Minutes of the 3rd Meeting of FoES RAC

held on 14th June 2024 through MS Teams

Bahria University

Contents

Minutes of the 2nd RAC Meeting of Faculty Board of Studies Engineering Sciences

Relevance Assessment Committee

Prof. Dr. Faisal Bashir Hussain	Dean ES	Chair
Prof. Dr. Shahzad Khalid	Principal BSEAS H-11	Member
Prof. Dr. Sohaib Ahmad	Principal BSEAS BUKC	Member
Prof. Dr. Moneeb Gohar	HoD (CS) BUIC H-11	Member
Assoc. Prof. Dr Amanullah Yasin	Air University	External Member
Prof. Dr. Usman Akram	EME, NUST	External Member

Proceedings

Preliminaries

FBoS-RAC meeting took place on 14th June 2024, the proceedings commenced at 1430 hours, with recitation of the Holy Quran.

In his opening remarks, the Chair stressed the importance for participation in the proceedings while staying focused on the point under deliberation.

Item no. 0301: Relevance of Faculty members for the MS Artificial Intelligence Program – CS Dept BUIC-H11

a. The agenda was presented by the HoD CS BUIC-H11 in which relevant data regarding qualification, teaching, and research of the following three PhD FMs from the department was presented. The presented data is attached at Annex - A.
   i. Dr Joodat Fatima
   ii. Dr Kashif Sultan
   iii. Dr Amina Waheed Awan

Discussion:

b. Dr Amanullah was of the view that all presented FMs had applied Artificial Intelligence techniques in their PhD work. In addition, some FMs have teaching experience in the same domain and are relevant to the MS AI degree program.
c. Dr Usman Akram also considered all presented FMs relevant to the MS AI degree program.

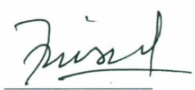
Decision 0301:

The RAC finds the following PhD Faculty Members relevant to the proposed MS Artificial Intelligence Program by the CS Dept BUIC-H11.

Sr No	Name	Designation	Research Domain
1	Dr. Joodat Fatima	Snr Asst Professor	Machine Learning, Image Processing.
2	Dr. Kashif Sultan	Snr Asst Professor	Communication and Information System, Machine Learning
3	Dr. Amina Waheed Awan	Asst Professor	Machine Learning, Pattern Recognition and Bio Medical Imaging.

Closing of the Meeting

There being no further points, the Chair brought the meeting to a close, thanking the participants for their wholehearted participation, especially the external Members of the Committee.



28/June/2024

Prof. Dr. Faisal Bashir Hussain
Dean Faculty of Engineering Sciences
Bahria University

Annex – A

Form-RFM-Ph.D. – 1

Bahria University, Islamabad

Directorate of Quality Assurance

Form of relevancy of Faculty Member
(To be filled by the Faculty Member)

Name of Faculty Member: Dr. Joddat Fatima

Designation of Faculty Member: Snr. Assistant Professor

Department: Software Engineering

School: Bahria School of Engineering and Applied Sciences

Campus: H-11 Islamabad

Status of Faculty Member: ● Regular FM ○ Adjunct FM

Qualifications:

1. Ph.D. Degree Title: PhD in Computer Science
2. Specialization in Ph.D.: Image Processing and Machine Learning
3. Ph.D. Thesis Title: Localization of Vertebrae and Deformity Analysis using Digital Spinal Cord Images
   (Abstract of Thesis must be attached)
4. MS/MPhil Degree Title: MS in Software Engineering
5. Specialization in MS/MPhil: Image Processing and Machine Learning
6. MS/MPhil Thesis Title: "Retinal Blood Vascular Pattern Based Personal Identification"
   (Abstract of Thesis must be attached)
7. BS Degree Title: BS in Software Engineering
8. PG Diploma (If any) N/A

Experience:

1. Total (Teaching & Research): 11 Years
2. Post-Ph.D. Experience (Teaching and Research): 1 Years
3. Corporate/Industry/Clinical: N/A

Supervision:

1. Number of Ph.D. Scholars: Graduated: 0 Currently Under supervision: 0
2. Number of MS/MPhil Scholars: Graduated: 4 Currently Under supervision: 0

3. Number of BS Students: Graduated: 10+ Currently Under supervision: 10+
(Capstone Projects)

Research Contributions:

Funded Research Projects

1. Funded Projects Completed: <= 1 Million: 0 >=5 Million: 0
2. Funded Projects (Currently under supervision) <= 1 Million: 2 >=5 Million:

Research Publications (Last 5 years)

1. No. of IF or 'W' Category Publications: 1
(List of Publication must be attached)
2. No. of X Category Publications: 3
(List of Publication must be attached)
3. No. of Y Category Publications: 3
(List of Publication must be attached)

25/6/2024

Signature of the FM

Dr Joddat Fatima

PHD THESIS ABSTRACT:

The spinal cord is an important structure that creates a connection between the brain and the rest of the body. The long thin cord is made up of twisted nerves and tissues in combination with the 33 separate bones stacked over one another. Curvature deformity causes an extra bend in the spinal curve. The curvature deformities are of three types Kyphosis (thoracic region); Lordosis (cervical and lumbar region), and Scoliosis (sideways). Different imaging techniques clinically used to diagnose these deformities include X-Ray, Computed Tomography and Magnetic Resonance Imaging. Many researchers have worked on deformity analysis of spinal curvatures, and numerous competitions and workshops have produced labeled datasets and new approaches as well. Recently, few semi-automated systems have been proposed for vertebrae segmentation and Scoliosis Cobb estimation but a fully automated method that can differentiate all three categories, and identify severity levels among the disorders with multiple imaging modalities is still missing. In this research, we present a two-step automated system for localization of vertebrae, segmentation of the spinal column, and classification of diseases on the basis of their curvature shape and Cobb estimation. A recent approach to object detection is utilized for vertebrae localization, in parallel to this spine column is segmented. Both of these results are used for the extraction of the midline curvature profile. These results supported in feature-based shape analysis mechanism for reliable classification of curvature, respectively. The proposed system also involves a traditional Cobb estimation procedure for curvature analysis and validation provides reliability to our predicted results. The evaluation of both modules has been carried out, using available datasets. The localization results achieved mean Average Precision (map) up to 0.94 for AASCE19, 0.97 for the Mendeley's dataset and 0.95 for the CSI16 dataset. Segmentation of spine column attained dice score up to 0.971, 0.960 and 0.953 for Mendel's, CSI16 and AASCE19 respectively. The comparison of segmentation block with literature shows improvement in dice score. The results of shape analysis using Random Forest (RF) classifiers attained an accuracy of 94.69%. Considering the same problem as that of image classification, the proposed feature-set performed better as compared with deep features of Efficient-Net B4 with a 2% improvement in the accuracy. The Cobb estimation results in comparison with latest state-of-the-art reduced the Mean Absolute Error (MAE) by 2 degrees. The classification of Lumbar Lordosis on the basis of proposed methodology achieved an accuracy up to 98.04% for Mendeley's dataset and 81.25% for CSI16 dataset respectively.

MS THESIS ABSTRACT:

Digital image processing, the immense field of engineering provides wide applications in Biometrics Engineering and Security. Biometrics technologies are mostly used for the certification and attesting purposes for secure access control. In early ages, biometrics was considered as flawless in comparison with keys, passwords, codes or pin numbers security measures, with least significance of imitation and deception in them. Due to physical exposure of the regions like fingerprints, iris or ear geometry recognitions can get burned and damaged. The rare and unique security system is addressed in this research, as the retinal vascular patterns for personal identification is a reliable technique. In this research, we present a methodology for retinal recognition on bases of blood vessels which has recently become popular for fraud detection and prevention, The proposed methodology is divided into two divisions i.e. enrollment and identification. The enrollment phase includes addition of new person in database whereas in identification phase, test fundus image is recognized by matching it with entries in databases. We propose a novel system for analysis of fundus images to represent it with reliable feature sets. The proposed system first enhances and segments vascular pattern from input retinal image using Gabor wavelets and multilayered thresholding technique. The feature points i.e. vessel endings and bifurcation are extracted and validated using crossing number method and a novel windowing based method respectively. We also propose a technique to filter false structure such as short vessels, breakages and spurs to improve the matching score. One main problem with retina recognition is that only one database (VARIA) is publicly available for retina recognition, so we have developed our own database with the help of AFIO (Armed Forces Institute of Ophthalmology) and named it as RIDB (Retina Identification DataBase). The proposed system is evaluated using these databases and results show the significance of proposed system.

List of Recent Publications

• Joddat Fatima, Mashood Mohsan, Amina Jameel, Muhammad Usman Akram, and Adeel Muzaffar Syed. "Vertebrae localization and spine segmentation on radiographic images for feature-based curvature classification for scoliosis." Concurrency and Computation: Practice and Experience 34, no. 26 (Aug 2022): e7300. (IF: 1.831)

• Joddat Fatima, Amina Jameel, Muhammad Usman Akram, Adeel Muzaffar Syed, and Malaika Mushtaq. "Automatic Localization and Segmentation of Vertebrae for Cobb Estimation and Curvature Deformity." Intelligent Automation and Soft Computing 34, no. 3 (Aug 2022): 1489-1504. (IF: 3.401)

• Malaika Mushtaq, Muhammad Usman Akram, Norah Saleh Alghamdi, Joddat Fatima, and Rao Farhat Masood. "Localization and Edge-Based Segmentation of Lumbar Spine Vertebrae to Identify the Deformities Using Deep Learning Models." Sensors 22, no. 4 (Feb 2022): 1547. (IF: 3.576)

• Joddat Fatima, Muhammad Usman Akram, Amina Jameel, and Adeel Muzaffar Syed. "Spinal vertebrae localization and analysis on disproportionality in curvature using radiography—a comprehensive review." EURASIP Journal on Image and Video Processing 2021, no. 1 (2021): 1-23. (IF: 1.789)

Bahria University, Islamabad

Directorate of Quality Assurance

Form of relevancy of Faculty Member
(To be filled by the Faculty Member)

Name of Faculty Member: _____Dr.Kashif Sultan_____

Designation of Faculty Member: _____Senior Assistant Professor_____

Department: _____Software Engineering_____

School: _____School of Engineering and Applied Sciences ____

Campus: _____BUIC, H-11_____

Status of Faculty Member: ◯ Regular FM ◯ Adjunct FM

Qualifications:

1. Ph.D. Degree Title: Doctor of Engineering in Communication and Information Systems___
2. Specialization in Ph.D.: _Communication and Information Systems_____
3. Ph.D. Thesis Title: _Research on call details record analysis towards 5G wireless communication networks _
   (Abstract of Thesis must be attached)
4. MS/MPhil Degree Title: __Master of Engineering_____
5. Specialization in MS/MPhil: __Information and Communication Engineering_____
6. MS/MPhil Thesis Title: _____
   (Abstract of Thesis must be attached)
7. BS Degree Title: _Research on PAPR reduction techniques for OFDM system. _____
8. PG Diploma (If any) _____

Experience:

1. Total (Teaching & Research): ____ 5 Years and 5 months_____
2. Post-Ph.D. Experience (Teaching and Research) _____4 Years and 9 months _____
3. Corporate/Industry/Clinical: _____

Supervision:

1. Number of Ph.D. Scholars: Graduated:____0____ Currently Under supervision:_____0___

2. Number of MS/MPhil Scholars: Graduated:____7___ Currently Under supervision:_____3____
3. Number of BS Students: Graduated:____6___ Currently Under supervision:_____4_____
   (Capstone Projects)

Research Contributions:

Funded Research Projects

1. Funded Projects Completed: <= 1 Million: ___2___ >=5 Million:_____
2. Funded Projects
   (Currently under supervision) <= 1 Million: _____ >=5 Million:_____

Research Publications (Last 5 years)

1. No. of IF or 'W' Category Publications: _____3_____
   (List of Publication must be attached)
2. No. of X Category Publications: _____4_____
   (List of Publication must be attached)
3. No. of Y Category Publications: _____3_____
   (List of Publication must be attached)

Signature of the FM

PhD thesis Abstract:

With the mammoth development in mobile and the internet of things (IoT) technologies, it can be anticipated that in next generation-networks (5G) everything will be connected. With every incremental step towards 5G development, the number of mobile devices such as smart phones, tablets, and wearable devices are on the rise exponentially. Such a huge connectivity of wireless devices and advancement in mobile networks technology will increase the data traffic volume largely. This large data is typically rich in useful information. However, the extract of useful information from such a big data is challenging. This thesis is focused on the analysis of cellular network data for improving the performance of next-generation networks. In particular, we focus on call details record (CDR) data. Whenever a subscriber uses a service such as voice call, SMS, or internet connection, a CDR is generated which is recorded by network operators. The information contained within the CDR of mobile networks can be used to study the operational efficacy of cellular networks and behavioral pattern of mobile subscribers. In this thesis, firstly we highlight the significance of big data analysis for 5G networks. We describe that to overcome the challenges and to fulfill the key requirements of 5G networks, big data driven analytics framework is of vital role. Second, we utilize the call details record data to detect anomalies in the network. For authentication and verification of anomalies, we use k-means clustering, an unsupervised machine learning algorithm. Through effective detection of anomalies, we can proceed to suitable design for resource distribution as well as fault detection and avoidance. Further, we prepare anomaly free data by removing anomalous activities and train a neural network model. By passing the anomaly and anomaly free data through this model, we observe the effect of anomalous activities in training of the model and also observe mean square error of the anomaly and anomaly free data. At last, we use an autoregressive integrated moving average model to predict future traffic for a user. Through simple visualization, we show that the anomaly free data better generalizes the learning models and performs better on prediction task. Third, we extract actionable insights from the CDR data and show that there exists a strong spatiotemporal predictability in real network traffic patterns. This knowledge can be leveraged by the mobile operators for effective network planning such as resource management and optimization. Motivated by this, we perform the spatiotemporal analysis of CDR data publicly available from Telecom Italia. Thus, on the basis of spatiotemporal insights, we propose a framework for mobile traffic classification. Experimental results show that the proposed model based on machine learning technique is able to accurately model and classify the network traffic patterns. Furthermore, we demonstrate the application of such insights for resource optimization. Finally, we analyze the internet activity record data separately for understanding and partitioning of network traffic. The internet activity records (IARs) of a mobile cellular network possess significant information which can be exploited to identify the network's efficacy and the mobile users' behavior. We extract useful information from the IAR data and identify a healthy predictability of spatiotemporal pattern within the network traffic. The information extracted is helpful for network operators to plan effective network configuration and perform management and optimization of network's resources. We report experimentation on spatiotemporal analysis of IAR data of the Telecom Italia. Based on this, we present mobile traffic partitioning scheme. Experimental results of the proposed model are helpful in modeling and partitioning of network traffic patterns.

Key Words : Big data, Call details record, Machine learning, Mobile networks

Publication:

2018
Call Detail Records Driven Anomaly Detection and Traffic Prediction in Mobile Cellular Networks

2018
Big Data Perspective and Challenges in Next Generation Networks

2019
Call details record analysis – A Spatiotemporal exploration toward mobile traffic classification and optimization

2021
Dynamic traffic congestion pricing and electric vehicle charging management system for the internet of vehicles in smart cities

2022
Lightweight Key Management Scheme Using Fuzzy Extractor for Wireless Mobile Sensor Network

2020
Intelligent tutoring supported collaborative learning (ITSCL): A hybrid framework" In: International Journal of Advanced Computer Science and Applications

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2015
SLM Technique with Hadamard Transforms for PAPR Reduction

2022
Malaria Detection using Microscopic Image Analysis: A Convolution Neural Network Based Approach.

2021
A Hybrid Approach for Feature Extraction and Classification Using Machine Learning Techniques

2021
DYNAMIC GROUP FORMATION IN COMPUTER SUPPORTED COLLABORATIVE LEARNING.

2023
Deep Learning Driven Framework for COVID-19 Detection – A Mobile/Web Application.

2024

Mitigating Software Vulnerabilities through Secure Software Development with a Policy-Driven Waterfall Model

Bahria University, Islamabad

Directorate of Quality Assurance

Form of relevancy of Faculty Member
(To be filled by the Faculty Member)

Name of Faculty Member: Dr. Amna Waheed Awan

Designation of Faculty Member: Assistant Professor

Department: Department of Computer Engineering

School: Bahria School of Engineering and Applied Sciences (BSEAS)

Campus: H-11 Campus

Status of Faculty Member: ◯ Regular FM ◯ Adjunct FM

Qualifications:

1. Ph.D. Degree Title: PhD in Computer Engineering
2. Specialization in Ph.D.: Biomedical signal processing
3. Ph.D. Thesis Title: ANALYSIS OF PHYSIOLOGICAL SIGNALS FOR EMOTION CHARTING

   (Abstract of Thesis in Annex A)
4. MS/MPhil Degree Title: MS in Computer Engineering
5. Specialization in MS/MPhil: Biomedical imaging
6. MS/MPhil Thesis Title: Extraction of Blood Vessels from Diseased Fundus Images

   (Abstract of Thesis in Annex B)
7. BS Degree Title: Bachelors in Computer Engineering
8. PG Diploma (If any) --

Experience:

1. Total (Teaching & Research): 8 years
2. Post-Ph.D. Experience (Teaching and Research): 4 months
3. Corporate/Industry/Clinical: --

Supervision:

1. Number of Ph.D. Scholars: Graduated: -- Currently Under supervision: --
2. Number of MS/MPhil Scholars: Graduated: -- Currently Under supervision: --

3. Number of BS Students: Graduated: 6 Currently Under supervision: 2
   (Capstone Projects)

Research Contributions:

Funded Research Projects

1. Funded Projects Completed: <= 1 Million: -- >=5 Million: --
2. Funded Projects
   (Currently under supervision) <= 1 Million: -- >=5 Million: --

Research Publications (Last 5 years)

1. No. of IF or 'W' Category Publications: 4
   (List of Publication attached in Annex C)
2. No. of X Category Publications: --
   (List of Publication must be attached)
3. No. of Y Category Publications: --
   (List of Publication must be attached)

Signature of the FM

Annex A: PhD thesis Abstract

Human emotions are complex mental and physiological states that arise in response to various internal and external stimuli. Emotional health is an important part of human physical and psychological health. An emotionally healthy person can perform multiple roles in his life in the best possible way, however, due to emotional imbalance and cognitive disorders a person can face so many physical and mental health issues. Therefore, the timely diagnosis of these mental illness can prevent severe mental disorders and can improve the quality of medical care. Recently, emotion recognition has gained great attention in affective computing and different modalities have been used for emotion recognition i.e. human physical signals and human physiological signals. Human physiological signals are considered to be most reliable source for emotion recognition as compared to human physical signals because they can't be manipulated. Emotion charting using multimodal signals have grown in popularity due to wide multidisciplinary applications such as health care department, neuromarketing, robotics, safety, security and e-gaming etc. There are numbers of physiological markers such as heart rate, respiration, electrodermal activity, conductance and brain activity, which can be used for performing emotion recognition. However, physiological signals such as Electrocardiogram (ECG) signals and Electroencephalograms (EEG) signals measure the cardiac and neuronal activities respectively, connected with different human emotional states. In addition to this, Galvanic Skin Response (GSR) signals are also very highly correlated with the emotional states of human. Therefore, these physiological signals are incorporated in the proposed method and they can be analyzed using different techniques of advanced signal processing and machine learning in order to identify the hidden patterns and classify the emotional states. Previously, researchers have developed different methods for classification of these signals for emotions detection but still there is a need to bridge the connection between the anatomy of human physiological signals and cognitive behaviors by critically analyzing the variation in the waveforms of physiological signals with respect to human emotions. Keeping this in view, this research work proposes two deep learning-based approaches for emotion charting using physiological signals. First approach is an Ensemble method using customized convolutional Stacked Autoencoder (ESA) for Emotion Charting. This approach performs preprocessing of physiological signals (EEG, ECG and GSR) using bandpass filtering and Independent Component Analysis (ICA) followed by Discrete Wavelet Transform (DWT). Then convolutional stacked autoencoder has been employed for feature extraction from the scalograms of physiological signals. Feature vector obtained from stacked autoencoder is then fed to three classifiers SVM (Support Vector Machine), RF (Random Forest), and LSTM (Long Short-Term Memory). The outputs of classifiers are combined using majority voting scheme for the final classification of signals into four emotional classes i.e. High Valence and High Arousal (HVHA), Low Valence and Low Arousal (LVLA), High Valence and Low Arousal (HVLA) and Low Valence High Arousal (LVHA). However, second approach is CNN-Vision Transformer (CVT) based emotion charting using ensemble classification. In this approach, initially signals are decomposed into non-overlapping segments, the noise is removed using bandpass filtering followed by ICA. Then two feature sets are obtained from 1D CNN and Vision Transformer, which are then combined to generate a single feature vector. Finally feature vector is fed to an ensemble classifier composed of LSTM (Long Short-Term Memory), ELM (Extreme Learning Machine) and SVM (Support Vector Machines) classifiers. The probabilities generated from each classifier is fed as input to few shot learning based technique Model Agnostic Meta Learning (MAML) which combines classifiers outputs and generates a single output in the form of emotional classes. The proposed system is validated on AMIGOS and DEAP datasets with 10-fold cross validation and obtained the highest accuracy of 94.75 % , sensitivity of 99.15% and specificity of 97.61 % with ESA based emotion charting. However, on the

other hand the proposed system achieved the highest accuracy of 98.2 %, sensitivity of 98.4% and specificity of 99.53% with CVT based approach. The proposed system outperforms the state-of-the-art emotion charting methods in terms of accuracy, sensitivity and specificity.

Annex B: MS thesis Abstract

Ophthalmological diseases bring different vascular disorders due to unusual variations in vascular pattern in human retina which appears as lesions, exudates or new abnormal vessels etc. Early detection of these diseases can reduce the level of disease severity. Presence of different abnormal structures due to eye diseases makes segmentation of blood vessels very difficult. Abnormal growth of new vessels, exudates, lesions etc. can appear as false positives and can degrade the performance of the diagnosis systems. It can be avoided only when false structures are removed while extracting the blood vessels. Within this framework, an automated retinal image analysis is required which can be achieved only if an accurate segmentation of blood vessels is performed. Segmentation is the pre-requisite process in most of the computer aided diagnosis systems for ophthalmological diseases. Vessel segmentation has been in research since years but the traditional techniques for vessel segmentation result in poor segmentation when applied to diseased images and produces false positives in the presence of lesions. To address this issue, this paper proposes two improved methods for blood vessels segmentation. Method-I is a classification-based method, which performs region-based analysis of retinal image. This method first extracts eight shape-based features and three intensity-based features from the centerlines of regions, then best features are selected from the extracted features and finally SVM classifier categorizes each region into true vessels and false vessels. Method-II is an unsupervised technique of segmentation which mainly aims to reduce false positives. This is achieved by filling the exudate regions using a novel algorithm of Neighborhood based Region Filling (NBRF). The validity of the proposed techniques is tested on our own AFIO database and two publicly available databases of STARE and DRIVE. Experimental results show the efficiency of the proposed approaches. The proposed system gives an accuracy of 91.49 %, 95.81% and 96.50% on AFIO, STARE and DRIVE datasets respectively.

Annex C: List of W category publications

- Waheed Amna, et al. " An Ensemble Learning Method for Emotion Charting using Multimodal Physiological Signals." Sensors 2022, 22(23), 9480, ISI Indexed **[Impact Factor: 3.576]**
- Amna Waheed, Zahra Waheed, M. Usman Akram, Arslan Shaukat, "Removal of False Blood Vessels Using Shape Based Features and Image Inpainting," Journal of Sensors, vol. 2015, Article ID 839894, 13 pages, 2015. doi:10.1155/2015/839894. **[Impact factor: 1.182]**
- Amna Waheed, M. Usman Akram, Shehzad Khalid, Zahra Waheed, Muazzam A Khan, Arslan Shaukat, "Hybrid Features and Mediods Classification based Robust Segmentation of Blood Vessels", Journal of Medical System, ISSN 0148-5598, Volume 39, Number 10, J Med Syst (2015) 39:1-14 , DOI 10.1007/s10916-015-0316-1 **[impact factor: 2.213]**
- Zahra Waheed, M. Usman Akram, Amna Waheed, Muazzam A. Khan, Arslan Shaukat and Mazhar Ishaq, "Personal Identification using Vascular and Non-Vascular Retinal Features", Computers and Electrical Engineering (CAEE) Journal, 2016. **[Impact factor: 0.817**