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INSIDE THIS ISSUE

Avinash Konkani has been (Sept-2010 to current date) a doctoral student in Systems Engineering at Oakland University (OU) , Rochester, Michigan, USA. He is one of just two students throughout USA to receive the 2012 Michael J. Miller Scholarship from the Association for the Advancement of Medical Instrumentation (AAMI) Foundation. The AAMI Foundation awards scholarships to two students in the USA who are aspiring to become biomedical equipment technicians (BMET) and clinical engineers (CE). This prestigious scholarship awarded each year to the students who have demonstrated academic excellence, technical aptitude, and commitment to the healthcare technology management field.

EDITORIAL

SADANAND B KULKARNI

Welcome to July-August issue of ENGMEDNEWS. It gives me distinct pleasure to enlighten all of you about the research work done on two articles that is published in this newsletter.

The first article mainly focuses on the doctoral work of Avinash Konkani at OAKLAND University.

The second article is about biosensor capable of detecting the smallest viruses in doctor's office.

The third article focuses on development of intelligent algorithms for diagnosis of brain abnormality and diseases from MRI images.

The fourth article focuses on face verification across age progression.

I believe that these research works have uplifted the technology of medical world by making it cost effective and efficient.

I hope you all find this newsletter informative and useful.

In his doctoral work at the OU, he is conducting the research by applying system engineering approach to understand and develop solution/s to the problem of increasing noise and number of false alarms from the medical devices in the hospital Intensive Care Units (ICUs) and Operation Rooms (OR). Increasing noise levels and alarm fatigue is an obstacle for clinician's work performance and increases adverse effects, which affects the patient safety. Therefore it is necessary to minimize the noise and number of false alarms. Most of his work is associated with Beaumont Health System's Hospital – one of the America's top 10 hospitals for quality leadership. Along with his research, he also works as a graduate teaching assistant in the department of Industrial and Systems Engineering at Oakland University.

He has nearly 15 years (1997-to date) of strong association with Biomedical Engineering as a student, an engineer, an academician and now as a researcher. He has educational background in Biomedical Engineering with bachelor from KLE's College of Engineering and Technology, Belgaum - Karnatak University, Dharwad, and master's degrees (with emphasis on Human Factor Engineering) from Wright State University, Dayton, Ohio, USA. Before joining OU for his higher education, he has worked as Assistant Professor of Biomedical Engineering at Trident Academy of Technology, a private engineering college affiliated with Biju Patnaik University of Technology (BPUT), Bhubaneswar, Orissa. During this period he has not only enhanced his teaching skills, but also played a role as a member of board of studies and developed the curriculum for the undergraduate program in Biomedical Engineering at BPUT. He was actively involved with the BPUT in preparing the exam question papers and evaluation process also.

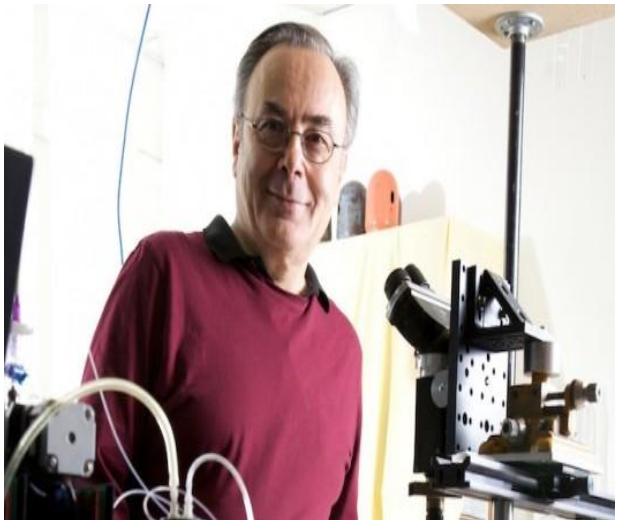
He has worked as a Clinical /Biomedical Engineer in an 1830- bedded multi-specialty teaching hospital: KLE's Dr.Prabhakar Kore hospital and medical research centre, affiliated with Jawaharlal Nehru Medical College and KLE University, Belgaum. As a biomedical and human factors engineer, he concentrated on issues of health care ergonomics and clinical engineering in the hospital. This work experience not only enhanced his knowledge of medical equipment management but also provided him the real word scenarios to interact with doctors, nursing staff and technicians to solve technical problems in medical equipment technology management.

He has published technical articles on his research work in International Journals: "Noise in Hospital Intensive Care Units — A Critical Review of a Critical Topic" – Journal of Critical Care, Oct, 2011 and his recent article "A Review of Medical Device Alarm Management: Paving the Way towards Reducing Hospital Noise" has been accepted by AAMI's Biomedical Technology and Instrumentation (BI&T) journal to be published by September /October-2012.

He maintains a strong relationship with the "movers and shakers" in his field, and has taken every opportunity to attend conferences, workshops and continue his education through publishing in technical journals and conference proceedings. He is an Associate Member of the Institute of Engineers, India (AMIE), a life member of Biomedical Engineering Society of India (BMESI), Indian Society of Ergonomics (ISE), Systems Society of India (SSI) and a student member of Association for the

Advancement of Medical Instrumentation (AAMI), USA.

Whispering gallery biosensor detects the smallest viruses



Researchers led by Professor Stephen Arnold at Polytechnic Institute of New York University have developed an ultra-sensitive biosensor that is designed to inexpensively identify viruses in a doctor's office in a matter of minutes instead of the weeks needed by conventional techniques. The biosensor can detect the even the smallest RNA virus particle, MS2, which weighs only six attograms (10^{-18} grams).

The Whispering Gallery-Mode Biosensor, to give it its proper name, derives its name from the famous Whispering Gallery under the dome of London's St. Paul's Cathedral. There a visitor can whisper next to the circular gallery wall and the curvature of the wall carries the sound around the gallery and the whisper can be heard clearly anywhere along the circumference. The shape of the wall holds the soundwaves next to it and bounces them around in a tight pattern.

The Whispering Gallery-Mode Biosensor works on the same principle, only using light instead of sound. The heart of the sensor is a glass microsphere. A tunable laser is led into the sphere with a fiberoptic cable and the beam shoots around the curve of the ball like sound in the Whispering Gallery until it covers every point of the sphere. If there are any viral particles in contact with the sphere, this changes its resonant properties, which affects the laser. The resulting shift in resonant frequency can then be measured. This effect is enhanced by coating the microsphere with gold nanoparticles, which can be treated to attract specific proteins or viruses.

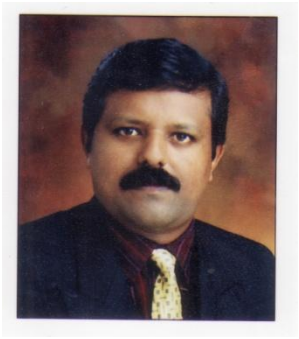
1)Call for Papers for Special Issue of IEEE Transactions on Biomedical Engineering (TBME) on Point of Care Healthcare Technologies

Jan 16-18, 2013 Shearton Bangalore at bridge gateway, Bangalore, India

Further questions to be directed to Atam Dhawan(dhawan@adm.njit.edu)

2)National level technical event "BIO-YANTRA"-MED EXPO 2012
6th to 8th sept-2012
SRM University, Kattankulathur
Chennai, Tamil Nadu
http://www.srmuniv.ac.in/bioyantra/

Development of Intelligent Algorithms for Diagnosis of Brain Abnormality and Diseases from MRI Images



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PhD thesis title: Development of Intelligent Algorithms for Diagnosis of Brain Abnormality and Diseases from MRI Images

Number of International Publications: 4
Number of National Publications: 1
Number of International presentation: 4
Number of National Presentation: 3

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Date of Award: 19th of April 2012.
Awarding Institute: Mangalore University, Mangalore.

Intelligent diagnostic Imaging System (IDIS) is a developing imaging modality that is beginning to show promise of detecting and characterizing abnormalities of the brain. The abnormalities of the brain are due to Intracranial Neoplasm, Cerebral Infections and Inflammations, Stroke, Cerebral Aneurysms, Vascular Malformations, Central Nervous System Trauma and Neurodegenerative Disorders. The abnormalities are detected mostly by scanning the brain. MRI is an effective technique to find the abnormalities of the brain. The work is concerned with the development of image processing tools and intelligent algorithms that will automatically detect the abnormalities of the brain and diagnosis of the abnormalities based on the structural information gathered from the images. This system helps to get information about disease and abnormality at the time of MRI scan if the system is assembled properly.

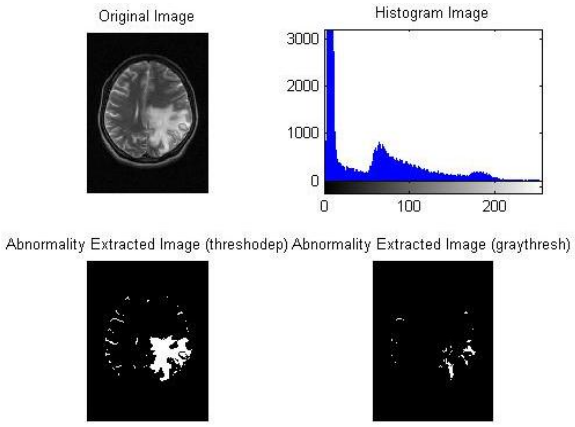
In absence of a well experienced physician, an Intelligent Diagnostic Imaging System (IDIS) can be used to diagnose the abnormalities. The IDIS uses intelligent algorithms developed in this work. It provides the volumetric information of the abnormalities. It will help the surgeon to locate the abnormalities and help to understand the size and severity of the abnormality. The surgeon can plan the surgery in a better manner. Precise diagnosis is needed for brain surgery. This work is very helpful for the entire department especially the Radiology departments of Medical Colleges and Hospitals. No automatic diagnostic imaging system for brain is developed so far. After having studied various developments that have taken place over the years in the area of medical imaging analysis, MRI techniques and GUI, we started with objectives of extraction of abnormalities and develop algorithms for abnormality extraction and

diagnosis.MRI images are mainly classified into T1 and T2 images.

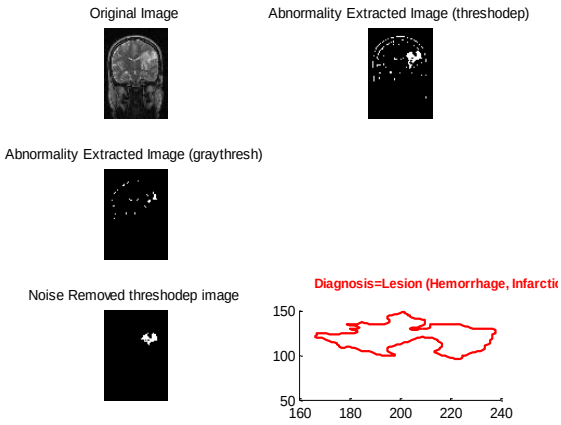
For abnormality extraction, many segmentation methods are studied and applied. Region growing method i.e. region based segmentation is well suited for the segmentation of the abnormalities of intensity change. Present threshold detection for Regional Growing Segmentation method is not up to the level for abnormality extraction. Therefore two new algorithms were developed for threshold detection for Regional Growing Segmentation method and they are found to give excellent results. Thus, the Regional Growing Segmentation with automatic seed point and threshold detection algorithms (J&K_1 and J&K_2 algorithms) are the best method for extracting the abnormalities of the MRI images and it is found that the new algorithms are better than the existing technology. The two new algorithms developed in this work are, J&K_1 for T1 and J&K_2 for T2. Around 99% of abnormalities of T1 and T2 images can be correctly extracted using the new algorithms. After the abnormality is extracted, a new method for diagnosis was developed based on the boundaries of the abnormality. Finally Graphical User Interface (GUI) has been developed and utilized to see the result of a diagnostic Imaging system in an easy way. The diagnoses were compared to the diagnoses done by the medical experts.

Figure 1- Abnormality Extraction: T2 Turbo Spin-echo Axial 13th Slice Image of a 30 year old patient with Venous Infarct. Abnormality extraction using regional growing segmentation algorithm with threshodep_modt2 (J&K2 algorithm) and graythresh function (Existing MATLAB function). Function threshodep_modt2 gives good result and graythresh failed in this case.

Figure 2: IDIS Result on a slice image of a patient which matches doctors finding. The Doctors Impression: altered signal intensity lesion in left partial deep white matter hypo intense on T1 and FLAIR and hyper on T2 with perilesional edema and showing ring enhancement following IV contrast. Findings suggestive of granulomatous lesion.



The accuracy of author defined method for individual slice is more than 98%, overall accuracy is well above 90% and sensitivity is above 95%. For T1, the existing method has completely failed. For T2, by using



existing method the accuracy of individual slice is around 28% to 40% and overall accuracy is around 28% to 36%.

It is found that the algorithm detects the abnormalities and the structural studies go with the diagnosis by the doctor. Thus clinical findings with doctors report matches with the conclusion of the developed work.

All the abnormalities with intensity change can be diagnosed by the algorithm.

Face Verification Across Age Progression

Submitted by

Dolly Tolani , Nagajyoti Ganachary
Mugdha Kulkarni
Shivaleela Chincholi

ABSTRACT Human faces undergo considerable amount of variations with aging. While studies have revealed the extent to which factors such as pose variations, facial expression and occlusions affect face recognition, the role of natural factors such as aging effects in affecting the same are yet to be studied. How does age progression affect the similarity between two images of an individual? What is the confidence associated with establishing the identity between two age separated images of an individual? **Here we propose a method to identify the images over age progression.** Face verification and face identification are two main applications for face recognition. Face verification is a one-to-one match that compares a query of face image against a template face image whose identity is being claimed. A method of automatic face verification for personal authentication is proposed considering the age progression between the registered face image and the captured one. In face verification, the features of the captured face image are compared with those of the registered faces in database and the closest registered face is selected as the person's.

SYNOPSIS: The biometric authentication is one of the best methods for the personal identification. Biometric authentication object includes: living body feature or symbolized characteristic. The former is, for example, fingerprint, voiceprint, vein, iris or face authentication, the latter is signature or gait authentication. Personal authentication is an important problem nowadays in order to verify the documents such as licenses, to keep security of our residence, and to make computer interface easy for human. Face verification is one of powerful methods for personal authentication, which can be easily realized with low cost and give little burden to the authenticated people. However, the performance gets lowered by various environments, such as lighting, the person's pose, the person's expression, and so on, and various methods have been proposed to avoid such harmful influences. Age progression is one of such harmful influences and some methods were proposed to verify faces, the registered face images of which were taken many years ago across age progression. The task of facial recognition is discriminating input signals (image data) into several classes (persons). The input signals are highly noisy (e.g. the noise is caused by differing lighting conditions, pose etc.), yet the input images are not completely random and in spite of their differences there are patterns which occur in any input signal. Such patterns, which can be observed in all signals could be – in the domain of facial recognition – the presence of some objects (eyes, nose, mouth) in any face as well as relative distances between these objects. These characteristic features are called eigenfaces in the facial recognition domain (or principal components generally). They can be extracted out of original image data by means of a mathematical tool called ***Principal Component Analysis*** (PCA).

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