
Co-Chair:
Julien Abi Nahed, Qatar Robotic Surgery Centre

Plenary Sessions, Tutorials, Publications, and Local arrangements

Chair:
Beena Ahmed, Texas A&M University at Qatar
Co-Chairs:
Nader Meskin, Qatar University
Naim Hadda, Weill Cornell Medical College in Qatar
Salma Mansar, Carnegie Mellon University in Qatar

International Advisory Board

Metin Akay, University of Houston
Abdulla Al-Ansari, Hamad Medical Corporation
Ahmed Al-Jumaily, Auckland University of Technology
Rashid Bashir, University of Illinois
Boualem Boashash, Qatar University
Guy Dumont, University of British Colombia
Ali Khademhosseini, Harvard Medical School
Nigel Lovell, The University of New South Wales
John Nolan, La Jolla Bioengineering Institute
Ahmed Tewfik, University of Texas

Nitish Thakor, John Hopkins University
Thomas Webster, Northeastern University
Guang-Zhong Yang, Imperial College of Science, Technology, and Medicine
Ziad Abu-Faraj, American University of Science and Technology

Steering Committee

Hasan Al-Nashash, American University of Sharjah – Chair
Khaled Assaleh, American University of Sharjah
Nasser Qaddoumi, American University of Sharjah
Kinda Khalaf, Khalifa University
Riad Mahfouz, Vital Quadro
Wathiq Mansoor, American University in Dubai

Conference Information

Plenary Lectures

Title: Cybergenetics: The Emerging Science of Feedback Control of Living Cells
Speaker: Dr. Mustafa Khammash
Time and Location: 08:30-09:25, Wednesday February 19, 2014, NASHIRA 1

Dr. Mustafa Khammash is Professor of Control Theory and Systems Biology in the Department of Biosystems Science and Engineering (D-BSSE) at ETH-Zurich. He received his B.S. degree from Texas A&M University in 1986 and his Ph.D. from Rice University in 1990, both in Electrical Engineering. In 1990, he joined the Electrical Engineering Department at Iowa State University. While at Iowa State University, he created the Dynamics and Control Program and led that control group until 2002, when he became a member of the Mechanical Engineering faculty at the University of California, Santa Barbara. In Santa Barbara, he served as Vice Chair of the Mechanical Engineering Department from 2003 to 2006 and as the Director of the Center for Control, Dynamical Systems and Computation from 2005 to 2011. In 2011 Prof. Khammash moved with his group to Switzerland, joining the Department of Biosystems Science and Engineering at ETH Zurich.

Dr. Khammash works in the areas of control theory, systems biology, and synthetic biology. His research aims to understand the role of dynamics, feedback, and randomness in biology, and to develop the tools needed to aid in this understanding. Work in his lab focuses on the creation of novel computational methods for the modeling, simulation, analysis, and control of biological networks, with particular attention to stochastic systems. Application of these methods to the understanding of specific biological systems include calcium homeostasis, bacterial heat-shock response, pheromone response in yeast, NFk-B signaling pathway, Pap and Ag43 epigenetic switches. Working at the interface of control theory and biology, Prof. Khammash's group is currently developing the theory, computational methods, and experimental tools for the computer control of living cell populations.

Title: Gene therapeutics for neurodegenerative diseases
Speaker: Professor Mimoun Azzouz
Time and Location: 13:00-13:55, Tuesday February 18, 2014, NASHIRA 1

Professor Mimoun Azzouz graduated in Biology and Neuroscience from the University of Rabat in 1993. He obtained a Master in Neuroscience with 1st Class Honours from the University of Marseille in 1994. In 1997 he was awarded a PhD in Neuropharmacology at the University Louis Pasteur in Strasbourg. He then worked as postdoctoral scientist at the Gene Therapy Center in Lausanne, Switzerland from 1997 to 2000. He was recruited in 2000 by Oxford BioMedica Ltd as Senior Scientist then appointed as Director of Neurobiology in 2003. He was also a visiting scientist at Oxford University between 2000 and 2005. In 2006, he was invited to join the University of Sheffield and was appointed to the Chair of Translational Neuroscience.

Professor Azzouz is currently Co-Director of Sheffield Institute of Translational Neuroscience (SITraN), Deputy Head of Neurology Unit and Director of Research & Innovation within the Department of Neuroscience. His track record of translational research productivity is characterised by publications in top ranking scientific journals, including Nature, Nature Medicine, Nature Neuroscience, and JCI. Several inventions emerged from his research. One of his major achievements is a gene therapy approach designed to achieve dopamine replacement in models of Parkinson[1]s disease. This strategy has yielded significant translational impact having entered into phase I/II human clinical trials since 2008. His pioneering work, which has already produced major breakthroughs in animal models, has short and medium term potential for real translation into major therapeutic advances for human neurodegenerative disease.

He has been successful in attracting an array of scientific awards and funding (over £9M in the last 5 years) from prestigious funding bodies. He recently won the prestigious ERC Advanced Investigator Award (2012). This award is a top level EU ad hominem award acknowledging his pre-eminence in European biomedical research. He has been a key academic partner in the successful fundraising of £18M necessary to build the new Sheffield Institute for Translational Neuroscience (SITraN). He is frequently invited as a plenary lecturer at international scientific and clinical meetings where his work generates intense interest from the scientific community. He has been advisor for pharmaceutical companies (BioMarin Pharmaceutical Inc, Oxford BioMedica Ltd). He is currently a member of the editorial board of various journals and member of scientific panels for various funding bodies such as the Medical Research Council (MRC, UK), the French Muscular Dystrophy Association (AFM) and The Research Council of Norway.

Title: Spherical Nucleic Acid (SNA) Nanostructures: Establishing a New Paradigm in Molecular Diagnostics and Intracellular Gene Regulation
Speaker: Professor Chad Mirkin
Time and Location: 09:30-11:30, Tuesday February 18, 2014, NASHIRA 1

Professor Chad A. Mirkin is the Director of the International Institute for Nanotechnology, the George B. Rathmann Prof. of Chemistry, Prof. of Chemical and Biological Engineering, Prof. of Biomedical Engineering, Prof. of Materials Science & Engineering, and Prof. of Medicine. He is a chemist and a world renowned nanoscience expert, who is known for his development of nanoparticle-based biodetection schemes, the invention of Dip-Pen Nanolithography, and contributions to supramolecular chemistry. He is the author of over 550 manuscripts and over 930 patents worldwide (241 issued), and the founder of four companies, Nanosphere, NanoInk, AuraSense, and AuraSense Therapeutics, which are commercializing nanotechnology applications in the life science and semiconductor industries.

Dr. Mirkin has been recognized for his accomplishments with over 80 national and international awards. These include the Linus Pauling Medal, a Honorary Membership in the Materials Research Society of India, the Walston Chubb Award for Innovation, an Honorary Degree from Nanyang Technological Univ. Singapore, recognition as the Lee Kuan Yew Distinguished Visitor to Singapore, an Honorary Professorship from Hunan Univ. China, the ACS Award for Creative Invention, the Herman S. Bloch Award for Scientific Excellence in Industry, an Einstein Professorship of the Chinese Academy of Sciences, the Edward Mack Jr. Memorial Award, the $500,000 Lemelson-MIT Prize, the Havinga Medal, the Gustavus John Esselen Award, the Biomedical Eng. Society's Distinguished Achievement Award, a DoD NSSEFF Award, the Pittsburgh Analytical Chemistry Award, the ACS Inorganic Nanoscience Award, the iCON Innovator of the Year Award, a NIH Director's Pioneer Award, the Collegiate Inventors Award, the National Inventors Hall of Fame, an Honorary Doctorate Degree from Dickinson College, the Pennsylvania State Univ. Outstanding Science Alumni Award, the ACS Nobel Laureate Signature Award for Graduate Education in Chemistry, a Dickinson College Metzger-Conway Fellowship, the 2003 Raymond and Beverly Sackler Prize in the Physical Sciences, the Feynman Prize in Nanotechnology, the Leo Hendrick Baekeland Award, Crain's Chicago Business "40 under 40 Award," the Discover 2000 Award for Technological Innovation, I-Street Magazine's Top 5 List for Leading Academics in Technology, the Materials Research Society Young Investigator Award, the ACS Award in Pure Chemistry, the PLU Fresenius Award, the Harvard University E. Bright Wilson Prize, the BF Goodrich Collegiate Inventors Award, the Camille Dreyfus Teacher-Scholar Award, the Alfred P. Sloan Foundation Award, the DuPont Young Professor Award, the NSF Young Investigator Award, the Naval Young Investigator Award, the Beckman Young Investigator Award, and the Camille and Henry Dreyfus Foundation New Faculty Award.

He is a Member of the President's Council of Advisors on Science & Technology (PCAST, Obama Administration), and the only chemist (one of only 12 scientists, engineers, and medical doctors) to be elected to all three US National Academies (the Inst. of Medicine, the Natl. Academy of Sci., and the Natl. Academy of Engin.). He is also a Fellow of the American Academy of Arts and Sciences and the American Association for the Advancement of Science and the Materials Research Society. Dr. Mirkin has served on the Editorial Advisory Boards of over twenty scholarly journals, includingBiosensors & Bioelectronics, JACS, Acc. Chem. Res., Angew. Chem., Adv. Mater., Biomacromolecules, Macromolecular Bioscience, SENSORS,Encyclopedia of Nanoscience and Nanotechnology, Chem. Eur. J., Chemistry & Biology, Nanotechnology Law & Business, The Scientist, J. Mater. Chem., J. Cluster Sci., and Plasmonics, and at present, he is an Associate Editor of JACS. He is the founding editor of the journal Small, one of the premier international nanotechnology journals, and he has co-edited three bestselling books.

Dr. Mirkin holds a B.S. degree from Dickinson College (1986, elected into Phi Beta Kappa) and a Ph.D. degree in Chemistry from the Penn. State Univ. (1989). He was an NSF Postdoctoral Fellow at the MIT prior to becoming a professor at Northwestern Univ. in 1991.

Title: Distance Health: A Solution For Dealing With Healthcare Shortages Using Technology
Speaker: Professor Curtis L. Lowery
Time and Location: 09:30-10:25, Thursday February 20, 2014, NASHIRA1

As the Chairperson for the University of Arkansas for Medical Sciences' Department of Obstetrics and Gynecology, Dr. Curtis Lowery is viewed as a champion of antenatal and neonatal telemedicine benefiting the patient and physician alike. Dr. Lowery facilitated the process in which Arkansas insurance handles telemedicine, increased Medicaid reimbursements and promoted understanding for telemedicine, and brought telehealth access to over 60 hospitals and community clinics in rural Arkansas providing medical consultations combined with provider and patient education. Dr. Lowery has established a Medicaid-funded, cost-effective programmatic solution to assist Arkansas' high-risk pregnancies, ANGELS. Dr. Lowery founded this effort that reaches throughout Arkansas to those in need of subspecialty Maternal-Fetal Medicine support. Through this expertise, Dr. Lowery founded the UAMS Center for Distance Health, a technology-based partnership of the College of Medicine and Regional Programs. This Center directly offers telemedicine, continuing medical and health education, public health education, and evaluation research through interactive video throughout Arkansas. The Center for Distance Health represents the culmination of Arkansas' telemedicine and distance health technology expertise, with directors and stakeholders who have been instrumental in developing telehealth initiatives in Arkansas. In his latest effort, Dr. Lowery led a statewide effort in attaining over $102M in federal funding to allow the creation of the Arkansas Healthcare, Higher Education, Public Safety, & Research Integrated Broadband Initiative. The grant will allow the creation of high-speed internet connections in all 75 counties in the state and in 135 communities. This program, now called E-Link, will make or upgrade connections to 81 hospitals, all two-year colleges, eight public libraries and a variety of public health institutions, bringing the total number of partners for the project to over 470. Additionally, Dr. Lowery was instrumental in reinvigorating the UAMS application for the Clinical and Translational Science Award (CTSA) grant from the National Institutes of Health. UAMS was awarded $20 million for the CTSA, with Dr. Lowery as the Principal Investigator for the university-wide project. He was recently recognized by the UAMS College of Medicine through the 2007 Educational Innovation Award, and ANGELS was announced by Harvard University Ash Institute as one of the nation's most innovative governmental collaborations. Dr. Lowery also received the 2007 Hugo Gernsback Award for Clinical Innovation in Telemedicine by the AT&T Center for Telehealth Research & Policy.

Title: Engineered Nanomaterials for siRNA delivery and Gene Silencing
Speaker: Dr. Hicham Fenniri
Time and Location: 13:00-13:55, Wednesday February 19, 2014, NASHIRA 1

Dr. Hicham Fenniri received undergraduate degree in chemistry and biochemistry and his M.Sc./Ph.D. degrees in supramolecular sciences and engineering, at the Université Louis Pasteur in Strasbourg, France. He then joined the Scripps Research Institute in California, USA, where he carried out his postdoctoral training. In 1997 he moved to Purdue University, where he established the Purdue Laboratory for Chemical Nanotechnology. In 2003, He joined the National Research Council and the University of Alberta in Canada to lead the Supramolecular Nanoscale Assembly program. Dr. Fenniri is currently Director of QBRI's Biomedical Engineering Research Center in Doha, Qatar and holds a Professorship in Chemical and Biomedical Engineering at Northeastern University, Boston, MA, USA.

Dr. Fenniri has achieved international recognition as a leader in the areas of self-assembly, supramolecular chemistry, nanomedicine, combinatorial chemistry, and materials sciences. His group works at the forefront of basic and applied nanosciences, in collaboration with various academic institutions, federal laboratories, and with the private sector. Dr. Fenniri's contributions appeared in over 130 publications, 8 patents, and over 350 contributed national and international conference papers. Dr. Fenniri has also presented his work in over 130 invited distinguished lectures, colloquia and seminars around the globe. Dr. Fenniri is the recipient of several academic and professional honours and awards, is a Member of the Editorial Board of several scientific journals and serves on several national and international scientific boards, panels, and committees.

Tutorial Sessions

Title: New Applications of Virtual and Augmented Reality in Medicine and Surgery

Presenters: Lucio Tommaso De Paolis

Abstract: Virtual Reality (VR) technology permits to create realistic-looking worlds where interactivity and captivating power provide feeling of immersion and presence in the virtual world. It is not only possible to see and manipulate the virtual objects, but also to feel and touch them using specific haptic devices. Augmented Reality (AR) technology allows the real-time fusion of computer-generated digital content within the real world and the user is under the impression that the virtual and real objects coexist in the same space. VR/AR concepts are applicable to a wide range of applications moving from pure academic research into industrial and potential consumer areas. In particular, these technological innovations have provided medicine and surgery with new tools for diagnosis and therapy definition by translating the information contained in medical images into a 3D virtual model of the patient who is a realistic replica of living patient with actual pathologies. This has allowed the development of a new form of medical education and training and the use of patient-specific surgical simulators permit to practice and rehearse the surgical procedures on a virtual patient that is a kind of digital clone of the real one. New applications of AR technology provide systems that help surgeons in the intra-operative phase by means of the overlapping of virtual information on the real patient and permit to perform the tasks in ways that are both faster and safer. The use of AR in surgery has the potential to bring the advantages of the open-surgery visualization also in minimally invasive surgery.

The aim of this tutorial is to bring together researchers and physicians in order to share points of views and impressions on the Virtual Reality and Augmented Reality technologies in medicine and surgery and discuss the clinical benefits and limitations.

Title: Brain Monitoring

Presenters: Arash Taki and Hasan Al-Nashash

Abstract: The purpose of this session is to provide an overview of three advanced technologies: Electroencephalography (EEG), Bispectral Index (BIS™), Near Infrared Spectroscopy (NIRS). These technologies are used for brain monitoring to protect brain against neurological damages during clinical procedures. The physics of devices, sensitivity and validation of measurement will be covered in this program. This workshop will include three parts:

Part 1: Electroencephalography (EEG) Brain electroencephalograph (EEG) signal analysis is very valuable in predicting epileptic seizures, classifying sleep stages, assessment and monitoring the brain and spinal cord injuries and determining the depth of anesthesia. There is a compelling need to bring to the bedside state-of-the art instrumentation for rapid and accurate assessment and monitoring of brain injury due to cardiac arrest. Part of this tutorial presentation will focus on using information based measures such as spectral entropy to quantify the levels of brain injury.

Part 2: Bispectral Index (BIS™) Bispectral Index (BIS™) monitoring systems allow anesthesia professionals the ability to access processed EEG information as a measure of the effect of certain anesthetics during the care of patients they select to monitor. It is an integrated measure of cerebral electrical activity that is statistically and empirically derived from the EEG, via a sensor placed on the forehead. It is a combination of several signal processing parameters including the power spectrum, bispectrum and time domain variables.

Part 3: Near Infrared Spectroscopy (NIRS): NIRS technology noninvasively monitors site-specific adequacy of perfusion in the brain or body tissue directly beneath its sensors. This gives real-time data on regional oxygen saturation (rSO2), which can detect site-specific ischemic complications even when systemic parameters or lab tests are within normal limits. Since the brain is the organ least tolerant to oxygen deprivation, use of this technology can help protect patients against brain injury or other complications that can last a lifetime and take a huge toll financially.

Content List of 2nd Middle East Conference on Biomedical Engineering

Technical Program for Tuesday February 18, 2014

Khoubani, Sahar	Amirkabir Univ. of Tech. (Tehran Pol.
Sheikhzadeh Nadjar, Hamid	AMI Semiconductor Canada Company
Fatemizadeh, Emad	Sharif Univ. of Tech.
Mohammadi, Elham	Amirkabir Univ. of Tech.

TuB2 QAMAR 1

Biomedical Circuts, Systems, Instrumentation, and Nano-Medicine (I) (Regular Session)

Chair: Contreras, Maria F	King Abdullah Univ. of Science and Tech.
Co-Chair: Rickers, Sebastian	Univ. of Duisburg-Essen

14:00-14:15 TuB2.1

A Novel Passive Micromixer with Trapezoidal Blades for High Mixing Efficiency at Low Reynolds Number Flow, pp. 25-28.

Le The, Hai	Vestfold Univ. Coll.
Tran-Minh, Nhut	Vestfold Univ. Coll. NorChip AS
Le-Thanh, Hoa	Vestfold Univ. Coll.
Karlsen, Frank	Oslofjord Res. Vestfold Univ. Coll.

14:15-14:30 TuB2.2

A Study on Mechanical Strength of Pyramid-Shaped Microneedle, pp. 29-32.

Le-Thanh, Hoa	Vestfold Univ. Coll.
Tran-Minh, Nhut	Vestfold Univ. Coll. NorChip AS
Le The, Hai	Vestfold Univ. Coll.
Karlsen, Frank	Oslofjord Res. Vestfold Univ. Coll.

14:30-14:45 TuB2.3

Receiver Coil Parameter Optimization Process for the Efficiency of an Implantable Inductive Power Transfer System, pp. 33-38.

Rickers, Sebastian	Univ. of Duisburg-Essen
Ruiz Navarro, Ignacio	Univ. of Duisburg-Essen
Bruck, Guido H.	Univ. of Duisburg-Essen
Jung, Peter	Univ. of Duisburg-Essen

14:45-15:00 TuB2.4

Design of Low Frequency Analog Low Pass Filter Using Tunable Pseudo Resistors, pp. 39-42.

Neshatvar, Nazanin	American Univ. of Sharjah
Al-Nashash, Hasan	American Univ. of Sharjah
Al Basha, Lutfi	American Univ. of Sharjah

15:00-15:15 TuB2.5

*Autonomous Sensor Dedicated to Force Measurements in Human Knee Implants**

Crescini, Damiano	Univ. of Brescia - DII
Serpelloni, Mauro	Univ. of Brescia - DII
Sardini, Emilio	Univ. of Brescia - DII

15:15-15:30 TuB2.6

Targeted Cancer Cell Death Induced by Low-Frequency Vibration of Biofunctionalized Magnetic Nanowires, pp. 47-50.

Contreras, Maria F	King Abdullah Univ. of Science and Tech.
Ravasi, Timothy	King Abdullah Univ. of Science and Tech.
Kosel, Juergen	King Abdullah Univ. of Science and Tech.

15:30-15:45 TuB2.7

A Low Voltage and Low Power Current-Mode Field Programmable Analog Computational Unit, pp. 51-54.

Al-Absi, Munir	KFUPM

TuB3 QAMAR 2

Biomechanics, Biomaterials, and Tissue Engineering (I) (Regular Session)

Chair: Al-Jumaily, Ahmed	Auckland Univ. of Tech.
Co-Chair: Nick, Christoph	Univ. of Applied Sciences Aschaffenburg

14:00-14:15 TuB3.1

Gold Nanopillar Microelectrodes on Low Temperature Curing Polyimide for the Interface with Electrogenic Cells, pp. 55-58.

Nick, Christoph	Univ. of Applied Sciences Aschaffenburg

Lippert, Paul	Univ. of Applied Sciences Aschaffenburg
Quednau, Sebastian	Tech. Univ. Darmstadt
Schlaak, Helmut	Tech. Univ. Darmstadt
Thielemann, Christiane	Univ. of Applied Sciences Aschaffenburg

14:15-14:30 TuB3.2

An "off-The Shelf" Synthetic Membrane to Simplify Regeneration of Damaged Corneas, pp. 59-62.

SEFAT, FARSHID	Univ. of Sheffield, Centre for Biomaterials and Tissue Engi
ORTEGA, ILIDA	Univ. of Sheffield, Centre for Biomaterials and Tissue Engi
MCKEAN, ROBERT	The Electrospinning Company Ltd, Oxford
DESHPANDE, PALLAVI	Univ. of Sheffield, Centre for Biomaterials and Tissue Engi
RAMACHANDRAN, CHARANYA	LV Prasad Eye Inst. (LVPEI)
HILL, CHRISTOPHER	Univ. of Sheffield, Department of Biomedical Science
TZOKOV, SVETOMIR	Univ. of Sheffield, Department of Biomedical Science
CLAEYSSENS, FREDERIK	Univ. of Sheffield, Centre for Biomaterials and Tissue Engi
SANGWAN, VIRENDER	LV Prasad Eye Inst. (LVPEI)
RYAN, ANTHONY	Univ. of Sheffield, Department of Chemistry
MACNEIL, SHEILA	Univ. of Sheffield, Centre for Biomaterials and Tissue Engi

14:30-14:45 TuB3.3

Computer Assisted to Determine the Influence of Connector Design and Stress Distribution in Incoris TZI (Zirconia) Fixed Partial Denture, pp. 63-66.

Nassef, Tamer	Misr Univ. for Science and Tech.
khalil, Moustafa	Professor of Biomaterials, Alexandria Univ.
Hussein, Sanaa	Professor of Fixed Prosthodontics, Alexandria Univ.

14:45-15:00 TuB3.4

An Aortic Arch Flow Loop for the Study of Hemodynamic-Induced Endothelial Cell Injury and Inflammation, pp. 67-70.

Alloush, Mhamad M.	American Univ. of Beirut
Oweis, Ghanem F.	American Univ. of Beirut
Nasr, Rihab	American Univ. of Beirut
Zeidan, Asad	American Univ. of Beirut

15:00-15:15 TuB3.5

Beaded Elastic Rods to Simulate the Diffusive Dynamics of Biofilament Deformations, pp. 71-74.

Goyal, Sachin	Univ. of California
Appanasamy, Nitish Ratan	Univ. of California

15:15-15:30 TuB3.6

Improving Relaxant Effect of Contracted Airway Smooth Muscles, pp. 75-78.

Al-Jumaily, Ahmed	Auckland Univ. of Tech.
Mathur, Meha	Auckland Univ. of Tech.

15:30-15:45 TuB3.7

An Iterative Finite Difference Scheme for Buckling of Graphene Beam Subject to Axial Compressive Load, pp. 79-82.

Ghazy, Mohammed	Texas A&M Univ. at Qatar
Elgindi, Mohamed	Texas A&M Univ. at Qatar
Wei, Dongming	Univ. of New Orleans

TuC1 NASHIRA 1

Biomedical Imgaing (II) (Regular Session)

Chair: Al-Jumaily, Adel	Univ. of Tech. Sydney
Co-Chair: Derraz, Foued	Medical Coll. Lille

16:00-16:15 TuC1.1

Integrating Soft and Hard Threshold Selection Algorithms for Accurate Segmentation of Skin Lesion, pp. 83-86.

Masood, Ammara	Univ. of Tech. Sydney
Al-Jumaily, Adel	Univ. of Tech. Sydney

16:15-16:30 TuC1.2

Edge-Based IVD Segmentation System, pp. 87-90.

Saleh Aboul-Yazeed, Rasha	systems and biomedical engineering dept., faculty of engineering

sayed ahmed mohamed, abdalla	cairo Univ.
El-Bialy, Ahmed M.	Cairo Univ.

16:30-16:45 TuC1.3

Enhanced Automatic Colon Segmentation for Better Cancer Diagnosis, pp. 91-94.

Ismail, Marwa	Univ. of Louisville

16:45-17:00 TuC1.4

*Multiple Sclerosis Lesion Segmentation Using Active Contours and Automatic Outlier Detection**

Derraz, Foued	Medical Coll. Lille
Peyrodie, Laurent	HEI
TALEB-AHMED, abdelmalik	Univ. de Valenciennes et du Hainaut Cambresis
Bousahla, Miloud	Abou Bekr Belkaid Univ.
Hautecoeur, Patrick	Medical Coll. Lille
verclytte, Sebastien	Medical Coll.

17:00-17:15 TuC1.5

Combining Long and Short Axis Myocardial Contours for Accurate Reconstruction of the Left Ventricular Surface, pp. 99-102.

El-Rewaidy, Hossam	Cairo Univ.
Khalifa, Ayman	Helwan Univ.
Fahmy, Ahmed S.	Cairo Univ.

17:15-17:30 TuC1.6

Medical Image Fusion Based on Joint Sparse Method, pp. 103-106.

Vekataraman, Anuyogam	Ryerson Univ.
Alirezaie, Javad	Ryerson Univ. Univ. of Waterloo
Babyn, Paul	Univ. of Saskatchewan
Ahmadian, Alireza	Tehran Univ. of Medical Sciences

17:30-17:45 TuC1.7

Mammograms Enhancement Using Wavelet Transform and Piecewise Linear and Nonlinear Coefficient Mapping, pp. 107-110.

Beheshti, Seyed Mohammadali	Science and Res. branch, Islamic Azad Univ. Tehran, Ir
Ahmadi Noubari, Hossain	1- Univ. of Tehran, and 2- Univ. of British Columbia
Fatemizadeh, Emad	Sharif Univ. of Tech.
Ramze Rezaee, Mahmoud	McKesson
Khalili, Mitra	Breast Cancer Res. Center, Tehran Medical Sciences Univ.

TuC2 QAMAR 1

Biomedical Circuts, Systems, Instrumentation, and Nano-Medicine (II) (Regular Session)

Chair: Meza-Cuevas, Mario A.	Hamburg Univ. of Tech.
Co-Chair: Poustinchi, Mohammad	McGill Univ.

16:00-16:15 TuC2.1

A Scalable 64 Channel Neurostimulator Based on a Hybrid Architecture of Current Steering DAC, pp. 111-114.

Meza-Cuevas, Mario A.	Hamburg Univ. of Tech.
Schroeder, Dietmar	Hamburg Univ. of Tech.
Krautschneider, Wolfgang H.	Hamburg Univ. of Tech.

16:15-16:30 TuC2.2

A Phantom for Cadaverless Evaluation of Targeting Systems for Distal Locking of Intramedullary Nails, pp. 115-118.

Jaber, Fadi	Qatar Univ.
Al-Jayyousi, Awni	Amber House

16:30-16:45 TuC2.3

Towards Technology Localization: Controlling Treadmill Speed Using Heart Rate, pp. 119-122.

Alothmany, Nazeeh	King Abdulaziz Univ.
Mohy AL-Deen, Badr	King Abdulaziz Univ.
Basyouni, Moayad	King Abdulaziz Univ.
Hanbazaza, Abdulrahman	King Abdulaziz Univ.
AL-Ghamdi, Ali	King Abdulaziz Univ.

16:45-17:00 TuC2.4

A Portable 12-Lead ECG Wireless Medical System for Continuous Cardiac-Activity Monitoring, pp. 123-126.

Gaxiola-Sosa, Jesus Efrain	Texas A&M Univ.
Mohsin, Nasreen	Texas A&M Univ. Qatar
PALLIYALI, ABDUL JALEEL	TEXAS A&M Univ. AT QATAR
Tafreshi, Reza	Texas A&M Univ. at Qatar
Entesari, Kamran	Texas A&M Univ.

17:00-17:15 TuC2.5

Visual Aid for Optic Nerve Hypoplasia Patients, pp. 127-130.

Moussa, Hesham	American Uiversity of Sharjah
Al-saboni, Yumna	American Uiversity of Sharjah
Al-Habash, Bilal	American Uiversity of Sharjah
Shehab El Din, Minnatullah	American Uiversity of Sharjah
Al-Nashash, Hasan	American Univ. of Sharjah

17:15-17:30 TuC2.6

*The Complete Molecular Real Life Monitoring System for Point-Of-Care Nucleic Acid Diagnosis of Blood and Cancer Disease**.

Karlsen, Frank	Univ. Coll. in Vestfold

17:30-17:45 TuC2.7

Low Power CMOS Neurochemical Biosensor Application in an Implantable Intelligent Neurotrophic Factor Delivery Hybrid Microsystem for Parkinson's, pp. 131-134.

Poustinchi, Mohammad	McGill Univ.
Musallam, Sam	McGill Univ.

TuC3 QAMAR 2

Neuro-Engineering (Invited Session)

Chair: Al-Nashash, Hasan	American Univ. of Sharjah
Co-Chair: Thakor, Nitish	Johns Hopkins Univ.

16:00-16:30 TuC3.1

*Brain Machine Interface for Neural Prosthesis: From Peripheral to Cortical**.

Thakor, Nitish	Johns Hopkins Univ.

16:30-17:00 TuC3.2

*From Cognitive Sciences to Cognitive Engineering and Beyond**.

Bezerianos, Anastasios	National Univ. of Singapore

17:00-17:30 TuC3.3

*Electrophysiological Assessment of CNS Plasticity and Spinal Cord Injury Therapeutic Strategies**.

All, Angelo	Johns Hopkins Univ.

WeP1L NASHIRA 1

Cybergenetics: The Emerging Science of Feedback Control of Living Cells (Plenary Session)

Chair: Fenniri, Hicham — Univ. of Alberta

08:30-09:25 WeP1L.1

*Cybergenetics: The Emerging Science of Feedback Control of Living Cells**.

Khammash, Mustafa — ETH-Zürich

WeA1 NASHIRA 1

Biomedical Imaging (III) (Regular Session)

Chair: Wahid, Khan A. — Univ. of Saskatchewan

Co-Chair: Peyrat, Jean-Marc — Qatar Science and Tech. Park

09:30-09:45 WeA1.1

A Color Reproduction Method with Image Enhancement for Endoscopic Images, pp. 135-138.

Imtiaz, Mohammad Shamim — Univ. of Saskatchewan

Wahid, Khan A. — Univ. of Saskatchewan

09:45-10:00 WeA1.2

Sparse Bayesian Image Restoration with Linear Operator Uncertainties with Application to EEG Signal Recovery, pp. 139-142.

Chaari, Lotfi — Univ. of Toulouse, IRIT - INP-ENSEEIHT, France

Batatia, Hadj — Univ. of Toulouse - UMR CNRS 5505

Tourneret, Jean-Yves — Univ. of Toulouse

10:00-10:15 WeA1.3

Performance of Optical Flow Tracking Approaches for Cardiac Motion Analysis, pp. 143-146.

Hassanein, Azza — Helwan Univ.

Khalifa, Ayman — Helwan Univ.

Al-Atabany, Walid Ibrahim Ali — Helwan Univ.

El-Wakad, Mohamed Tarek — Faculty of Engineering, Helwan Univ.

10:15-10:30 WeA1.4

Electrical Capacitance Volume Tomography for Human Brain Motion Activity Observation, pp. 147-150.

Taruno, Warsito P. — CTECH Lab.

Ihsan, Muhammad Fathul — CTECH Lab. EdWar Tech.

baidillah, marlin ramadhan — edwar Tech. co.

Tandian, Timothy Alexander — EdWar Tech.

Mahendra, Mahdi — Inst. Teknologi Bandung

Aljohani, Mohammed — King Abdul Aziz Univ.

10:30-10:45 WeA1.5

Development of an Optical Measurement System for Hip Implant Surgery to Evaluate the Leg Length and the Hip Rotation Center, pp. 151-154.

Grunert, Ronny — Fraunhofer Inst. for Machine Tools and Forming Tech.

Kretzschmar, Christian — Fraunhofer Inst. for Machine Tools and Forming Tech.

Rotsch, Christian — Fraunhofer Inst. for Machine Tools and Forming Tech.

Werner, Michael — Fraunhofer Inst. for Machine Tools and Forming Tech.

Prietzel, Torsten — Orthopedic Hospital, Univ. of Leipzig

10:45-11:00 WeA1.6

A Novel System for Scoring of Hormone Receptors in Breast Cancer Histopathology Slides, pp. 155-158.

Khan, Adnan Mujahid — Univ. of Warwick

Fahad ,Mohammed, Aisha — Ministry of Ec. and Trade

Ali Al-Hajri, Shama — Qatar Univ.

marri , Al Shamari, Hajer — Qatar Uniersity

Qidwai, Uvais — Qatar Univ.

Mujeeb, Imaad Bin — Hamad Medical Corp.

Rajpoot, Nasir — Qatar Univ. (Qatar) & Univ. of Warwick

11:00-11:15 WeA1.7

Towards Multi-Modal Image-Guided Tumour Identification in Robot-Assisted Partial Nephrectomy, pp. 159-162.

Hamarneh, Ghassan	Simon Fraser Univ.
Amir-Khalili, Alborz	Univ. of British Columbia
Nosrati, Masoud S.	Simon Fraser Univ.
Figueroa Garcia, Ivan	Univ. of British Columbia
Kawahara, Jeremy	Simon Fraser Univ.
Al-Alao, Osama	Hamad Medical Corp.
Peyrat, Jean-Marc	Qatar Science and Tech. Park
JULIEN, ABI-NAHED	QATAR ROBOTIC SURGERY CENTRE, QATAR SCIENCE & Tech. PARK
AL-ANSARI, ABDULLA	HAMAD MEDICAL Corp.
Abugharbieh, Rafeef	Univ. of British Columbia

WeA2 — QAMAR 1

Bioinformatics and System Biology (I) (Regular Session)

Chair: Serpedin, Erchin	Texas A&M Univ.
Co-Chair: Alanis-Lobato, Gregorio	King Abdullah Univ. of Science and Tech.

09:30-09:45 — WeA2.1

Investigating Effects of Copy Number Alterations on Targeted Therapy Response Using a Conditioning-Based Model, pp. 163-166.

Fang-Han, Hsu	Sigma-Aldrich
Serpedin, Erchin	Texas A&M Univ.

09:45-10:00 — WeA2.2

Exploring the Genetics Underlying Autoimmune Diseases with Network Analysis and Link Prediction, pp. 167-170.

Alanis-Lobato, Gregorio	King Abdullah Univ. of Science and Tech.
Cannistraci, Carlo V	King Abdullah Univ. of Science and Tech.
Ravasi, Timothy	King Abdullah Univ. of Science and Tech.

10:00-10:15 — WeA2.3

Application of a Fuzzy Learning Intervention Approach to a Purine Metabolism Pathway Model, pp. 171-174.

Basha, Nour	Texas A&M Univ. at Qatar
Nounou, Hazem	Texas A&M Univ. at Qatar
Nounou, Mohamed	Texas A&M Univ. at Qatar

10:15-10:30 — WeA2.4

Direct Adaptive Disturbance Rejection Control for Sedation and Analgesia, pp. 175-179.

Padmanabhan, Regina	Qatar Univ.
Meskin, Nader	Qatar Univ.
Haddad, Wassim	Georgia Inst. of Tech.

10:30-10:45 — WeA2.5

Modulation of Mrna Circadian Transcription Cycle by Micrornas, pp. 180-183.

Ptitsyn, Andrey	Sidra Medical and Res. Center
Ptitsyna, Natalia	Embry-Riddle Aeronautical Univ.
Al-Ali, Rashid	Sidra Medical and Res. Center
AlSaad, Rawan	Sidra Medical and Res. Center

10:45-11:00 — WeA2.6

Human MicroRNAs Targeting Hepatitis C Virus, pp. 184-187.

Eid, Fatma Elzahraa	Virginia Tech.
Elmarakeby, Haitham	Virginia Tech.
Heath, Lenwood	Virginia Tech.
Elhefnawi, mahmoud	Assoc. Prof. Mahmoud M. ElHefnawi (Ph.D.) Bioinformatician& Drug

11:00-11:15 — WeA2.7

MUSIC: A Hybrid Computing Environment for Burrows-Wheeler Alignment for Massive Amount of Short Read Sequence Data, pp. 188-191.

Gupta, Saurabh	Bio-IT centre, Inst. of Bioinformatics and Applied Biotechno
Choudhury, Sanjoy	Inst. of bioinformatics and applied biotechnology
Panda, Binay	Inst. of Bioinformatics and Applied Biotechnology

WeA3 QAMAR 2

Biomedical Systems Modeling (I) (Regular Session)

Chair: Qamar, Adnan — KAUST
Co-Chair: Wassar, Taoufik — Univ. of Houston

09:30-09:45 WeA3.1

A Model for Ultrasound Contrast Agent in a Phantom Vessel, pp. 192-195.

Qamar, Adnan — KAUST
Samtaney, Ravi — KAUST

09:45-10:00 WeA3.2

Tissue Perfusion in Fluid Therapy, pp. 196-199.

Siam, Jamal — Tel Aviv Univ.
Barnea, Ofer — Tel Aviv Univ.

10:00-10:15 WeA3.3

Neural Wavelet Packet Percentage Energy for Congestive Heart Failure Recognition,*

daqrouq, khaled — king abdulaziz Univ.

10:15-10:30 WeA3.4

Micro-Fibers Shape Effects on Gas Exchange in Total Artificial Lung, pp. 204-207.

Qamar, Adnan — KAUST
Guglani, Aditya — IIT Guwahati
Samtaney, Ravi — KAUST

10:30-10:45 WeA3.5

Heart Assist Devices: Modeling and Diagnostics, pp. 208-211.

Wassar, Taoufik — Univ. of Houston
Franchek, Matthew — Department of Mechanical Engineering, Univ. of Houston
Grigoriadis, Karolos — Univ. of Houston
Benkowski, Cedric — MicroMed Cardiovascular, Inc.
Kadipasaoglu, Mehmet — Texas Heart Inst. at St. Luke's Episcopal Hospital
Parnis, Steven — Texas Heart Inst. at St. Luke's Episcopal Hospital

10:45-11:00 WeA3.6

Effect of Remodeled Tumor-Induced Capillary Network on Interstitial Flow in Cancerous Tissue, pp. 212-215.

sefidgar, Mostafa — Mechanical Engineering Faculty of K. N. Toosi Univ. of Tech.
Raahemifar, Kaamran — Ryerson Univ.
Bazmara, Hossein — Mechanical Engineering Faculty of K. N. Toosi Univ. of Tech.
bazargan, majid — Mechanical Engineering Faculty of K. N. Toosi Univ. of Tech.
mousavi, mojtaba — Mechanical Engineering Faculty of K. N. Toosi Univ. of Tech.
Soltani, Madjid — The Johns Hopkins Univ. and KN Toosi Univ.

11:00-11:15 WeA3.7

Performance Analysis of Mass Transfer of Hollow Fiber Hemodialyser with Ultrafiltration and Varied Dialysate Concentration, pp. 216-219.

Kamali, Marziyeh — Univ. of semnan
hormozi, faramarz — Univ.
karimi, reza — Univ. of shiraz

WeP2L NASHIRA 1

Engineered Nanomaterials for SIRNA Delivery and Gene Silencing (Plenary Session)

Chair: Tafreshi, Reza — Texas A&M Univ. at Qatar

13:00-13:55 WeP2L.1

*Engineered Nanomaterials for SIRNA Delivery and Gene Silencing**.

Fenniri, Hicham — Univ. of Alberta

WeB1 NASHIRA 1

Biomedical Signal Processing (I) (Regular Session)

Chair: Begg, Rezaul — Victoria Univ.
Co-Chair: KHODOR, Nadine — Univ. de rennes 1

14:00-14:15 WeB1.1

Automated Classification of Plantar Pressure Asymmetry During Pathological Gait Using Artificial Neural Network, pp. 220-223.

Wafai, Linah — Victoria Univ.
Zayegh, Aladin — Victoria Univ.
Woulfe, John — Coll. of Engineering and Science, Victoria Univ. Melbour
Begg, Rezaul — Victoria Univ.

14:15-14:30 WeB1.2

MFC Peak Based Segmentation for Continuous Arabic Audio Signal, pp. 224-227.

Abdo, Mohamed S. — Minia Univ.
Kandil, Ahmed H. — Cairo Univ.
Fawzy, Sahar Ali — Cairo Univ.

14:30-14:45 WeB1.3

Improving P300 and SCP-Based Brain Computer Interfacing by Spectral Subtraction Denoising, pp. 228-231.

Makary, Meena M. — Cairo Univ.
Kadah, Yasser M. — Cairo Univ.

14:45-15:00 WeB1.4

Accurate Automatic Identification of Slow Wave Sleep Using a Single Electro-Oculogram Channel, pp. 232-235.

ElMessidi, Mohamed — Texas A&M Univ.
Tmar-Ben Hamida, Sana — Texas A&M Univ. at Qatar
Ahmed, Beena — Texas A&M Univ. at Qatar
Penzel, Thomas — Charite Univ. Hospital

15:00-15:15 WeB1.5

New T-Wave Parameters Describing Repolarization Abnormalities Induced by Drug, pp. 236-239.

KHODOR, Nadine — Univ. de rennes 1
Carrault, Guy — Univ. de Rennes 1
I'hostis, philippe — Biotrial Core Lab.
Amoud, Hassan — Lebanese Univ.
Khalil, Mohamad — Lebanese Univ. Doctoral school for sciences andtechnology,
Hernández, Alfredo I — Univ. of Rennes 1 and INSERM U642

15:15-15:30 WeB1.6

Detection of Coupling with Linear and Nonlinear Synchronization Measures for EEG, pp. 240-243.

Bakhshayesh, Hanieh — Flinders Univ.
Fitzgibbon, Sean — Flinders Univ.
Pope, Kenneth — Flinders Univ.

15:30-15:45 WeB1.7

ECG Noise Reduction Using Empirical Mode Decomposition Based on Combination of Instantaneous Half Period and Soft-Thresholding, pp. 244-248.

Samadi, Shamim — Sharif Univ. of Tech.
Shamsollahi, Mohammad Bagher — Sharif Univ. of Tech.

WeB2 QAMAR 1

Neuro-Science, Rehabilitation, and Therapeutic Systems (Regular Session)

Chair: Al-Jumaily, Adel — Univ. of Tech. Sydney
Co-Chair: Tangutooru, Siva Mahesh — Qatar Univ.

14:00-14:15 WeB2.1

Early Design Considerations for a Thalamic Visual Prosthesis to Treat Blindness Resulting from Glaucoma, pp. 249-252.

Tangutooru, Siva Mahesh — Qatar Univ.
Yoon, Woon Jong — Qatar Univ.
Troy, John — Northwestern Univ.

14:15-14:30 WeB2.2

Influence of Stroke Location on Heart Rate Variability in Robot-Assistive Neurorehabilitation, pp. 253-256.

Jelinek, Herbert Franz — Charles Sturt Univ.
August, Katherine — INI Univ. of Zurich ETH Zurich
Imam, Hasan — Univ. of Melbourne

Khalaf, Kinda	KUSTAR
Koenig, Alexander	Harvard Univ.
Riener, Robert	ETH and Univ. Zurich
Palaniswami, Marimuthu	The Univ. of Melbourne
Khandoker, Ahsan Habib	Khalifa Univ. of Science, Tech. and Res.

14:30-14:45 WeB2.3

An Experimental Study on Redundancy Resolution Scheme of Postural Configuration in Human Arm Reaching with an Elbow Joint Kinematic Constraint, pp. 257-260.

Moon, Hyosang	Texas A&M Univ.
Robson, Nina Patarinsky	California State Univ. Fullerton
Langari, Reza	Texas A&M Univ.
Shin, Sungtae	Texas A&M Univ.

14:45-15:00 WeB2.4

Neuronal Cell Navigation within a Microfluidic Device, pp. 261-264.

Shamloo, Amir	Sharif Univ. of Tech.

15:00-15:15 WeB2.5

Augmented Reality Based Illusion System with Biofeedback, pp. 265-268.

Aung, Yee Mon	Univ. of Tech. Sydney
Al-Jumaily, Adel	Univ. of Tech. Sydney

15:15-15:30 WeB2.6

Adaptive Trajectory Control Based Robotic Rehabilitation Device, pp. 269-272.

Anwar, Tanvir	Univ. of Tech. Sydney
Al Juamily, Adel	Univ. of Tech. Sydney

15:30-15:45 WeB2.7

Swarm-Based Extreme Learning Machine for Finger Movement Recognition, pp. 273-276.

Anam, Khairul	Univ. of Tech. Sydney
Al-Jumaily, Adel	Univ. of Tech. Sydney

WeB3 QAMAR 2

Healthcare Information Systems and E-Health (Regular Session)

Chair: Wahid, Khan A.	Univ. of Saskatchewan
Co-Chair: DAKUA, SARADA	QATAR ROBOTIC SURGERY CENTRE, QATAR SCIENCE & Tech. PARK

14:00-14:15 WeB3.1

A 3G/WiFi-Enabled 6LoWPAN-Based U-Healthcare System for Ubiquitous Real-Time Monitoring and Data Logging, pp. 277-280.

Tabish, Rohan	Qatar Univ.
Ghaleb, Abdulaziz M.	Qatar Univ.
Hussein, Rima	Canadian Univ. of Dubai
Touati, Farid	Qatar Univ.
Ben Mnaouer, Adel	Canadian Univ. of Dubai
Khriji, Lazhar	Sultan Qaboss Univ.
Rasid, Mohd Fadlee A	Univ. Putra Malaysia

14:15-14:30 WeB3.2

Towards a Computational System to Support Clinical Treatment Decisions for Diagnosed Cerebral Aneurysms, pp. 281-284.

DAKUA, SARADA	QATAR ROBOTIC SURGERY CENTRE, QATAR SCIENCE & Tech. PARK
Navkar, Nikhil Vishwas	Qatar Robotic Surgery Center
jabinahed, Julien	QRSC
Groen, Derek	Univ. Coll. London
Bernabeu, Miguel O.	Univ. Coll. London
Saghir, Mazen	Texas A&M Univ. at Qatar
Kamel, Hussein	Hamad Medical Corp.
Al Ansari, Abdulla Ali Asad	Hamad Medical Corp.
Peter, Coveney	Univ. Coll. London

14:30-14:45	WeB3.3
Sleep Ediary: A Mobile Health Application for Insomnia Assessment, pp. 285-288.	
Yousaf, Faizan	Texas A&M Univ. at Qatar
Tmar-Ben Hamida, Sana	Texas A&M Univ. at Qatar
Ahmed, Beena	Texas A&M Univ. at Qatar
14:45-15:00	WeB3.4
Clinical Dynamic Decision Support System Based on Temporal Association Rules, pp. 289-292.	
Ben Ayed, Mounir	Faculty of Science of Sfax
Kammoun, fatma	Univ. of Sfax, National School of Engineers (ENIS), BP 1173
15:00-15:15	WeB3.5
Towards Real-Time Remote Diagnostics of Capsule Endoscopic Images Using Wi-Fi, pp. 293-296.	
Shrestha, Ravi	Univ. of Saskatchewan
Wahid, Khan A.	Univ. of Saskatchewan
Khan, Tareq	Univ. of Saskatchewan
15:15-15:30	WeB3.6
Usability Study of Mobile Social Networking System among Saudi Type 2 Diabetes Patients (SANAD), pp. 297-300.	
Alanzi, Turki	Kingston Univ. London
Istepanian, Robert	Kingston Univ. London
Philip, Nada	Kingston Univ.
15:30-15:45	WeB3.7
Toward an Integrated E-Health Based on Acquired Healthcare Knowledge, pp. 301-304.	
Nasiri, Sara	Inst. of Knowledge Based Systems and Knowledge Management, U
Fathi, Madjid	Inst. of Knowledge Based Systems and Knowledge Management, U

WeC1	NASHIRA 1
Biomedical Imaging, Signal Processing, and Education (Regular Session)	
Chair: Goenezen, Sevan	Texas A&M Univ.
Co-Chair: Abu-Faraj, Ziad	American Univ. of Science & Tech.
16:00-16:15	WeC1.1
Monte Carlo Simulation of Scatter Effect for Clinical Gamma Camera, pp. 305-308.	
Saikouk, Hind	Lab. de Physique Nucléaire, Faculté des Sciences, Mohamme
El Khayati, Naima	Lab. de Physique Nucléaire, Faculté des Sciences, Univ.
16:15-16:30	WeC1.2
Automatic Shadow Enhancement in Intra Vascular Ultrasound (IVUS) Images, pp. 309-312.	
Basij, Maryam	Isfahan Univ.
Taki, Arash	TU Munich, Germany
Yazdchi, Mohammadreza	Isfahan Univ.
16:30-16:45	WeC1.3
Particle Filter-Assisted Positioning Method for Identifying RFID-Tag Implanted in the Organism, pp. 313-316.	
Imai, Gen	Nara Inst. of Science and Tech.
matsuda, katsushi	Nara Inst. of Science and Tech.
TAKAHATA, HIROMI	OsakaUniversity
Okada, Minoru	Nara Inst. and Tech.
16:45-17:00	WeC1.4
*Elasticity Imaging a Novel Diagnostic Imaging Tool? What Has Been Done and What Needs to Be Done**.	
Goenezen, Sevan	Texas A&M Univ.
17:00-17:15	WeC1.5
*Statistical Processing of Electromyography Examination**.	
Rama Raju, Venkateshwarla	GITAM for Women Engg Coll. Proddatur (Jawaharlal Nehru Tech. Univ. and Nizams Inst. of Medical Sciences
17:15-17:30	WeC1.6
Biomedical Engineering Education in the Middle East and North Africa, pp. 317-320.	
Abu-Faraj, Ziad	American Univ. of Science & Tech.

17:30-17:45	WeC1.7
*Student Attrition and Retention in a Biomedical Engineering Program – a Case Study**	
Imran, Ahmed	Ajman Univ. of Science and Tech.
Nasor, Mohamed	Ajman Univ. of Science and Tech.
Hayati, Fahar	Ajman Univ. of Science & Tech.

WeC2	QAMAR 1
Bioinformatics and Neuroscience (Regular Session)	
Chair: ElSayed, Mohamed	Univ. of Michigan
Co-Chair: Sulllivan, Pierre Edward	Univ. of Toronto
16:00-16:15	WeC2.1
Characterization of Bead-Based Reactions and Mechanical Supernatant Dilution in Digital Microfluidic Devices, pp. 325-328.	
Schertzer, Michael J	Univ. of Toronto
Blume, Steffen	Univ. of Toronto
Badwi, Alaa	Public Health Agency of Canada
Ben-Mrad, Ridha	Univ. of Toronto
Sulllivan, Pierre Edward	Univ. of Toronto
16:15-16:30	WeC2.2
A Space-Efficient Solution to Find the Maximum Overlap Using a Compressed Suffix Array, pp. 329-333.	
Haj Rachid, Maan	Qatar Univ.
Malluhi, Qutaibah	Qatar Univ.
Abouelhoda, Mohamed	Nile Univ.
16:30-16:45	WeC2.3
Cloud-Based Parallel Suffix Array Construction Based on MPI, pp. 334-337.	
Abdelhadi, Ahmed	Cairo Univ.
Kandil, Ahmed H.	Cairo Univ.
Abouelhoda, Mohamed	Nile Univ.
16:45-17:00	WeC2.4
Approach for the Evaluation of a KDD Based DSS Visual Representations, pp. 338-341.	
Brahmi, Awatef	REGIM
LTIFI, Hela	REGIM
Ben Ayed, Mounir	Faculty of Science of Sfax
17:00-17:15	WeC2.5
*Development of in Vitro Model of the Blood-Brain Barrier in Layered Microfluidic Channels**.	
ElSayed, Mohamed	Univ. of Michigan
17:15-17:30	WeC2.6
*Assembling Functional Biosynthetic Tissues with Induced Pluripotent Stem Cell-Derived Cardiac Progenitor Cells**.	
Christoforou, Nicolas	Khalifa Univ.
17:30-17:45	WeC2.7
Improving Measurement of Hip Joint Center Location Using Neural Networks, pp. 342-345.	
Abdulrahman, Alaa	Univ. of Arkansas at Little Rock
Iqbal, Kamran	Univ. of Arkansas at Little Rock

WeC3	QAMAR 2
Innovation in Fetal Maternal Exploration (Invited Session)	
Chair: Haddad, Naim	UAMS
Co-Chair: Eswaran, Hari	Univ. of Arkansas for Medical Sci
16:00-17:00	WeC3.1
*Innovation in Fetal Maternal Exploration: Fetal Magnetoencephalography and Uterine Magnetomyography**.	
Eswaran, Hari	Univ. of Arkansas for Medical Sci

ThP1L	NASHIRA 1
Distance Health: a Solution for Dealing with Healthcare Shortages Using Technology (Plenary Session)	
Chair: Tafreshi, Reza	Texas A&M Univ. at Qatar
09:30-10:25	ThP1L.1
*Distance Health: A Solution for Dealing with Healthcare Shortages Using Technology**.	
Lowery, Curtis	Univ. of Arkansas for Medical Sciences

ThA1	NASHIRA 1
Biomedical Signal Processing (II) (Regular Session)	
Chair: Abbasi, Qammer Hussain	Texas A & M at Qatar
Co-Chair: Ghazy, Mohammed	Texas A&M Univ. at Qatar
10:30-10:45	ThA1.1
*Analysis between ECG and Respiration Signals in Type II Diabetic Patients in the UAE**, pp. 346-348.	
Alkhoori, Thuraia	Khalifa Univ.
Alsafar, Habiba	Khalifa Univ.
Khandoker, Ahsan Habib	Khalifa Univ. of Science, Tech. and Res.
10:45-11:00	ThA1.2
Non-Invasive Extraction of Fetal Electrocardiogram Using FAST Independent Component Analysis Technique, pp. 349-352.	
Shehada, Dina	Khalifa Univ. of Science, Tech. and Res.
Khandoker, Ahsan Habib	Khalifa Univ. of Science, Tech. and Res.
11:00-11:15	ThA1.3
A Performance Comparison of Hand Motion EMG Classification, pp. 353-356.	
Shin, Sungtae	Texas A&M Univ.
Tafreshi, Reza	Texas A&M Univ. at Qatar
Langari, Reza	Texas A&M Univ.
11:15-11:30	ThA1.4
Electrode Reduction Using ICA and PCA in P300 Visual Speller Brain-Computer Interface System, pp. 357-360.	
Selim, Abeer	Cairo Univ.
Abdel Wahed, Manal	Cairo Univ.
Kadah, Yasser M.	Cairo Univ.
11:30-11:45	ThA1.5
Newborn Sleep Stage Identification Using Multiscale Entropy, pp. 361-364.	
Fraiwan, Luay	Jordan Univ. of Science and Tech.
11:45-12:00	ThA1.6
Numerical Characterisation and Modeling of In-Vivo Radio Communication, pp. 365-367.	
Abbasi, Qammer Hussain	Texas A & M at Qatar
Qaraqe, Marwa	Texas A&M Univ.
Serpedin, Erchin	Texas A&M Univ.
12:00-12:15	ThA1.7
Poincare Plot Analysis of Heart Rate Variability in Diabetic Patients in the UAE, pp. 368-370.	
Abubaker, Hanin B.	Khalifa Univ. of science, Tech. and Res.
Alsafar, Habiba	Khalifa Univ.
Jelinek, Herbert Franz	Charles Sturt Univ.
Khalaf, Kinda	KUSTAR
Khandoker, Ahsan Habib	Khalifa Univ. of Science, Tech. and Res.

ThA2	QAMAR 1
Biomechanics, Biomaterials, and Tissue Engineering (II) (Regular Session)	
Chair: Garmestani, Hamid	Georgia Inst. of Tech.
Co-Chair: ElSayed, Mohamed	Univ. of Michigan

10:30-10:45	ThA2.1
Toward Quantifying Geometric Microstructural Differences between Primary and Secondary Osteons Via Segmentation, pp. 371-374.	
hage, ilige	americain Univ. of beirut
Hamade, Ramsey	American Univ. of Beirut
10:45-11:00	ThA2.2
Biomimetic Engineering of a Fully Bio-Based System in Nanomedicine, pp. 375-378.	
Pooyan, Parisa	Georgia Inst. of Tech.
Garmestani, Hamid	Georgia Inst. of Tech.
11:00-11:15	ThA2.3
Effect of Electrospinning Parameters on Nanofiber Diameter Made of Poly (Vinyl Alcohol) As Determined by Atomic Force Microscopy, pp. 379-381.	
Aljehani, Abdelmoamen	King Abdulaziz Univ.
Hussaini, Mohammed Abdullah	King Abdulaziz Univ.
Hussain, Mohammad Asif	King Abdulaziz Univ.
Alothmany, Nazeeh	King Abdulaziz Univ.
Aldhaheri, Rabah W.	King Abdulaziz Univ.
11:15-11:30	ThA2.4
Efficient Walking of a Simple Biped with a Torso, pp. 382-384.	
AL Yahmedi, Amur Salim	Sultan Qaboos Univ.
Sayari, Muhammed	National School of engineering of Sfax
11:30-11:45	ThA2.5
*Development of Targeted Enzyme-Activated Nano-Conjugates for Hepatic Cancer TherapyS**.	
ElSayed, Mohamed	Univ. of Michigan
11:45-12:00	ThA2.6
*Bioabsorbable Magnesium Based Materials for Medical Implants**.	
Mansoor, Bilal	Texas A&M Univ. at Qatar
12:00-12:15	ThA2.7
*The Future of Biomaterials and Biomechanics in the Implantable Medical Device Industry**.	
Breyen, Mark	Medtronic, Inc.

ThA3	QAMAR 2
Mechanics of Filaments and Biomaterials (Invited Session)	
Chair: RUIMI, Annie	Texas A&M Univ. at Qatar
Co-Chair: Cabibihan, John-John	Qatar Univ.
10:30-10:45	ThA3.1
*Simulation Software for Surgical Sutures: Dream or Reality?**.	
RUIMI, Annie	Texas A&M Univ. at Qatar
10:45-11:00	ThA3.2
*Towards a Visualization Framework for Interactive Thread Simulation ?**.	
Fratarcangeli, Marco	Univ. of Rome Sapienza
11:00-11:15	ThA3.3
*String Simulation Using Information Theoretic Algorithms**.	
Wang, Zhujiang	Texas A&M Univ. Coll. Station
11:15-11:30	ThA3.4
*Beaded Elastic Rods to Simulate the Diffusive Dynamics of Bio-Filament Deformations**.	
Goyal, Sachin	Univ. of California
11:30-11:45	ThA3.5
*Design and Development of a Prosthetic Finger with Natural Feel, Movement, and Appearance**.	
Cabibihan, John-John	Qatar Univ.