PROCEEDINGS OF THE FIFTH INTERNATIONAL CONFERENCE ON BIOSIGNALS, IMAGES, AND INSTRUMENTATION

MARCH 14 - 15, 2019

DEPARTMENT OF BIOMEDICAL ENGINEERING

CENTER FOR HEALTHCARE TECHNOLOGIES

SSN COLLEGE OF ENGINEERING

KALAVAKKAM - 603110

TAMILNADU, INDIA

Proceedings of the

5th International Conference on Biosignals, Images and Instrumentation

Department of Biomedical Engineering,

SSN College of Engineering

In association with

Centre for Healthcare Technologies

CHT

Research beyond Innovation

ICBSII - 2019

(14th– 15thMarch 2019)

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Dedicated to
all the Staff and Students
of the Department of Biomedical Engineering

From the Chief Patron

Mrs. Kala Vijayakumar

President, SSN Institutions

SSN Institutions (SSN) nurture the all-round development of the students, focusing not only on academic excellence but also on honing life skills such as leadership, discipline, team spirit and time management. Students are encouraged to think critically and creatively. SSN prides itself on providing holistic education to its students.

Biomedical Engineering is a multi-disciplinary branch of study which brings together healthcare and technology, the front runners in the modern world. I congratulate the Department of Biomedical Engineering for organizing the 5thInternational Conference on Bio-signals, Images and Instrumentation, in association with the Centre for Healthcare Technologies of SSN. This conference will provide, the participants and the students a unique opportunity to develop enriching perspectives by interacting with some of the renowned experts in these fields, from all over the world. I am certain that the talks by eminent scientists, researchers, industry-experts and the papers presented will stimulate lively discussions and will lay a strong foundation for further advanced research in these fields. I appreciate the untiring, excellent teamwork carried out by the faculty of Biomedical Engineering department towards organizing this conference.

I extend my felicitations to BME department and wish the conference all success.

Mrs. Kala Vijayakumar
Chief Patron,
ICBSII – 2019.

From the Patron

Dr. S. Salivahanan

Principal, SSN College of Engineering

I am pleased that the department of Biomedical Engineering is organising the 5th International conference on Bio signals, Images and Instrumentation in a manner befitting the stream.

Biomedical engineering is a multidisciplinary field integrating Engineering and healthcare. It focuses on the advances that improve human health and health care at all levels. The department's engagement in wide spectrum of activities with involvement of students and faculty along with strategic planning process has strengthened it.

The 5th International Conference on Bio Signals, Images and Instrumentation (ICBSII-2019) was conceived with the thought of bringing together scientists, engineers and researchers from various domains all over the world. It has been a platform where some of the greatest minds of the country and abroad could interact, exchange ideas and work together towards a common goal.

I congratulate the entire team of Biomedical department for structuring it to perfection and wish them all success.

Dr. S. Salivahanan,
Patron,
ICBSII – 2019.

From the Convener

Dr. A. Kavitha

Professor& Head,
Department of Biomedical Engineering
SSN College of Engineering

Education is a holistic endeavor, creating new paths with endless boundaries and priming minds to orient one to the world. That being said, it gives me immense pleasure to present the Fifth International Conference on Bio-signals, Images and Instrumentation.

Biomedical engineering discipline is one which catalyzes interactions between biologists, physical scientists, and engineers to benefit medicine and human health. This serves society by conducting research that develops quantitative linkages across scales in the human body and uses that development to build new tools to improve human health. The outcomes of research assume a whole new level of importance and significance.

The department is frequently organizing workshops, seminars, project exhibitions and guest lectures on diverse concepts related to the core and interdisciplinary subjects in biomedical engineering to equip the students in gaining a comprehensive knowledge of the industrial requirements to the fullest.

The Centre for Healthcare Technologies, a multidisciplinary research initiative, concentrating on research through innovation in healthcare, in association with the Department of Biomedical Engineering, is organizing the 5th International Conference on Biosignals, Images and Instrumentation, an annual flagship conference of the duo, hoping to instill research aptitude in students and provide a great platform for the researchers to showcase their work in various domains of Biomedical Engineering. It is rightly said, Coming together is a beginning, Keeping together is a progress, and Working together is a success.

With confidence, we aim higher and higher, raising our bars towards the next success!!!

Dr. A. Kavitha
Convener,
ICBSII – 2019

From the Coordinators

Dr. J. Vijay

Associate Professor,
Department of Biomedical Engineering
SSN College of Engineering

I extend a hearty welcome to all to the IEEE sponsored fifth International Conference on Biosignals, Images and Instrumentation (ICBSII 2019) on March 14th and 15th, 2019 in SSN College of Engineering. It gives me immense pleasure to once again put our hands together in organising the department's annual extravaganza!

This conference provides an excellent opportunity for researchers, scientists, academicians and students from all over the world to share their ideas, experiences and the work done by them. It's a platform which can help students to explore new ideas and build upon the existing ones. It also provides an opening to exchange ideas with experts and scholars from various fields.

The conference will involve various talks from experts, presentation of papers & posters and a forum for discussion to unveil different facets of science and engineering.

I would like to thank the management of SSN College of Engineering, Mrs. Kala Vijayakumar, President, SSN Institutions and Dr. S. Salivahanan, Principal, SSN College of Engineering for granting the department a delightful opportunity to organise such a magnificent event that enables the department as a whole to grow on a global level. I would also like to thank all the members who have contributed towards organising the occasion to make it a grand success!

Dr. J. Vijay
Coordinator,
ICBSII-2019

From the Coordinators

Dr. S. Arun Karthick
Associate Professor,
Department of Biomedical Engineering,
SSN College of Engineering

On behalf of the biomedical engineering department, it is with great personal pleasure that I welcome you to the 5th International Conference on Biosignals, Images and Instrumentation (ICBSII 2019) on March 14th and 15th, 2019 in SSN College of Engineering, Kalavakkam. This two day conference features keynote talk from distinguished scientist of international standing. Keynote presentations often lead to thought-provoking insights that can be applied to one's research problems, so I am convinced that, like me, you are very much looking forward to such stimulating talks. This conference will provides a platform for researchers, scientists and industry practitioners from all over the country to present, discuss, and share their knowledge on novel approaches and solutions in the field of biomedical engineering for the betterment of the society.

My sincere gratitude to the management of SSN College of Engineering, Mrs. Kala Vijayakumar, President, SSN Institutions and Dr. S. Salivahanan, Principal, SSN College of Engineering, without whom a prolific occasion of this magnitude would have not been possible. I would like to thank ICBSII 2019 committee members for their support, constructive feedback, and timely help. Finally, I would like to take an opportunity to thank all keynote speakers, external reviewers, student volunteers and contributing authors presenting at ICBSII 2019

I sincerely hope that you will enjoy the Technical Program about to unfold in the next two days, and that you will leave you the fond memories of ICBSII 2019.

Dr. S. Arun Karthick
Coordinator,
ICBSII –2019.

From the Organizing Secretary

Dr.K.Nirmala

Assistant Professor,
Department of Biomedical Engineering
SSN College of Engineering

The 5th International conference on Bio Signals, Images and Instrumentation provides an opportunity for researchers, engineers and academician to present and share research information, receive feedback, create networking and learn about the emerging technologies that will influence future advances in biomedical engineering and healthcare technology. The conference also aims to expand its coverage through expert talks, research presentations & discussions in many areas of Biomedical Engineering such as bio Signals, medical image processing, biomedical system design, rehabilitation, neuro engineering, and brain computer interface.

I extend my sincere gratitude to the Management of SSN College of Engineering, Ms. Kala Vijayakumar, President, SSN Institutions and Dr.Salivahanan, Principal, SSN College of Engineering for granting the department an opportunity to organize and conduct this event. I immensely thank the delegates from various places for their honourable presence to share their knowledge in the area of biomedical engineering. I would like to extend my sincere thanks to the reviewers and the contributing authors. I also thank the faculty, staff and the student of the biomedical engineering department for the immoral support and joining hands to make this event a grand success.

Dr. K. Nirmala
Organizing Secretary,
ICBSII –2019.

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5th International Conference on Biosignals, Images and Instrumentation

ICBSII 2019

KEYNOTE SPEAKERS' PROFILE

Technology Enabled Remote Health Care

Dr. Ganapathy Krishnan

Abstract:

Healthcare is one of the most essential services in any society. The Indian healthcare services is one of the largest services in the world, with every sixth individual on the planet, being a participant. India is expected to rank amongst the top three healthcare markets by 2025. India is also one of the biggest ICT capitals of the modern world. We have Centers of Excellence in Healthcare better than the best. ICT is growing exponentially. It is slowly being realised that the only way to provide equitable affordable quality health care to anyone anywhere anytime
is the deployment of cost effective affordable technology. Recognizing the change in technological innovations, more hospitals are now adopting ICT to improve the quality of healthcare delivery. ICT bridges distances and provides access to clinical knowledge leading to better quality healthcare. Disseminating information and knowledge management with ICT will empower all stakeholders.

Having been trained in the BC era (before Computers and Before Christ are essentially one and the same!!). The author has witnessed the growth and development of medical care in the last 42 years in India including the gradually increasing use of HCIT particularly in the last few years.. It would be no exaggeration to state that ICT has made, is making and will continue to make a significant difference in patient care. Whether it be in the field of diagnosis, investigations, treatment, documentation, retrieval of information, access to state of the art knowledge, medical instrumentation, teaching, research etc. ICT has made a major difference.

Hospitals are people intensive enterprises and capacity of the people to embrace change is a major challenge. The functional requirements for adequate automation support of clinical healthcare activities, far exceed those of any other industry. For instance, most industries do not need to maintain 24/7, 365-days-a-year service with absolutely zero tolerance of downtime.

Dr. Ganapathy Krishnan
Director and founder
President of theApollo
Telemedicine Networking

Dr. Ganapathy Krishnan is currently Director and founder President of the Apollo Telemedicine Networking Foundation (ATNF) India, Emeritus Professor at the Tamil Nadu Dr. M.G.R. Medical University in Chennai, a member of the BIRAC (Biotechnology Industry Research Assistance Council).

The Past President of the Telemedicine Society of India and former Secretary and Past President of the Neurological Society of India. He was an Adjunct Professor at the IIT Madras and Anna University in Chennai, Honorary Consultant and Advisor in Neurosurgery for the Armed Forces Medical Services. Dr. Ganapathy was the first neurosurgeon in South East Asia to gain a PhD in neuroimaging, and the first to establish Stereotactic Radiosurgery, Clinical Telemedicine and Robotic Radiosurgery.

The major urban rural health divide with lop sided distribution of specialists can only be addressed with ICT. Integration of user-friendly systems access to mobile devices such as tablets, more shareable information platforms and standardisation could lead to more usability. Integrated systems will enable developers to create cloud-based solutions, making upgrades and maintenance quicker and more efficient. Shift to wireless technology, mobile devices and cloud computing will reduce system costs and improve workflows. Introducing new technology in an existing health care system is one of the foremost challenges of "Digitizing

IT improves patient care, by enabling processes and systems to be introduced and repeatedly monitored. Standard operating procedures and audit processes can be introduced in almost every aspect of healthcare. We not only have software and hardware we have the most precious commodity brain ware. Creating awareness aggressively with success stories is a prerequisite. Lars Leksell the inventor of the Gamma Knife, had remarked half a century ago -I quote "a fool with a tool, is still a fool". He also observed that when one has a hammer everything around you looks like a nail, particularly when the hammer is expensive. Technology should not go in search of an application. We should develop a technology for a pre-conceived application. Digital technology should be viewed as an enabler to achieve an end, not an end by itself. We should not become slaves to technology. TLC should continue to be Tender Loving Care not only telephone or TV linked care.

The presentation will be profusely illustrated with success stories of mega pan India PPP projects where technology is being used to make distance meaningless. Today Geography has become History. The challenges encountered and how these were addressed will be highlighted. Apollo Telehealth services enables 3000 teleconsults per day. We did not follow the advanced countries. We do not piggy back or leap frog. We pole vaulted!!

The Prospects Of Engineering In Medicine – A Surgeon's Perspective

Dr. G. Sudhir

Abstract:

Scientists study the world as it is, while engineers create a world that has never been! With this thought provoking quote there are innumerous prospects for engineers in the field of medicine. Directly or indirectly engineers have always played their role along with doctors to improve the quality of life of the patients. One can view these two specialties as tracks of a train that travel together, helping patients to board and alight as and when required.

The field of medicine has innumerous lacunae and each lacuna provides a sea of opportunities for the engineers to create and work on. To state a few ,surgeries that require implant placement, precise and delicate instrumentation, correction of spinal deformities, and discectomy procedures can excel much more if specially designed products are available for the surgeons to work with. Currently the western literature and their products are incorporated or adapted in wide number of scenarios for the Indian patients, for the most part it works but at times doctors do feel the need of specially designed tools, equipment or implants which could help them provide more accurate relief to the patients.

Yet many a times, this thought is not translated into actions and the prospects of engineering seem to be bleak in the field of medicine. The reasons may be varied from lack of time and communication, dearth of interests and motivation and these reasons have created a gap between these two fields.

To bridge the gap and transverse the distance, a common platform like a conference or symposium or even an online portal that links the two different specialties must be created. Exchange of knowledge and ideas between experts from the respective fields will ignite the minds and indigenous production designed specifically for the needs of the Indian patients can be created. Hence, Engineers and doctors should always work together for improving the quality of life of patients.

Dr. G. Sudhir,
Ortho Spine Surgeon, Sri Ramachandra Medical Centre

Sudhir pursued MBBS from the Thoothukudi Government Medical College, under the Tamil Nadu Dr. MGR Medical University, and DNB in Orthopedics from the prestigious Ganga Medical Centre, Coimbatore, Tamil Nadu under National Board of Examinations. His high academic record includes many distinctions and gold medals like University second in pathology, top rank in anatomy, medicine, surgery, distinction in ophthalmology and pharmacology. He received Dr.Balu Sankaran Gold Medal for securing All India First Rank in DNB Orthopedics in 2011. To further pursue his passion, he entered FNB (Fellowship in National Board) in Spine Surgery in Sir Ganga Ram Hospital, New Delhi and excelled as the Best Outstanding Fellow. He has presented many papers, posters, and has participated in various State and National and International conferences.

Currently, he is practicing in SRMC Hospital, Chennai. He is specialized to deal with all types of spinal pathologies like degenerative spinal disorders, spinal deformities, infections, tumors and fractures of spine.

Development Of Indigenous Medical Technologies: CSIR-CSIO Perspective

Dr. Neelesh Kumar

Abstract:

Providing quality (state-of-art) healthcare facilities with affordability and its reach to the masses of Indian population are major challenges for the country. Migration of rural population to urban areas, absence of healthcare facilities in rural areas, changing lifestyle & related disorders etc. are some of the major factors demanding quality healthcare in the country. To overcome these problems in healthcare and for improving & sustainability in healthcare index of the nation, providing better healthcare solution through technological intervention is today's need.

Keeping view of this CSIR-CSIO is working to implement a mission on 'Indigenous Medical Devices and Technologies for Mass Healthcare'. The primary objective of the mission is to provide state-of-art medical devices with affordability, so that the reach of quality healthcare facilities to the masses of Indian population will be possible. To achieve these social and sustainable development goals in healthcare segment through technological intervention, it requires multi-disciplinary approach and core-competence in the field of bio-signal acquisition & processing, imaging, mechatronics &robotics. CSIR-CSIO, is also making continuous efforts to develop technologies at par to the global developments, covering medical instruments for diagnostics, therapeutics, prosthetic & assistive devices and has developed several technologies in this field. The laboratory has R&D base in electronics & IT, mechanical design & fabrication, mechatronics, material research etc. required to pursue high quality work in this interdisciplinary area.

Dr. Neelesh Kumar
CSIR- Central Scientific Instruments Organization, Chandigarh

Dr. Neelesh Kumar working as Principal Scientist in Biomedical Instrumentation Unit of CSIR-Central Scientific Instruments Organisation Chandigarh from 2001. He was also head of Mechatronics/Electronics at CSIO-Indo-Swiss Training Centre, Chandigarh. He worked on projects of national importance like "Jai Vigyan" Linear Accelerator, Functional Electrical Stimulation System for Paraplegics, Electronics Portal Imaging System and Electronic Knee Joint. His areas of interest are techniques of gait assessment, sensor development, design and development of assistive devices and methods to quantify rehabilitation.

He is versed with application of prosthetic biomechanics for development robotic rehabilitation. He has received National award for development of technological aids for mobility of disabled in 2012, IETE- B V Baliga Memorial Award (2018)and Institution of Engineers India-Young Engineers Award (2009) in Electronics & Telecommunication Engineering Discipline and fellowships as INSA Bilateral Exchange Fellowship 2018, Raman Research Fellowship 2013-2014. He has more than 85 publications and 06 technologies commercialized to his credit.

The Largescale Brain Connectivity And Lifespan Trajectory Of Neural Oscillatory Activity In The Motor System

Dr. Dipanjan Roy

Abstract:

A wide number of studies connect beta oscillations in the motor cortices in the human brain to volitional movement, and beta is known to be aberrant in multiple movement related disorders. However, the dynamic interplay between these beta oscillations, motor performance, and spontaneous beta power (e.g., during rest) in the motor cortices remains largely unknown and amenable to a variety of brain signal processing techniques. We will show in our work how we can use amplitude and phase based signal processing measure to decipher large-scale brain connectivity patterns using magnetoencephalography (MEG) to investigate various influencial parameters and their lifespan trajectory in 100 healthy participants aged 18–85 years old. Movement-related beta activity was imaged using a beamforming approach, and voxel time series data were extracted from the peak voxels in the primary motor cortices.

Our results indicated that spontaneous beta power during rest followed a quadratic lifespan trajectory, while movement-related beta oscillations linearly increased with age. Subsequently, Brain network analyses showed that spontaneous beta power and the beta minima during movement, together, significantly predicted task performance above and beyond the effects of age. These data are the first to show lifespan trajectories among measures of beta activity in the motor cortices, and suggest that the healthy brain compensates for age-related increases in spontaneous beta activity by increasing the strength of beta oscillations within the motor cortices.

Prof. Dipanjan Roy
National Brain Research Centre, Gurgaon

Prof. Dipanjan Roy is a scientist at NBRC and leading a Cognitive Neurodynamics group working on various research aspects related to Neuroimaging, Brain Connectivity, Multiscale computational modelling, EEG, and behavior. He has made several key contributions to understanding the computational role of time delay, time-scale separation, structure-function relationship and plasticity that unfolds in a dynamical landscape in the brain.

His research combines developing methods to analyze EEG, FMRI recordings at rest and task conditions along with whole brain computational modelling.

A Capacitive Electromyography Sensor ForExtramural Monitoring Of Muscle Activity

Dr. Mamun Bin Ibne Reaz

Abstract:

An important biosignal often used in clinical diagnosis, medical treatment, and rehabilitation for patients with musculoskeletal disorders is electromyography (EMG). Conventional EMG measurements are done using contact electrodes such as needle electrode (nEMG) and surface electrode (sEMG) that require the attention of a professional medical officer throughout the tedious skin preparation and complex measurement process, limiting the efficiency of the EMG measurement and portability of the system. Recent technological developments in amplifier electronics allow the use of small capacitive EMG (cEMG) biosensor. These electrodes can measure the EMG signals without galvanic contact with the human body which overcome the limitations of the contact electrode. We are developing a cEMG biosensor that can be applied to an ambulatory monitoring system of muscle activity.

The main components of the measurement system are the capacitive electrode, front-end amplifiers, pre-processing filters, a data acquisition unit, and the user interface for data storage, analysis, and monitoring. An electrical model of skin-electrode capacitance was developed and derived to determine the optimum capacitance for a cEMG biosensor. Experimental results showed that the cEMG biosensor was able to measure EMG signal accurately and achieved extremely low noise floor of less than 2 mV. This cEMG biosensor was also able to measure the EMG signal with fabric as an insulator. This cEMG biosensor was able to overcome the limitations of the contact electrodes, yielding a comparable performance to EMG signals measured by conventional wet contact electrodes which makes it ideal for Ambulatory applications.

Dr. Mamun Bin IbneReaz
UniversitiKebangsaan Malaysia, Malaysia

Mamun Bin IbneReaz, Professor in the Centre of Advanced Electronic and Communication Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Malaysia.

He received his B.Sc. and M.Sc. degree in Applied Physics and Electronics, both from University of Rajshahi, Bangladesh, in 1985 and 1986, respectively. He received his D.Eng. degree in 2007 from Ibaraki University, Japan. He is author and co-author of more than 300 research articles in design automation, IC design for biomedical applications and Smart Home. He is also the recipients of more than 50 research grants (national and international).

Development Of UHMWPE Based Next Generation Load Bearing Nanocomposites Using A Novel Manufacturing Technique for Total Joint Replacements And Testing Them in an Ingenuously Developed Hip Joint Wear Simulator

Dr. S. Kanagaraj

Abstract:

Bio medical engineering especially bio implants has always been an emerging field along with advancements in human endeavors. Such bio implants were begun to be incorporated in orthopedics in late 19th century after the proposal of concept "aseptic surgery". This concept was refined which eventually made implanting foreign materials into the body with an acceptably low risk of infection viable. Thus, bio material implants in orthopedics begin to establish which is growing at a tremendous rate. Owing to its increasing application and demand, orthopedic materials contributed US$ 29.2 billion to global medical market in 2012, which is expected to increase to US$41.2 billion by 2019.Generally orthopedic materials are subjected to continuous loading and friction which eventually requires a high strength and less abrasive material. Hence, different combinations of metals, ceramics and polymers are being developed which possess distinct properties and applications.

In this talk, an attempt will be made to discuss the application of ultrahigh molecular weight polyethylene (UHMWPE) reinforced with multi-walled carbon nanotubes (MWCNT) in total joint replacements. The fabrication of composites, characterization, and mechanical properties of UHMWPE/MWCNT will be discussed in detail. The effect of gamma irradiation on wear resistance and the surface morphology and topography of the wear tracks of the composites will be explained. The talk will be concluded with the emphasis on the possible future developments on polymer bio materials and role of reinforcements for high strength, wear resistant bio materials.

Dr. S. Kanagaraj
Indian Institute of Technology
Guwahati

Dr.S.Kanagaraj is currently a professor at IIT Guwahati. He finished his UG, B.E -Mechanical engineering at Thiagarajar college of Engg., Madurai. He did his Ph.D. at Indian Institute of Technology Kharagpur. His area of research interest is carbon nanotube based nanocomposites, material characterization, prosthetic and orthotic devices.

He is a member of Society for Biomaterials and Artificial Organs, Tribology Society of India, and Indian Cryogenics Council. He is the author and co-author for more than 60 papers with 6 patents.

Artificial Intelligence for Applications in Neurology

Dr. Justin Dauwels

Abstract:

Many tasks in medicine still involve substantial manual work. In many cases there is strong potential for intelligent automation by Artificial Intelligence (AI), leading possibly to a reduction in costs and man-hours, while increasing the quality of clinical service. In this talk, we will consider applications of AI in the domain of neurology.

We are developing a low cost validated system called NeuroBrowser to automatically interpret EEG via remote access. Diagnosis and management of neurological disorders rely on visual review of EEG data by specialized physicians. As the duration of EEG recordings ranges from 30 minutes to several weeks, the visual review is time consuming, and accounts for approximately 80% of total cost associated with EEG reading. Our system has the potential to reduce expenses associated with EEG testing and allows physicians to devote more quality time to their patients. One of the applications that we have explored so far is diagnosis of epilepsy of EEG. In this talk, we will show numerical results on large EEG datasets of epilepsy patients and healthy control subjects for multiple center

Dr. Justin Dauwels
Nanyang Technological University, Singapore

Justin Dauwels is an Associate Professor in School of Electrical & Electronic Engineering at Nanyang Technological University (NTU). In 2000 he received the engineering physics degree from the University of Ghent. He obtained a PhD degree in electrical engineering at the Swiss Polytechnical Institute of Technology (ETH) in Zurich in December 2005. Some of his projects include Mathematical modeling of the start and ending of epileptic seizures, Diagnosis of Alzheimer's disease from EEG signals, Machine learning techniques for guiding neurosurgery, Copula based modelling of extreme events and Copula based graphic models. His current projects include Advanced Multi-Sensor Anomaly Monitoring and Analytics for Gas Pipeline, Automated Detection of Seizure-Spectrum Patterns and Quantitative Neurological Outcome Prediction, Automatic Analysis of EEG for Neurological Patients by Deep Learning Methods.

5th International Conference on Biosignals, Images and Instrumentation

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Session 1: Signal and Image Processing

Research papers

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Abstract. This paper presents an innovative, biofeedback based, dual-mode android application designed to help users perform better physical and mental exercises. The first mode or the 'Exercise Mode' is a biofeedback game which helps the user to adhere longer to the cardio work-outs in the gymnasium such as cycling or running on a treadmill. The second mode or the 'Meditation Mode' is a biofeedback based relaxation training game for reducing anxiety. The hardware used is miBEAT® - an open-source, wireless, biomedical data acquisition system by Cardea Labs, which sends medical grade ECG signals to smartphones using bluetooth. The android application is developed using Android Studio and Unity3D. The designed device when born by the user captures a medical grade ECG signal which is then sent to the built mobile application. In the 'Exercise Mode', the character in the game moves in positive Y-axis on the screen if the heart rate increases and in the negative Y-axis if the heart rate drops. This feedback of gaining/losing points makes the user exercise for a longer duration of time and hence adheres to the exercise for a longer duration of time. Similarly in the 'Meditation Mode' the user tries to relax and induces a decrease in the heart rate value and perform better relaxation and meditation.

Keywords: Android Application, biofeedback game, miBEAT, wireless DAQ, Unity3D

STUDY OF IMAGE BASED, NON-INVASIVE METHODS USED FOR HAEMOGLOBIN LEVEL MEASUREMENT AND ANAEMIA DETECTION: A REVIEW

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Abstract. The aim of this study is to understand, compare and review the various non-invasive methods developed and used to measure the haemoglobin levels in blood, which helps to identify the presence of anaemia in human beings. This paper briefly describes about haemoglobin and its importance, anaemia and its consequences and explains the invasive methods, non-invasive methods and low cost devices used for haemoglobin measurement and anaemia detection. This paper mainly focuses on image based, non-invasive methods especially using palpebral conjunctiva images. This study helps to analyse the advantages, disadvantages and limitations of various non-invasive methodologies which leads to identify the better non-invasive device, algorithm or methodology that can be used for mass screening of anaemia in rural areas.

Keywords: Haemoglobin, anaemia, invasive, non-invasive, conjunctiva, linear regression, Kalman filtering, penalty regression, correlation, sensitivity, specificity, accuracy, Pearson Correlation Index (PCI).

WIRELESS SYSTEM FOR EPILEPTIC SEIZURE DETECTION AND PATIENT MONITORING USING BIO-SENSORS

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Abstract. In this paper development of seizure monitoring system using wireless sensors is proposed. The proposed epileptic seizure detection and monitoring system consists of modules such as Multi-modal data acquisition system, Feature Extraction, Classification with Support Vector Machine (SVM) and Mobile App for Monitoring, Detection and Alarm System. In order to detect and monitor epileptic seizure, set of time domain features are extracted. Support Vector Machine (SVM) based light weight classifier is deployed. The proposed system is based on mobile phone application that uses machine learning program to detect epileptic seizures. The proposed system is evaluated using benchmark EEG datasets and analysed the performance using the metrics namely classification accuracy, sensitivity and specificity.

Keywords: Wireless Sensors, Epileptic seizures, EEG signal, Support vector machine, Android Application

AUTOMATED POINT OF CARE SYSTEM FOR ANALYSIS OF CALCIUM LEVEL

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Abstract. There are numerous health problems that people face today due to lifestyle changes. One such health issue is calcium deficiency. Thus developing the need for healthcare system to monitor their health regularly and provide quick and accurate results. This can reduce hospital visits and make it easier for the user to monitor the health status from home. The development of colour science and image processing techniques has made way for the detection of pH level on the litmus paper strips. In this paper, application is developed and designed with an aim to provide a first level diagnostic test for early identification of calcium deficiency. This proposed mobile application is developed on android based mobile phones displaying the pH colour level and message alert regarding the blood calcium level.

Keywords: Calcium deficiency, healthcare system, color science, image processing, pH test strips, mobile application.

MATHEMATICAL MODEL IN EARLY DETECTION OF PARKINSON'SDISEASEUSING GABA

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Abstract. Clinical and non-clinical management regarding early stage of Parkinson's Disease (PD) is complex. It may lead to diagnostic errors, delayed diagnosis, and excessive medical cost. An accurate and precise technique is needed to identify PD at an early stage. The present work proposes a diagnostic mathematical model for Gamma Amino Butyric Acid (GABA) in terms of Striatal Binding Ratio (SBR) of caudate left, right and putamen left, right. SBR values are calculated from Single Photon Emission Computed Tomography (SPECT) images of the midbrain called Substantia Nigra (SN). Thus, these features are considered as input parameters to develop a mathematical model. The developed mathematical model for GABA predicts the Parkinson's disease in its early stage. An Analysis of Variance (ANOVA) is also performed to evident the significance of the model.

Keywords: Parkinson's disease, SPECT, SBR, GABA, Mathematical model

INFRARED THERMOGRAPHIC ANALYSIS OF INTERRELATION BETWEEN BLOOD PRESSURE AND TEMPERATURE OF FOREARM FOR NORMAL, HIGH AND LOW BP SUBJECTS

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Abstract. The thermal variation in body have been detected, monitored, analysed using IR thermography which is a non-invasive clinical imaging method. In the precursory work, the empirical relationship and interrelationship between temperature (℃) and blood pressure(mmHg) is derived at three different regions (common interosseous artery, radial artery and palmar arch regions) in forearm for normal, low and high BP subjects. It is done for the study set up, consisting 40 subjects (age group of 20 to 50 years), where 15 high Blood pressure subjects,15 normal blood pressure subjects and 10 low blood pressure subjects are chosen. The future works is the development of an IR based sensor which would assist in measuring the blood pressure of a body from the surface of the skin. This IR sensor can be used by diabetic patient, sports persons to know their blood pressure instantly as IR sensor can fit in smart watch.

Keywords: Infrared thermography, Empirical relationship, Surface temperature, Forearm, Abnormality BP subjects.

NON-INVASIVE DETECTION OF JAUNDICE USING PCA

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Abstract. Neonatal jaundice has been known since olden days and currently, diagnostic approaches are being developed constantly for neonatal jaundice. Neonatal jaundice is evidently perceived as soon as the infant's bilirubin level surpasses 5 mg/dL (85 mmol/L). Bilirubin level increases in every newborn infant in the first week of life. Jaundice is identified in nearly sixty percent of the full-term babies and eighty percent of the preterm babies. The aim of this project is for early detection of jaundice in neonates. For this study, 22 normal and 15 jaundice affected babies were considered. Babies of various skin tones were included. The images of the babies were captured using a smartphone camera. The acquired images were then processed in MATLAB® environment. Face detection and skin detection algorithm were applied to the images. Colour map transformation (RGB, LAB and YCbCr) and white balancing were applied to the region of interest. Various quantitative features like mean, energy, entropy, standard deviation, skewness, kurtosis, homogeneity and correlation were obtained from the processed image. To reduce data redundancy, Principle Component Analysis (PCA) was used. PCA indicated that features like energy, entropy and standard deviation possess more information for further classification of normal and jaundice affected neonates. The energy and standard deviation of the images of the jaundice affected neonates were found to be much higher than those of normal babies. This research conclusively demonstrates that the features of the images can be utilised for jaundice detection

Keywords: Neonatal Jaundice, Bilirubin, Face Detection, Skin Detection, Image processing, Colour Map Transformation, PCA, Feature Extraction.

HEART DISEASE PREDICTION USING DATA MINING

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Abstract. Heart Disease (HD) is a common form of disease affecting the heart and an important cause for premature death. From the point of view of medical sciences, data mining is involved in identifying various sorts of metabolic syndromes. Classification techniques in data mining play a significant role in prediction and data exploration. Classification technique such as Decision Trees has been used in predicting the accuracy and events related to HD. In this paper, a Data mining model has been developed using Neural Network classifier to improve the prediction accuracy and to investigate various events related to HD. This model can help the medical practitioners for predicting HD with its various events and how it might be related with different segments of the population. The events investigated are Percutaneous Coronary Intervention (PCI),Angina, Acute Myocardial Infarction (AMI) and Coronary Artery Bypass Graft surgery (CABG). Experimental results have shown that classification using Neural Network Classification algorithm can be successfully used in predicting the events and risk factors related to HD.

Keywords: Data Classification, Data Mining, Heart Disease, Neural Network, Predictive Analysis

ANALYSIS OF ELECTROHYSTEROGRAM AND ULTRASOUND IMAGES FOR THE EARLY DETECTION OF PREECLAMPSIA

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Abstract. Preeclampsia is a disorder that arises during pregnancy which results in maternal death during delivery , foetal death in the womb and growth retention in infants based on the degree of severity and duration of onset. The markers for identification is found to be Strength of uterine muscles, Decreased velocity & volume of Uterine Artery, Poor placentation,Deficient in Remodeling of Spiral artery.The proposed work emphasis on extraction of features of EHG signal and Ultrasound Image of normal and suspected preeclampsia patients at second trimester to identify the condition at the earliest. The ability of the Uterine Muscle can be identified by recording of electrical activity of the uterus, by a device called Electrohysterograph that uses Surface Bipolar electrodes placed at various points in the lower abdominal of pregnant women that can indicate the possibility of Preterm labour. The anatomy of Uterus, an indicator of weaker cervix and anatomy of kidney can be analysed by abdominal Ultrasound Imaging. Based on the combined analysis of images and signal along with the support of biochemical tests it is possible to identify the disease at the start of second trimester.

Keywords: Electrohysterograph, abdominal ultrasound imaging, second trimester.

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Research papers

DEEP CONVOLUTIONAL NEURAL NETWORKS IN DETECTING LUNG MASS FROM CHEST X-RAY IMAGES

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Abstract. There are more than one million cases of Lung Cancer per year in India alone. Early detection of Lung Cancer is vital in increasing the survival rate and decreasing the treatment costs. This research is aimed at building a Deep Convolutional Neural Network which uses Chest X-Rays to identify Lung Mass, and then make a comparative study by tuning the hyper parameters. A lung mass or a lung tumor can be Malignant or Benign. NIH Chest X-Ray Dataset containing more than 112000 images was used for training and testing. After pre-processing, the data was analyzed and then fed to the designed Convolutional Neural Network. Accuracy of over 96 percent was obtained in all the trials. A comparative study by varying the number of input images and varying the number of hidden layers was carried out. The accuracies obtained were compared and was found that the accuracy increased with the increase in number of hidden layers. A complete product was then ideated which when implemented would be a vital diagnostic tool to detect Lung Mass which can be used in the remote locations of our country having just X-Ray facilities and no other advanced medical equipment like CT, also it will be able to solve the problem of less availability of expert Radiologists at such locations.

Keywords - Convolutional Neural Networks; Deep Learning; Biomedical Engineering; Cancer; Computer Vision; Medical Image Processing

TEXTURE ANALYSIS USING IMPROVED FRACTAL DIMENSION

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Abstract.Fractal Geometry plays a significant role in image processing and texture image analysis. Fractal Dimension (FD) is an important feature that measures the degree of roughness at multiple scales. Differential Box Counting technique is used for grey scale image FD computation. This paper addresses the drawback of DBC technique in terms of box over counting and undercounting and proposes a new method to overcome the defects with improved accuracy. The proposed method is compared with DBC and Improved DBC techniques using simulated images, Brodatz texture images and Medical images from Mini-MIAS database and produce good result with less computational error.

Keywords: Fractals, Differential Box counting, IDBC, Texture, Roughness

A REVIEW PAPER ON DIAGNOSING EARLY STAGE OF PARKINSON'S DISEASE USING IMAGE PROCESSING TECHNIQUES

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Abstract. Parkinson's Disease (PD) is the most common neurodegenerative and movement disorder. The loss of dopamine generating cells in the human mid brain, called Substantia Nigra (SN) which creates Parkinson‟s disease. Characteristics of PD are loss of muscle control, which leads to trembling of the limbs and head while at rest, stiffness, slowness, and impaired balance. Single-Photon Emission Computed Tomography (SPECT) imaging might have the potential (high diagnostic accuracy and practical to use) to act as standard in detecting loss of dopamine cell in patients with Parkinson‟s disease even at an early stage. The imaging techniques, Computer Aided Diagnosis (CAD) and machine learning approach have been implemented for identifying the Parkinson‟s disease accurately even in the early stage. The available image processing techniques using CAD systems are discussed in this paper.

Keywords: Parkinson‟s disease, SPECT, Substantia Nigra, Computer Aided Diagnosis

RETINAL VESSEL SEGMENTATION IN FUNDUS IMAGES USING MULTIVIEW ENSEMBLE LEARNING

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Abstract. In the recent years, the advancement in the computer technology has created a larger impact in every other fields like medicine and industry. The medical field has seen a higher peeks in terms of automation. These advances have rightly used in the computer image analysis area.The computed scanning is widely done for the detection of diseases in various regions of eye,lungs,heart, bones and many other parts. Glaucoma has been an increasing threat to many of us. The detection of glaucoma is always connected to the eye. It can also be said as many important blood vessels connecting to the brain are also found in the Eye. Changes in blood vessel structures are important indicators of many diseases such as diabetes, hypertension, etc... Blood vessel is useful in the tracking of disease progression and for biometric authentication. The fundus image of eye has been taken for study and retinal blood vessels were extracted using the appropriate image analysis techniques. Multi-view ensemble learning technique has been introduced inorder to classify the diseased blood vessels from the healthy blood vessels.

Keywords: Fundus image, retinal blood vessels, segmentation, multiview ensemble learning.

DIAGNOSIS OF GLAUCOMA USING TEMPLATE MATCHING AND SUPERVISED MACHINE LEARNING TECHNIQUES ON FUNDUS RETINAL IMAGES

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Abstract. Glaucoma is the second leading cause of blindness in the world[6].It occurs due to high Intraocular Pressure in the eye resulting in gradual nerve head damage and blindness. Fundus and Optical Coherence Tomography (OCT) are imaging techniques used for Glaucoma detection. These require experienced ophthalmologists to detect the disease in early stages. Hence, there is a need to automating Glaucoma detection to save millions of lives from permanent blindness. In this paper, we are presenting a new methodology to detect Glaucoma using machine learning algorithms. Features are extracted from the data after locating the region of interest (ROI). Then the pre-processed image and the extracted features used for classification of Normal and Glaucomatous using Logistic Regression and SVM. We used publicly available database RIM-ONE which contains both normal and glaucomatous images. The proposed method achieved an accuracy of 94.28%

DNA-CHAOS BLENDED CROSSOVER AND MUTATION FOR SECURE MEDICAL IMAGE COMMUNICATION

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Abstract. This article proposes a medical image cryptosystem by blending DNA computing with chaos to ensure that the medical images are securely transferred over the network. The proposed cryptosystem utilized two dimensional chaotic map for key generation. The proposed bio – chaos system employs a biological crossover and mutation process for encryption. At first, the given medical image and the chaotic series are converted into biomolecules by applying DNA encoding. After in crossover phase the position of the DNA image is scrambled and in mutation phase, XOR operation is executed between the result of crossover and DNA key image. Finally, DNA decoding is applied to the result of mutation phase to obtain the encrypted image. Experimental results and the results of different attacks such as statistical, differential and crop attack analysis proves that the proposed cryptosystem provides a good security level for transmitting and storing the medical image in the real-time environment.

Keywords: Medical image, logistic map, crossover, mutation, dna encoding.

DETECTION AND CLASSIFICATION OF BREAST CANCER FROM MAMMOGRAMS USING ARTIFICIAL NEURAL NETWORK

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Abstract. Among women community, the most dangerous disease is breast cancer. If it is detected in the early stage, the women will be rescued by giving proper treatment. The early detection is possible only by screening in regular interval. It will decrease the mortality rate. Mammography is a specialized medical imaging phenomenon that uses a low-dose x-ray system to see inside the breasts. It is called as mammogram, given support to the early detection and diagnosis of breast diseases in women. In this paper, an automated system is proposed to classify the breast tissues as normal or benign or malignant. Artefacts in the images are removed using Gaussian Mixture Model. Contrast-Limited Adaptive Histogram Equalization (CLAHE) algorithm is used to improve the appearance of the image. The features of the region of mammogram are extracted using hybrid feature extraction which includes Gray Level Co-occurrence Matrix (GLCM), texture and gradient. The features such as contrast, correlation, energy, homogeneity, global mean, uniformity, entropy and skewness are the best features that guarantee the improvement of classification with less feature dimension. K-Means clustering based segmentation is performed to identify the abnormality in the mammogram. The MIAS database images are considered for the evaluation. The feed forward Neural Network classifier is used for classification. Based on the classifier, the given input image is classified as normal or benign or malignant image. From the results, it shows that the proposed breast cancer identification method offers high accuracy and low complexity than the all other existing method.

Keywords : Mammogram, Gray Level Co-occurrence Matrix, Feed forward Neural Network, Receiver operating characteristic curve.

CLASSIFICATION OF THE EXTRACTED OCT RNFL LAYER FEATURES FOR THE EARLY PREDICTION OF ALZHEIMER'S DISEASE

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Abstract .Dementia of Alzheimer's type (DAT), is a progressive neurodegenerative disorder, is the most common cause of dementia in the elderly population. Previous clinical and histological studies suggest that the neurodegenerative process, which affects the brain, may also affect the retina of DAT patients, especially the Retinal Nerve fiber Loss (RNFL) layer. Any disease-modifying treatments which are developed are most possibly to be achieving success if initiated early in the process, and this needs that we tend to develop reliable, validated and economical ways to diagnose Alzheimer's kind brain disease. However, despite comprehensive searches, no single test has shown adequate sensitivity and specificity, and it is possible that a mixture will be required. Profiling of human body parameter using computers can be utilized for the early judgment of Dementia of Alzheimer's type. There are many imaging techniques utilized in clinical practice for the identification of Alzheimer's kind pathology. In this paper, extracting the RNFL layer of Retina Optical Coherence Tomography (OCT) Images for the early diagnosis of DAT has been proposed. For this purpose, we have proposed a method based on Discrete Wavelet Networks (DWNs) for extracting the RNFL layer of Retina OCT images for the classification of Alzheimer's from normal. This method provides reliable and validated results for OCT images.

Keywords: Dementia of Alzheimer's type, early diagnosis, DWNs, and OCT.

ENHANCEMENT OF X-RAY IMAGES AND ANALYSIS OF STATISTICAL PARAMETERS FOR DETECTION OF OSTEOPOROSIS

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Abstract. Recent researchers are motivated by the research challenges in the measurement of Bone Mineral Density (BMD) in X-Ray images. Osteoporosis is a bone related disease that depicts the low bone mineral density. X-Ray images are the traditional imaging modality used for the detection of osteoporosis. Bone Mineral Density measures the amount of calcium present in the bone. Lot of research challenges in the detection of osteoporosis paved a way to measure the BMD in a simpler way based on the statistical parameters. An effort is made in to measure BMD from X-ray images by means of two parameters viz., entropy and standard deviation. The main contribution of the paper is the enhancement of the X-ray images using the Adaptive Histogram Equalization Method and a mathematical model derivation for BMD Measurement using the Entropy values. The Fracture Risk condition detected by the proposed method is validated through the Physicians. Spine images are taken for the analysis.

Keywords: Image Enhancement, entropy, standard deviation, x-ray, BMD and osteoporosis.

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Session 3: Instrumentation

Research papers

CUSTOMIZED 3D PRINTED ORTHOTIC DEVICE – A REHABILITATION SOLUTION FOR CONGENITAL HEMIPLEGIC CHILDREN

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Abstract. With the development of additive manufacturing systems and rapid prototype technologies, the customization of the rehabilitation solutions for better health of patients' especially spastic cases of cerebral palsy (CP) is strongly upgraded. Rapid prototyping technologies consists of high resolution 3D scanners, CAD software and 3D printers. Customization of orthotic devices for hemiplegic patients and stroke survivors becomes very flexible and effective through rapid prototyping. Through additive manufacturing, solutions can be customized for the upper limb and lower limb rehabilitation. Upper limb deformity cases are very serious in congenital hemiplegic children. Recovery of functional movements of hand in congenital hemiplegic children is directly linked to rehabilitation duration and intensity of therapies and effectiveness of orthotic devices. The main aim of this work is to design and fabricate dynamic rehabilitation solutions with a high degree of customization depending upon variable patient requirements and recommendations made by the physicians.

Keywords: Additive manufacturing technology, orthotic devices, congenital hemiparesis, rehabilitation, upper limb, lower limb.

DESIGN OF COMPACT IMPLANTABLE MEANDERED AND SHARP EDGED MEANDERED SHAPED ANTENNA FOR BIOMEDICAL APPLICATION.

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Abstract. The introduction of Implantable device in early 1960's, the IMD have become more interesting for Human care services. Currently the devices designed and proposed to monitor the biological data and signals from inside the human tissue have greater promises. The major contribution to illness is prevention, diagnosis and therapy. The Implantable device in few days, a miniaturized antenna is proposed to work in ISM band. The resonant frequency of antenna design is about 2.4 – 2.5 GHz. A combination of Meandered and Sharp Edged Meandered shape on a patch design is proposed for biotelemetry applications. The structure of the antenna is designed to meets the satisfied requirements. The simulation is done with CST MW studio is used to calculate reflection coefficient about –25.941 dB and -31.941 dB between 2.0 GHz to 3.0 GHz. The results obtained with various parameters, the proposed Patch Antenna has gain which the Meandered is 1.927 dB and the Sharp Edged Meandered Patch is 2.02 dB. The design of a Proposed Antenna is a need because the antennas are operated inside the human body. The proposed design obtains the good results towards the requirements.

Keywords: Biotelemetry, Triple Meandered Shaped, Sharp Edged Meandered, Implantable Antenna, ISM Band.

AN AUTOMATED RECOVERY DEVICE FOR PEOPLE AFFECTED WITH HAMSTRING MUSCLE INJURY

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Abstract. Hamstring Muscle injury generally occurs to the sports persons such as athletes, Soccer players, Cricket players, etc. When the Hamstring muscles are less flexible for an individual and stretched beyond the limit during several physical activities, the injury occurs. The first aid treatment given immediately after the injury is RICE protocol. Hamstring muscle injuries are pulled injuries that can be treated by non-surgical treatment. This injury is of three Grades in which severe grade of injury is treated by surgical method. The physiotherapy treatment is performed to recover the flexibility of the muscle. This treatment has been done manually by elevating the injured lower limb at various angle and interval of time. It is difficult for the physiotherapist to elevate and hold on the lower limb for longer duration. To overcome this problem, we have developed an automated device for hamstring muscle injury recovery treatment.

Keywords: Hamstring Muscle, RICE protocol, Physiotherapy Treatment.

AN AUTOMATIC CARDIO PULMONARY RESUSCITATOR- A DEVICE FOR PEOPLE AFFECTED WITH CARDIAC ARREST

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Abstract. Cardiac Arrest is a sudden loss of electrical conduction to the heart that ceases the pumping action of the heart. This in turn may be due to some Coronary Artery disease. When a person with cardiac arrest has not been treated or given first aid within few minutes, then it may lead to brain death followed by fatality. The common first aid given to people who have cardiac arrest is the Cardio Pulmonary Resuscitation (CPR). The CPR is a technique where the rescuer will take the chance to do the CPR to the victim. CPR techniques involve constant chest compressions followed by respiratory support periodically. In certain cases CPR is required for almost an hour or more. During such cases the rescuer cannot perform CPR for more than an hour. To overcome this problem our team ended up with the design of an automated device for chest compressions and respiratory support and finally ensures the exact operation of CPR.

Keywords: CPR, cardiac arrest, chest compression, coronary artery disease

BEHAVIOURAL MONITORING OF SINGLE RESIDENTS IN SMART ENVIRONMENT USING DEEP LEARNING

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Abstract. Population of aged people has been in raise considerably in recent years, due to their increase in age span. Activities of Daily Living (ADL) are the set of routine tasks for self-care carried out by an individual every day without any ones' assistance. The advancements in technologies paved way for smart homes, where the independent living of the elderly can be easily monitored for their behaviours. Monitoring their behaviours will help in providing timely services to the elderly people, who are living independently. In this paper, we have proposed a system that classifies the behaviours of the single resident, living in a smart home environment enabled with multiple sensors. We have implemented a sequence to activity mapping, a deep learning architecture to perform the behavioural monitoring using a benchmark, Single resident apartment dataset. Activities detected by our proposed Seq2Seq model includes eating, personal hygiene, cooking, relaxing and other behaviours of total 29. Our proposed work is able to achieve an accuracy of about 57.75%. Proposed work will be a useful addition to learn the various behaviours of the elderly people for providing essential and timely healthcare, by detecting the changes in their behaviours.

Keywords: Behavioural Monitoring · Activities of Daily Living (ADL) · Smart Home · Deep Learning · Ambient Assisted Living.

DROWSY TRACKING SYSTEM

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Abstract. Image Recognition and Image Processing is nothing but the ability of a software to identify people's facial expressions, handwritings, objects, places and action in a picture. Using this Image Recognition and Image Processing, We are going to detect the driver's Drowsiness and prevent them from getting into accidents. Smart band is nothing but a wearable gadget that monitors the human's health status and sends the recorded information to the smartphone. In this paper, we are going to present a design on how to implement this image recognition and image processing in smartphone in detecting a driver's drowsy state. We are going to connect the smartphone with the smart band and command the smart band to give a vibration to give the driver a signal that he is in a drowsy state. Here the smartphone with image recognition acts as a monitoring device, which gives warning to the driver through smart band.

Keywords: Image Recognition, Smartphone, Smart band, Drowsy state, Vibration

DESIGN OF A DEVICE TO MONITOR SILENT ASPIRATIONS FOR PATIENTS SUFFERING FROM NEURAL DISORDERS AND SWALLOWING TROUBLES BY MONITORING THE PHYSIOLOGY OF THEIR SWALLOWING

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Abstract. Swallowing is the act of engulfing food or drink to pass down the throat into the digestive tract. It utilises a skeletal muscle (tongue) and several smooth muscles of the pharynx and oesophagus. The initiation of swallowing is voluntary but once the deglutition process starts, it becomes involuntary. Swallowing happens in four phases .An issue in any of the phases of swallowing leads to many swallowing disorders, dysphagia being one among them. Degenerative conditions like Parkinson's also tend to affect the various phases of swallowing in the long run. The base of our study focuses on the pharyngeal phase. The most important aspect of the pharyngeal phase is the superior and anterior movement of the hyoid bone and larynx, to keep the air ducts out of the pathway of the bolus. Conditions leading to the impairment of the muscles and nerves related to the pharyngeal phase lead to aspirations and swallowing troubles. A non-invasive method used by speech pathologists is Electroglottography. By using Electroglottograph, the vibrations produced by the movement of the vocal cords during phonation can be measured. The most recent and precise method is the digital accelerometry of swallowing imaging (DASI™, Elixir research). Our study aims at the development of a simpler and cost effective means for real time assessment of deglutition problems.

Keywords: Swallowing, dysphagia, aspirations, accelerometry, deglutition

WAGON BEACON SYSTEM

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Abstract. This paper presents implementation of low cost tracking system with the help of GPS antenna and ESP8266 with IOT BLYNK mobile application. The GPS antenna get the respective coordinates of that particular vehicles. The coordinates send to arduino or ESP8266 uploads the coordinates to IOT. We can see the location through BLYNK or and thinkspeakIot application, And with the help of thinkspeak we can narrow down the location sharing as private and also expand the sharing of location for public. Now we can know our particular vehicle location we specially do this for public transportation to know our buses

Keywords: Esp8266,arduinouno,gps antenna.

FETAL KICK MONITORING SYSTEM USING FLEXI FORCE-BASED SENSOR FOR ANALYSING FETAL MOVEMENTS IN THE LAST TRIMESTER OF PREGNANCY

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Abstract. Monitoring the foetal activity is extremely important in the pregnant mother especially in the last trimester. Foetal kicks are sensations perceived by the mother, when the foetus exerts force on her abdominal wall. Foetal kicks serve as the most important simple non-invasive parameter which indirectly assess the foetal well-being. In this paper, we have developed a portable foetal monitoring belt which can continuously monitor foetal movements. The belt consists of 5 FSR sensors, which is attached directly to the abdomen of the patient. The sensor device is interfaced with arduino and the foetal kicks are monitored. The results show 90% sensitivity with accurate sensor placement.

Keywords: Parturient, Foetal Kick, Force Sensitive Resistor

5th International Conference on Biosignals, Images and Instrumentation

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Poster Presentation

Abstracts

NON-INVASIVE ELECTROGRASTROGRAPHY ACQUISITION SYSTEM FOR GASTRIC ODDITIES DETECTION

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Abstract:

Gastrointestinal (GI) diseases are becoming more common in the past two decades. Electrogastrography (EGG) is a non-invasive method for recording gastric myoelectric activity (Signal from stomach) that controls the gastric motility. EGG signal for normal activity is defined within a low frequency range of 0.0083-0.10Hz. Analysing these signals is much essential in diagnosing various conditions like nausea, vomiting, ulcer, gastric dyspepsia etc. The prime objective of the project is to design a low-cost non-invasive EGG acquisition setup (belt) that actively picks up the gastric signals, process it and categorize it under different gastric conditions like bradygastria, tachygastria, normal gastric rhythm, and gastric arrhythmia. The results are wirelessly transmitted to the user mobile. Further, acquiring low-frequency gastric signal from high frequency artefacts like ECG, respiratory motion etc. requires unique signal pre-processing and signal conditioning techniques that has been utilized in the setup.

Keywords: Gastro-intestinal, myoelectric, electrogastrography, non-invasive, endoscopy, wire-less.

SMART CANE WITH INTEGRATED SENSORS FOR VISUALLY IMPAIRED WITH VOICE PLAYBACK

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Abstract:

Visually impaired people face difficulties in their normal daily life activities. The major problem encountered by the visually impaired people is mobility. People with impaired vision feel insecure while walking even in familiar places and need assistance for their mobility. The proposed paper is focussed in developing a smart cane which is a form of assistive technology for visually impaired people to alleviate their struggle in mobility and to gain a personal independence. In the traditional cane, the visually impaired people do not know the type of the obstacle they come across. The smart cane is more advanced than the traditional walking stick as the use of different sensors makes object detection easier. In the proposed smart cane, the type of the obstacle is differentiated with the help of sensors like Inductive Proximity sensor, Capacitive Proximity sensor, Passive Infrared sensor and Water sensor. The Inductive proximity sensor detects the ferrous materials by electromagnetic induction. The Capacitive proximity sensor helps in detecting the non-metallic objects like paper, wood and plastic. The human presence is detected by the Passive Infrared sensor. The water sensor is used in detecting the presence of water. The sensors detect the signal reflected from the different obstacles and the detected signal is processed by the Arduino Board. A threshold level is set for different type of obstacles like paper, water, wood, metal, plastic and human. Based on the voltage level detected by the sensor, a voice message about the type of the obstacle which is determined by the preset threshold level is delivered to the subject via earphones.

Keywords: Capacitive Proximity, Inductive Proximity, Smart Cane, Visually impaired.

DESIGN AND DEVELOPMENT OF COMMAND PROMPT ASSIST DEVICE FOR LOCKED-IN SYNDROME PATIENTS

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Abstract:

Locked-in syndrome eventually arises mainly when a person is quadriplegic and has no way to produce any muscular movements. The affected person cannot communicate but is aware of their surroundings; the patient is able to hear and see and has normal intelligence and reasoning ability but may only communicate with eye movements. So we deployed a communication device that suitably produces audio command crucially based on the blink movements. We recorded blink signal from eye movements by placing appropriate surface electrodes at the standardized locations. An efficient algorithm for detecting the occurrence of eye blinks was developed. In this protocol we used a software called NI LabVIEW, which is a graphical stimulation software. Many of these patients find great difficulty in expressing what they feel and what they want. In order for them to overcome these difficulties we have built a virtual talk module using LabVIEW. We have used a set of LEDs which will be toggling, the patient will be able to select the preferred LED through an eye blink. On doing so, a voice file which is attached to that corresponding LED gets played (these voice files are some essential or basic needs of a person). Each LED will have a particular wording corresponding to it. This aids the patient in selecting the correct LED. The communication system has voice module and thus provides more comfortable and less frustrating method of access to the subject as they can convey their thoughts faster. Also few pulses were required from the subject for usage of the system. This system is highly suitable for those who are bed ridden and require communication of their needs to others for helping them do their day to day basic needs.

Keywords: Locked-in syndrome, LabVIEW, Eye-blink signal, Communication-device

NON-INVASIVE DEVICE TO MEASURE JUGULAR VENOUS PRESSURE

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Abstract:

It is a non-invasive device that is being developed to measure the jugular venous pressure of a patient. Our device comes in handy for the patient to measure his/her own JVP. It consists of ECG electrodes to sense ECG signals, microphone to pickup signals, and amplifier to amplify and separate the JVP signal. It is easy to maintain the data of a particular person because digital output is obtained. It is enough that the patient has the only job of keeping our device in the left or right side of the neck to measure it. Further the device is very scalable to integrate into any healthcare system present in the world, making the diagnosis process very easy. The main concept of our project is to eliminate the traditional manual method and to avoid the requirement of a trained technician. The future in healthcare systems is personalized and real time devices which can be self-monitored by the patient himself.

Keywords: Jugular Venous Pressure, Carotid Artery, Cardiac activities, Blood Pressure, Accelerometer

BIOCOMPATIBILITY OF ASTAXANTHIN

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Abstract:

Development of eco-friendly process for the synthesis of nanoparticles is one of the main steps in the area of bio nanotechnology research. Nanotechnology is now creating a growing sense of excitement in the life sciences, especially biomedical devices and biotechnology. Plants can be used in large-scale production of nanoparticles, and in order to improve their potential in nanoparticle synthesis. The present study has been designed to phytosynthesis the ZnO nanoparticles (NPs) from the leaf extract of medicinal plant *Chamaecostuscuspidatus*and evaluated for its anti-bacterial efficacy. The synthesis of ZnO NPs was confirmed by the colour change. The X-ray diffraction studies (XRD), FESEM confirmed that synthesized ZnO NPs exhibited the hexagonal rod structure. From the EDAX spectra, the elemental compositions were identified. The optical studies were carried out using UV-Vis and Photoluminescence spectra for ZnO NPs respectively. The antibacterial studies were performed against few gram positive and gram negative bacteria's. The results confirmed that phytosynthesizedZnO NPs are capable of rendering high antibacterial efficacy and hence has a greater potential in the preparation of drugs used against bacterial diseases.

Keywords: Phytosynthesis, ZnO NPs, *Chamaecostuscuspidatus*, antibacterial efficacy

AN AUTOMATED PRE TRANSFUSION TEST BASED ON IMAGE PROCESSING

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Abstract:

This paper presents a new methodology for blood phenotyping based on the plate test and on image processing techniques to determine the occurrence of agglutination (between blood sample and reagent) and Rhesus type (C, c, E and e). Analysis of such for various donor- reagent blood samples gives a pattern which proves useful while administering blood transfusion during emergency situations (when not all tests are done properly). The system was tested with donor and receiver blood samples.

Keywords: blood type determination, phenotyping, image processing techniques, MATLAB.

COGNITIVE ATTENTION IN AUTISM USING VIRTUAL REALITY LEARNING TOOL

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Abstract:

Individuals with autism spectrum disorder demonstrate impairments in social functions including difficulties in social interactions, social communication and emotion recognition. They struggle in making eye contact and this hampers their learning due to lack of listening. Virtual reality provides a supportive environment for individuals with autism disorders to learn and practice things safely. In this work, a Virtual reality (VR) platform has been developed which acts as a simulative learning tool to teach and train kids affected with autism spectral disorder. EEG signals of participants during flashcard teaching and VR teaching sessions were acquired and functional connectivity parameters were estimated from the acquired signals. Results prove that the cognitive ability of the autistic children are enhanced due to focused VR based learning. Thus, it can be extended for different learning disorders in assisting children to practice things safely without any social fear and in enhancing their interpersonal skills.

Keywords: autism, electroencephalography, functional connectivity, learning disabilities, virtual reality

AN EXTERNAL AID FOR AMYOTROPHIC LATERAL SCLEROSIS AND OTHER HEAD DROPPING CONDITIONS

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Abstract:

The work describes an elastic external aid with a three-way support system, consisting of frames and Hook and loop system, for Amyotrophic Lateral Sclerosis (ALS) and drooping head syndrome (DHS) patients to arrest the head-movements such as flexion, extension, rotation and abduction with better efficiency and comfortness than the commercially available designs. The support system consists of base panel, head panel, chin cap, anterior and posterior support frames. The base panel, head panel and chin cap is fabricated using polypropylene; whereas the anterior and posterior support frames are fabricated using aluminum alloy respectively. The frames are completely height adjustable to suit definite age groups. The aid weighs less than 800 grams and thus promoting its reliability and portability. It is currently available in four different sizes, XS, S, M and L. The effect of temperature, force, force deplumation and stress analysis of the supporting bars are studied to understand the load distribution on the support systems. The supporting systems are assembled using straps, made up of nylon Velcro material, facilitating easier portability and effective immobilization of head. The support system overcomes the problems of suffocation, overheating, difficulty in swallowing, and neck soreness/pain and skin irritation, for that the cushion support is provided. The aid is currently in validation in Chennai special schools like The Spastic society of Tamilnadu (SPASTN), Tharamani and in Don Gaunella special school, Poonamallee.

Keywords: Amyotrophic Lateral Sclerosis, Cerebral palsy, External aid, Immobilization, load distribution, Stress analysis

DEVELOPMENT OF HAND EXOSKELETON USING LINEAR ACTUATOR CONTROLLED VIA EMG

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Abstract:

Orthotic devices are externally applied devices used to assist movement generally. They provide control and guidance to the extremity by modifying the structural and functional characteristics of the neuromuscular and skeletal systems. In the state of the art, different control strategies and approaches can be easily found; but it is still a challenge to develop an assistive strategy which makes the exoskeleton supply efficient and natural assistance. So, this project aims to provide a design for a hand exoskeleton and control using linear actuator which is in turn controlled via EMG. The main goal of this work is to design a hand exoskeleton for a person affected by stroke or other motor diseases. The muscle activity of the human hand is measured using electromyography and nearly 10 features are extracted from the raw signals obtained. Once the features have been extracted from the raw signal, it is necessary to distinguish different categories among the features by applying a classifier. These obtained categories are used to control the hand exoskeleton.

Keywords: Hand Exoskeleton, Electromyography, Feature Extraction, Classification, Control Signal

DEVELOPMENT OF AN ELECTRONIC NOSE FOR THE DETECTION OF TUBERCULOSIS

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Abstract:

Due to an increase in awareness that the early detection of diseases greatly increases the chances for successful treatment, there is an urge in demand for inexpensive, non-invasive, simple, and fast early qualitative diagnosis of diseases. There have been various advancements in the diagnosis of tuberculosis. But the current diagnostic techniques are complex, time consuming and highly expensive. Our project aims to detect tuberculosis in the onset stage and to determine the severity of the disease in those people who have been infected by the disease by non-invasive means. We endeavor to create a diagnostic electronic nose for the detection of tuberculosis bacteria from the exhaled breath of a person, which may lay the ground for detection of many diseases like lung cancer, COPD and asthma. The principle of our invention is similar to that of an alcohol breath analyzer with the biomarker and analyte varying for the compound. It consists of a mechanism for chemical detection using an array of gas sensors which overlaps selectively along with a pattern recognition component.

Keywords: electronic nose, biomarkers, tuberculosis, fabrication, inter-digitated electrodes.

ORTHOPEDIC BELT USING SODIUM ACETATE CRYSTALS

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Abstract:

Orthopedic heating belt is one of the most convenient and easier way to cure joint pain, muscular pain etc. Here the gel material is made up of sodium acetate crystals. The major purpose of this belt is to provide heat therapy or thermo-therapy which is the use of heat to relieve pain in joints and other areas. This heat therapy will be successful only if efficient heat is produced by the exothermic chemical reaction of gel material. The Gel material is a solution of water (solvent) and sodium acetate crystal (solute), which when prepared with optimal solute to solvent ratio (STS) yields the efficient heat which is required for clinical application. To calculate the efficient solute to solvent ratio, we have devised two novel computational methods and named them as Value assessment principle and Scale narrow down approach. After a series of experimental trails, we have reached the required STS to be 5.46. Medium with an STS ratio of 5.46 is used in gel preparation. The belt's outer backing is made out of cotton material, pocket with a window is stitched to the backing material for insertion of the gel filled plastic packs and elastic straps with hook and loop fastener are provided at the end of elastic strap and posterior side of the belt, which respectively helps to bind each other and provides a stable connection between them. Thus, this helps in the attachment of belt to the users with enough grip.

Keywords: Orthopedic belt **,** Sodium Acetate Trihydrate, Exothermic Heat, Heat therapy, VA Principle, Scale Narrow Down Approach.

DETECTION OF DRUSEN MACULAR DEGENERATION AND DIABETIC MACULAR EDEMA IN OPTICAL COHERENCE TOMOGRAPHY IMAGES USING CONVENTIONAL AND DEEP LEARNING METHODS

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Abstract:

In this paper, we propose a method for the diagnosis of Drusen Macular Degeneration and Diabetic Macular Edema in Optical Coherence Tomography Images using Conventional and Deep learning methods. These degenerative abnormalities in the eye result in moderate to severe vision loss. Early detection of this disease reduces the risk of further complications and can expedite the treatment process. The proposed network, JasNet is a convolutional neural network (CNN) which diagnoses and classifies the images as Normal (No signs of abnormality), DMD (Signs of Drusen Macular Degeneration present) and DME (Signs of Diabetic Macular Edema present). Using Conventional techniques, the retinal database is preprocessed, and the texture features are extracted and ranked. These features are fed to the classifier for classification. This conventional technique can be used when the dataset is small for the diagnosis and classification.

Keywords: Deep Learning, Conventional Image Processing, Optical Coherence Tomography, Image Processing, Image Classification

GLAUCOMA DETECTION USING ULTRASOUND BIO-MICROSCOPY IMAGES (UBM)

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Abstract

Glaucoma is an eye disease that leads to blindness by damaging the optic nerve. Symptoms occur only when the disease is quite advanced, therefore detecting in time is critical. The eye continuously produces fluid called aqueous, that must be drained to maintain a healthy eye in glaucoma eye's drainage channel get blocked resulting in fluid accumulation. This results in increase in intraocular pressure (IOP), thus damaging the optic nerve. There are different types of glaucoma which includes primary open angle glaucoma, angle closure glaucoma, normal tension glaucoma and secondary glaucoma. The IOP measurement using noncontact tonometry is neither specific nor sensitive enough to be effective screening tool because glaucoma can be present with or without increased IOP. Assessment of the damaged optic nerve head or anterior segment structures is both more promising and superior to IOP measurements. Hence Ultrasound Bio-microscopy Images are considered which provides exceptionally two-dimensional images of the anterior segment structure of eye. An automatic assessment of Images would provide an accurate and efficient solution to the high demand of screening for eye diseases such as glaucoma. The parameters that can be measured from UBM images for glaucoma detection are Iris Area, Iris Thickness, Angle Opening Distance (AOD), Tubercular Iris Space Area (TISA), Tubercular Iris Angle (TIA), Anterior Chamber Area by image processing techniques which includes pre-processing, binarization, segmentation and detection of Open angle and Closed angle glaucoma.

Keywords: Glaucoma, Drainage channel, Iris Area, Iris Thickness, Angle Opening Distance (AOD), Tubercular Iris Space Area (TISA), Tubercular Iris Angle (TIA), Anterior Chamber Area, Segmentation, Ultrasound images.

A REVIEW ARTICLE ON DETECTION OF PARKINSON'S DISEASE USING PAPER-BASED SENSORS

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Abstract:

A biomarker is a biomolecule by which the pathogenesis of a particular disease can be identified. Cerebrospinal fluid and saliva are the most commonly used biomarkers for the detection of Parkinson's disease. According to recent discoveries, tear fluid also contains a proportion of the biomarker which pinpoints to the presence Parkinson's disease. A compound called Alpha-synuclein is found to be in excess in the above-mentioned body fluids in patients affected by Parkinson's when compared to normal person, thus making the above compound the required biomarker for the detection. For the detection of Alpha-synuclein, the plan of action to do so is by initiating a antigen antibody reaction. The required antibody to be synthesized is the mouse monoclonal antibody labelled with HRP (HorseRadish Peroxidase). The tear fluid of a patient afflicted with Parkinson's disease is obtained, and the above-mentioned antigen-antibody reaction can propagate. The antigen antibody reaction is to be carried out on a paper-based biosensor labelled with a suitable bioluminescent compound. Upon successful propagation of the reaction, activation of the bioluminescent material impregnated on the paper based sensor enables the detection of the early detection of the disease.

Keywords: Biomarker, Alpha-synuclien

WEARABLE READER FOR VISUALLY IMPAIRED PEOPLE

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Abstract:

Visually impaired people report numerous difficulties with accessing to printed text using existing technology, including problems with alignment, focus, accuracy, mobility and efficiency. The current day scenario of reading for blind people is with the help of braille. Braille is a code- a system of dots that represent letters of an alphabet. All books are not written in Braille; thus, a visually impaired person is limited to countable no of books. Hence here we want to propose a finger worn device that enables a more manageable eyes-free operation (like reading). The Wearable Reader hardware features are high resolution miniature camera, raspberry pi (microcontroller) and feedback via vibration motors. The vibration motors are embedded in the device to provide feedback on which direction the user should place and move the camera. Using high resolution miniature camera non-perfect images (type of text) are acquired. After Processing of the acquired image, it is converted into text using raspberry pi microcontroller. And the output as a text is given to voice synthesizer. Recording and storing the audio output for future purposes can be done. The device can gain access to various no. of learning resources and it is widely used by blind people for their higher studies and used by visually impaired people also.

Keywords: Miniaturized camera, Image processing, Raspberry pi, Bluetooth, Speaker

A GLIMPSE OF ICBSII 2018

Proceedings of the 5th International Conference on Bio Signals, Images and Instrumentation (ICBSII2019)

Biomedical Engineering is a field of study that integrates two dynamic professions, Medicine and Engineering. It has recently established itself as an independent field with the objective of assisting medicine towards the betterment of society, throughresearch.

Being an interdisciplinary science, it has associations with various other subjects such as Electrical Engineering, Mechanical Engineering, Chemical Engineering and Biotechnology. The spectrum of Bio-medical research aims to unite these disciplines in synergy, leading to new possibilities thus enabling the development of technology that could savelives.

The 5th International Conference on Bio Signals, Images and Instrumentation (ICBSII-2019) was conceived with the thought of bringing together scientists, engineers and researchers from various domains all over the world.it has been a platform where some of the greatest minds of the country and abroad could interact, exchange ideas and work together towards a common goal.

Research papers were received from diverse areas such as Physiological Modeling, Medical Imaging, Medical Robotics, Biomechanics, Biomedical Instrumentation and Nano-materials amounting to a total of 54 papers. After a rigorous review process by an expert review committee, 38 papers that displayed quality in idea and work were selected for final presentation at the conference.

This conference is the fruit of a vision of the Management, faculty and students of the Department of Biomedical Engineering, SSN College of Engineering in association with the Centre for Healthcare Technologies (CHT), a multi-disciplinary R&D center, which works unanimously towards materializing it and were instrumental in its success.

The Department of Biomedical Engineering, since its inception in 2005, has been a pioneer in the field of biomedical technology, instrumentation, and administration. The department has excellent infrastructure, experienced faculty members and motivated students. Department also has several foreign collaborations which includes Birmingham University, UK, Drexel University, Philadelphia, USA, Neolight LLC, USA, Wildbox Technologies Pvt Ltd., Singapore and several industries such as L&T Medical System, Texas Instruments, National Instruments, Chettinad Hospitals and Sri Ramachandra Medical College. To add feather to the crown, the department has conducted three International conferences (ICBSII) in 2013, 2015, 2017 and two national conferences (NCABES) in 2014, 2016.