PROCEEDINGS OF EIGHTH INTERNATIONAL VIRTUAL CONFERENCE ON BIOSIGNALS, IMAGES, AND INSTRUMENTATION (ICBSII)2022

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ICBSII 2022

DEPARTMENT OF BIOMEDICAL ENGINEERING

SSN COLLEGE OF ENGINEERING
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Proceedings of the

8th International Virtual Conference on Biosignals, Images and Instrumentation

(ICBSII 2022)

Department of Biomedical Engineering

Sri Sivasubramaniya Nadar College of Engineering

In association with

Centre for Healthcare Technologies

March 16 -18, 2022

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

From the Chief Patron

Dr. Kala Vijayakumar

President, SSN Institutions

SSN Institutions (SSN) nurture the all-around 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 Eighth International Conference on Biosignals, Images and Instrumentation (ICBSII 2022), in association with the Centre for Healthcare Technologies of SSN. This flagship conference of the Department of BME 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 worldwide. I am certain that the talks by eminent scientists, researchers, clinicians and surgeons, and the papers presented will stimulate lively discussions to lay a strong foundation for further advanced research in these fields. I appreciate the untiring, excellent teamwork carried out by the faculty of the Biomedical Engineering department towards organizing this conference.

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

Dr. Kala Vijayakumar,
Chief Patron,
ICBSII – 2022

From the Patron

Dr. V. E. Annamalai

Principal, SSN College of Engineering

I am pleased that the department of Biomedical Engineering is organizing the Eighth International Conference on Biosignals, Images and Instrumentation (ICBSII 2022), in association with the Centre for Healthcare Technologies of SSNCE, in a manner befitting the biomedical engineer's community.

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 involvement in a wide range of activities with students and faculty has strengthened it, allowing students to get a thorough understanding of industrial requirements to the fullest extent possible.

This International Conference 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 Engineering Department for structuring it to perfection and wish them all success.

Dr. V. E. Annamalai
Patron,
ICBSII – 2022

From the Conference Chair

Dr. A. Kavitha

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

Education is a holistic endeavour that involves gaining new roads with endless boundaries and priming brains to orient oneself to the outside world. That being said, it gives me immense pleasure to present the Eighth International Conference on Bio-signals, Images and Instrumentation.

Biomedical engineering is a discipline that catalyses interactions between biologists, physical scientists, and engineers in order to improve medicine and human health. This benefits society by undertaking research that creates quantitative correlations across scales in the human body and then applies that knowledge to the development of new instruments to improve human health. The impact and significance of findings have risen to greater heights. Workshops, seminars, project exhibitions, and guest lectures on various ideas relevant to the core and multidisciplinary disciplines in biomedical engineering are often offered by the department to help students obtain a thorough understanding of industry requirements.

The 8th International Conference on Biosignals, Images, and Instrumentation is being organised by the Centre for Healthcare Technologies, a multidisciplinary research initiative focusing on research through innovation in healthcare, in collaboration with the Department of Biomedical Engineering, with the goal of instilling research aptitude in students and providing a great platform for researchers to showcase their work in various domains of healthcare.

It is rightly said, “Many ideas grow better when transplanted into another mind than the one where they sprang up." – Oliver Wendell Holmes.

ICBSII has been successful for the past seven years. With confidence, we aim higher and higher, raising our bars towards the next success!!!

Dr. A. Kavitha
Conference Chair,
ICBSII – 2022

From the Organizing Chair

Dr. B. Geethanjali

Associate Professor,
Department of Biomedical Engineering,
SSN College of Engineering

The role of healthcare in shaping the future of our lives is inevitable, and no one can deny its importance. Healthcare innovation has done various improvements in our lives from lowering the death ratio of diseases to replicating an organ of the body; technology has changed the face of health industry. With changes constantly coming into play it is important to ensure that they are upheld.

The changes, improvements, and developments that are on the way for technology within healthcare are exciting. This conference provides an opportunity to collaborate with experts and scholars from various branches of biomedical engineering.

Our invited sessions in the Eighth International Conference on Bio signals, Images, and Instrumentation (ICBSII 2022) are therefore here to feature multidisciplinary group of researchers, academicians, and industry practitioners across the globe to showcase their novel ideas in the field of biomedical engineering.

We have seen tremendous response this time, with 139 papers received from almost all continents and speakers from the USA, Europe, Middle East, and Singapore will share their expertise with us. And only 56 papers with a similarity index of less than 12% along with good technical content, quality, and presentation style were accepted and will be forwarded to Journal of Physics:Conference Series (Scopus Indexed) published by IOP Publishers.

I extend my sincere gratitude to the management of SSN College of Engineering, our madam president Dr. Kala Vijayakumar SSN Institutions, and Dr. V. E. Annamalai sir - Principal, SSN College of Engineering for granting the department a delightful opportunity to organize this brilliant event that enables us to grow on a global level. I would like to thank our department Head and organizing chair Dr. A. Kavitha, and my fellow organizers of the conference, and all my colleagues in the ICBSII-2022 co coordinating committee for their support, constructive feedback, timely, tireless, and meticulous efforts in conducting this online event. Finally, I would also like to take this opportunity to thank all external reviewers and contributing authors for producing high-quality papers to be presented at the conference.

Dr. B. Geethanjali
Organizing Chair,
ICBSII – 2022

From the Organizing Chair

Dr. S. Saranya

Assistant Professor,
Department of Biomedical Engineering,
SSN College of Engineering

Biomedical Engineering is an innovative field, focusing on the advances that improve human health and health care at all levels. This is evident throughout healthcare, from diagnosis and analysis to treatment and recovery, and has entered the public conscience through the proliferation of futuristic technologies. With healthcare needs constantly evolving, an international forum to foster an environment conducive to exchanging ideas and information is critical. At this juncture, we are extremely delighted to present our international conference which is eighth in its series themed on latest innovations in the field of Biosignals, Images and Instrumentation to be held on March 16-18, 2022 at SSN College of Engineering. The scientific tracks cover the standard topics consistent with the conference theme. This event is launched with the aim to attract global participants to share, exchange and explore new avenues of Biomedical Engineering.

The conference program consists of workshops, plenary lectures, keynote lectures, Invited lectures by both national and international stalwarts in healthcare research. Parallel technical sessions for students, researchers, academic professionals, and industrialists are scheduled to provide a wonderful opportunity to enhance their knowledge about newest interdisciplinary approaches in Biomedical Engineering. Moreover, the conference also offers a valuable platform to create new contacts in the field of Biomedical Engineering, by providing valuable networking time to interact with great personnel in the field.

We have received an overwhelming interest from the research community in India and abroad to participate in our conference. With more than 130 research articles received the acceptance rate is only close to 50% to uphold the quality of the presented papers. This was possible due to the rigorous review process extended by national and international reviewers with unmatched expertise in relevant fields. We are thankful to our publishing partner IOP Science who have given their consent to publish the selected papers in their Journal of Physics: Conference Series (Scopus indexed) adding one more feather to our cap.

I would like to extend my gratitude to Dr. Kala Vijayakumar-President, SSN Institutions and Dr. V. E. Annamalai- Principal, SSN College of Engineering for the encouragement and support offered to our department to organise this delightful event. I would like to thank our Head and organizing chair Dr. A. Kavitha for her belief in me and providing an opportunity to serve as a member of the organizing committee. My heartfelt thanks to my colleagues who are fellow organizers and committee members, supporting staffs and student volunteers of Biomedical Engineering department whose shared responsibilities and teamwork has paved for a smooth organization of this prestigious event.

Dr. S.Saranya
Organizing Chair,
ICBSII – 2022

From the Organizing Chair

Dr. R. Subashini

Assistant Professor,
Department of Biomedical Engineering,
SSN College of Engineering

On behalf of the Biomedical Engineering Department, it is with great pleasure that I welcome you to the 8th International Conference on Bio signals, Images and Instrumentation (ICBSII 2022) on 16th, 17th and 18th March at SSN College of Engineering, Kalavakkam. The purpose of this Conference is to bring researchers and industry practitioners together to present and discuss novel approaches and solutions. The outcomes in the field of Biological, Medical, Health Care, Pharmaceutical, Biotechnology, Bioinformatics, Computer Science, Information Technology and Communication to create synergy, support interdisciplinary research, and to exchange ideas and explore new avenues of collaborations.

I extend my sincere gratitude to the Management of Sri Sivasubramaniya Nadar College of Engineering, Ms. Kala Vijayakumar, President, SSN Institutions and Dr.V.E. Annamalai, Principal, Sri Sivasubramaniya Nadar 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 registration team, reviewers and the contributing authors. I also thank the faculty, staff and the students of the biomedical engineering department for the moral support and joining hands to make this event a grand success.

I sincerely hope that you will enjoy the technical conference about to unfold in the next three days and that will leave you with fond memories of ICBSII 2022.

Dr. R. Subashini
Coordinator,
ICBSII – 2022

From the Organizing Chair

Dr. Pauline John

Assistant Professor,
Department of Biomedical Engineering,
SSN College of Engineering

As we all are very much aware of the bountiful growth in the human healthcare system especially because of the importance of health realized during this pandemic, biomedical personnel - engineers, scientists as well as medical practitioners globally stand in the forefront to fight the battle and bring about success by exploring the latest Biomedical Technologies. The Eighth International Conference on Biosignals, Images and Instrumentation (ICBSII 2022), paves the way towards an excellent networking opportunity to acquire the state-of-the-art knowledge resulting from the outstanding inventions and innovations of experts in the fields of Biosignals, Images and Instrumentation. This conference also provides an opportunity to the researchers to collaborate with highly respectable internationally renowned speakers, gain insights in their respective fields, as well as put forth interdisciplinary ventures aiding in the welfare of humankind.

It is certainly an overwhelming joy for me to be a part of the organizing team of the Department of Biomedical Engineering and the Centre for Healthcare Technologies, Sri Sivasubramaniya Nadar College of Engineering, SSNCE, in organizing the Eighth International Conference on Biosignals, Images and Instrumentation (ICBSII 2022), 16th - 18th March 2022.

I extend my sincere gratitude to the Management of SSNCE, Dr. Kala Vijayakumar, President SSN Institutions, Dr. V. E. Annamalai, Principal and Dr. S. Radha, Vice Principal, SSN College of Engineering for granting the Department of Biomedical Engineering an opportunity to organize this fruitful event, benefitting the scientists, academicians, young researchers and students worldwide in exploring various avenues in the field of Biomedical Engineering and Technology. I would like to extend my sincere thanks to Dr. Shashikant Albal, Director of SSN School of Advanced Software Engineering and Career Education for his timely support related to conducting online conference. I would also like to convey my special thanks to the Head of our Department and Organizing Chair of ICBSII 2022, Dr. A. Kavitha for her immense support and guidance provided in each step of this event. I would like to thank Dr. B. Geethanjali who led the organizing team with her fervent dedication. I would also like to thank Dr. R. Subashini and Dr. S. Saranya, organizing team members for their enormous support provided while working together, in making this event a memorable one. I extend my sincere thanks to all the committee chairs of ICBSII 2022, especially Dr. K. Nirmala and Dr. B. Divya for their constant support. I would also like to thank all the authors in showing tremendous interest towards actively participating in the ICBSII 2022. I extend my sincere thanks to all the faculties, student volunteers for their commendable job and non-teaching staff of the biomedical department in contributing in various ways towards accomplishing this grand event.

Dr. Pauline John
Organizing Chair,
ICBSII – 2022

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Eighth International Virtual Conference on Biosignals, Images and Instrumentation (ICBSII 2022)

KEYNOTE SPEAKERS' PROFILE

Dr. Ajit P. Yoganathan is the Wallace H. Coulter Distinguished Faculty Chair and Associate Chair for Translational Research in the Wallace H. Coulter Department of Biomedical Engineering and a Regents' professor at the Georgia Institute of Technology and Emory University. He is also the founder and the Director of the Center for Innovative Cardiovascular Technologies. He received a Bachelor of Science and a Doctor of Philosophy in Chemical Engineering in 1973 from University College, University of London and in 1978 from the California Institute of Technology, respectively. Since joining the faculty at Georgia Tech in 1979, Dr. Yoganathan has made significant professional contributions at both the national and international levels, and a played a key role in the creation of the master's and Ph.D. degrees in bioengineering and the joint Ph.D. in Biomedical Engineering with the Emory University School of Medicine. Dr. Yoganathan's 40+ year research career has been pioneering and translational in nature by applying basic engineering science to develop meaningful human health outcomes, specifically in the realm of cardiovascular engineering and biology. His research success has led to more than 400 peer reviewed journal articles in leading biomedical journals and more than 40 book chapters. He has also been an invited speaker to over 70 conferences/ seminars around the world and has mentored more than 50 doctoral students, 35 masters' students, and 30 post-doctoral trainees.

Dr. Joshua Ewen is a pediatric neurologist, developmentalist and electroencephalographer. He is director of the Clinical Neurophysiology Clinic and Laboratory at the Kennedy Krieger Institute and an associate professor in both the Department of Neurology at the Johns Hopkins University School of Medicine and the Department of Psychological and Brain Sciences at the Johns Hopkins University Krieger School of Arts and Sciences. Dr. Ewen attended Brown University and Tulane University School of Medicine, from which he graduated in 2000. He received training in general pediatrics at Cincinnati Children's Hospital Medical Center and then was one of the first graduates of the Kennedy Krieger/Johns Hopkins program in neurodevelopmental disabilities. He subsequently took a year of training in specialized training in clinical neurophysiology/epilepsy (Johns Hopkins). He is currently a neurologist and developmental paediatrician at Kennedy Krieger, where he sees patients with autism. He also interprets clinical EEGs at Kennedy Krieger's Clinical Neurophysiology Laboratory and Epilepsy Monitoring Unit, of which he is medical director. A large portion of his effort is focused on research into the cognitive alterations in developmental disabilities. Dr. Ewen's research involves the use of behavioural and EEG-based techniques to study developmental disabilities and basic questions within psychology and neuroscience. His current primary work focuses on the borderlands between cognition and motor control in autism, but he also has ongoing research in ADHD. He has strong collaborations with neuroengineers and signal processing experts. He is further focused on the process for developing and validating biomarkers.

Dr. Srinivasan Ramachandran is a Senior Research Analyst (Dept. Bioengineering), University of California, San Diego. He completed his MBBS at Stanley Medical College, Madras. He persuaded his MTech (Biomedical Engineering) from Indian Institute of Technology, Bombay followed by Ph.D. (Biomedical Engineering) at Indian Institute of Technology, Madras. He is a Post-Doc (Neuroscience) from Univ. California Santa Barbara. He is a biomedical scientist with a rare blend of knowledge and expertise in multiple disciplines, including Medicine, Biomedical Engineering, Cell, Molecular & Systems Biology, and Medical Informatics. have published more than sixty high-profile research publications in the last two decades, with 3000+ citations, h-index of 31, and i10-index of 42 (Google scholar profile). He is also a co-author of four patents

Dr. K. Mohanavelu joined as Scientist in DEBEL, DRDO in 2002, serving 20 years of experience in R&D for Biomedical Product Research. He is currently the Joint Director, Head of Biomedical Technology in DEBEL, DRDO. His post-graduation and PhD was in Biomedical Engineering from IIT – Madras and Anna University respectively. His areas of research include Wearable Electronics & Remote Health Monitoring, High Altitude Life Support Technology, Brain Computer Interface / Augmented Cognition, Human centric Robotics. He is actively involved in the development of Biomedical Products for COVID Management.

Opportunities and Challenges in utilizing the affective computing methods in Cognitive Neuroscience

Dr. M. Murugappan

Abstract:

The field of affective computing involves the interdisciplinary study and application of psychology, artificial intelligence, and neuroscience. A variety of applications, including e-learning, remote health care monitoring, computer-aided diagnosis (CAD) systems, neuromarketing, neuroeconomics, intelligent transportation systems, robotics, and others, have used affective computing methods in recent years. Specifically, it enables researchers to examine brain-behavioral interactions through the application of brain signal processing and imaging techniques. Biosignals are mostly preferred over other modalities due to their robustness, non-invasiveness, low cost, and increased flexibility in acquiring information related to physiological changes when it comes to the design of intelligent assistive or diagnostic systems. Researchers are also utilizing multimodal systems to develop a real-time system to analyze emotional state responses. Researchers have also been interested in developing affective computing systems based on wearable sensors to enhance and improve the quality of services (QoS). A number of interesting applications that utilize affective computing methods in cognitive neuroscience include pain assessment, emotional impairment detection, anxiety, stress, and the assessment of psychological stress. The purpose of this talk will be to discuss some of the interesting applications of affective computing in cognitive neuroscience, as well as the major challenges in designing intelligent systems involving Artificial Intelligence (AI). I will conclude my presentation by presenting some experimental results pertaining to the applications of affective computing in neurological disorders.

Dr. M.Murugappan
Associate Professor - Electronics and Communication Engineering, Kuwait College of Science and Technology, Kuwait

He received his M.E. (Applied Electronics), and Ph.D. (Mechatronic Engineering) from Anna University, India, and Universiti Malaysia Perlis, Malaysia, respectively, in 2006, and 2010. Since February 2016, he has been working as an Associate Professor in the Department of Electronics and Communication Engineering at the Kuwait College of Science and Technology (KCST), Kuwait. He had more than 15 years of research and teaching experience in different countries, such as India, Malaysia, and Kuwait. His publications and research have been recognized with various research awards, medals, and certificates. In the fields of Experimental Psychology, Artificial Intelligence, and Cognitive Neuroscience, he was ranked in the top 2-percent of scientists in the world by Stanford University researchers in 2020 and 2021. More than 125 of his research articles have appeared in peer-reviewed journals, conference proceedings, and book chapters. A maximum score of 4807 citations is recorded by Google Scholar, along with an H index of 36 and an I10 score of 73. His research has been awarded nearly $2.5 Million by the government of Malaysia, and Kuwait Foundation for Advancement of Sciences (KFAS), Kuwait. He has also guided 14 postgraduate students, 9 Ph.D. and 5 M.Sc. Currently, he serves as the Chair of Educational Activities in the IEEE Kuwait Section.

IoT Empowerment in Medication Adherence & Compliance

Dr. Kalaivani Chellappan

Abstract:

Medication adherence and compliance has significant roles in SDG3: Good Health & Well-being. Medication adherence is the act of filling new prescriptions or refilling prescriptions on time whereas medication compliance is the act of taking medication on schedule or taking medication as prescribed. While often used interchangeably, a distinction definition is important when organizations set out to improve patient adherence and/or compliance with a medication regimen. The differentiation allows organizations more effectively analyse their performance in each area, identify targeted changes to implement, and then measure the effectiveness of those changes. On the other hand, the treatment of chronic illnesses commonly includes the long-term use of pharmacotherapy. Although these medications are effective in combating disease, their full benefits are often not realized because approximately 50% of patients do not take their medications as prescribed. Factors contributing to poor medication adherence are myriad and include those that are related to patients. The barriers to medication adherence are complex and varied, solutions to improve adherence must be multifactorial. Internet of Things (IoT) bring about an end-to-end solution to this challenge. Timely or real-time monitoring and information gathering found to be the way forward in increasing medication adherence and compliance among patients and care-takers. IoT empowered medication adherence manager designed and developed by a team of interdisciplinary researchers from Universiti Kebangsaan Malaysia has brought a handy solution that is able to address both medication adherence and compliance challenge in ensuring both patient's post treatment compliance and chronic disease management. The proposed cost-effective medication adherence manager is expected to bring a new holistic and sustainable medication adherence and compliance practice in healthcare industry.

Assoc Prof Ts. Dr. Kalaivani Chellappan
Department of Electrical, Electronics and Systems Engineering, Universiti Kebangsaan, Malaysia

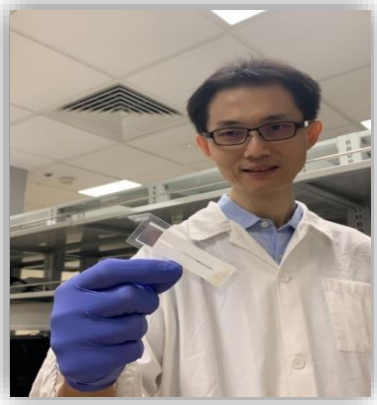
Dr. Kalaivani Chellappan is an Associate Professor in Faculty of Electrical, Electronics and Systems Engineering, Universiti Kebangsaan Malaysia since Nov 2011. She specializes in Healthcare Engineering. Her current research interests are Cardiovascular Engineering Modeling, Internet of Things in Healthcare and Data Modeling & Analytics. A holistic knowledge in management, engineering technology, healthcare and IT provides her the opportunity to be creative in supporting organizations to realize the modern empowerment science. Talent building and management empowerment through sustainable knowledge are the core values imbedded in all her project deliveries.

Surface Enhanced Raman Spectroscopy for Detection of Hemozoin in Malaria Diagnosis

Dr. Clement Yuen

Abstract:

Malaria is a worldwide disease with an estimation of 229 million cases and 409000 related deaths in 2019. Early malaria diagnosis is critical to improve survival rates and to prompt for timely treatment. However, the biomarker, hemozoin biocrystal, exists in extreme low concentrations. Therefore, a sensitive technique is needed for hemozoin biocrystal detection for early malaria diagnosis. In this work, we discuss the strategies from our group by employing the surface enhanced Raman spectroscopy (SERS) for sensitive detection of hemozoin biocrystal and also its chemical equivalent, beta-hematin crystal. Additionally, we also examine the feasibility to perform our SERS-based methodology for malaria field diagnosis, without the laboratory environment and other complicated equipment.



Dr. Clement Yuen
Lecturer (Part-Time), Nanyang Technological University, Singapore

Dr. Clement Yuen received his B.Eng and PhD degree in Electrical and Electronics Engineering from Nanyang Technological University (NTU) in Singapore. He is a part-time lecturer in the School of Chemical and Biomedical Engineering at NTU. His research is focused on surface-enhanced Raman spectroscopy and other imaging techniques for biomedical applications. He was the recipient of the Mistletoe Research fellowship, Lee Kuan Yew (LKY) post-doctoral fellowship, and Agency for Science, Technology and Research (A*STAR) graduate fellowship. He was also the former founder of his own startup company. His research outcomes include 1 US patent and 3 invention disclosure, 1 invited book chapter, 32 international technical journals papers, and 24 conference papers. Moreover, his test kit for malaria received interviews by the Channel News Asia (CNA) and a series of other media including Phys.org, Scienmag, etc. His microneedle-based enhanced Raman work has been featured in Advanced Science News, and the editor's choice in Journal of Biophotonics.

Robotic Exoskeleton for Post-Stroke Neuro-Rehabilitation

Dr. Neha Singh

Abstract:

Robots have the potential to help provide exercise therapy in a repeatable and reproducible manner for stroke survivors. To facilitate rehabilitation of the wrist and fingers joint, an electromechanical exoskeleton was developed that simultaneously moves the wrist and metacarpophalangeal joints. The device was designed for the ease of manufacturing and maintenance, with specific considerations for countries with limited resources. Active participation of the user is ensured by the implementation of electromyographic control and visual feedback of performance. It was made customizable according to the individual clinical presentation. A pilot prospective randomized controlled trial at clinical settings was designed for patients with stroke and patients were assigned to two groups- Robotic group and Control. Clinical-scales and neurophysiological measures of cortical-excitability were acquired pre- and post-therapy. Robotic-exoskeleton training showed improvement in motor outcomes and cortical-excitability in patients with stroke as compared to control group

Dr. Neha Singh
Senior Scientist, Center for Advanced Research and Excellence in Disability & Assistive Technology (CARE-DAT) Indian Institute of Technology Delhi (IITD)

Dr. Neha Singh is a Research Scientist in Centre for Biomedical Engineering at IIT Delhi after completing Ph.D. from IIT Delhi. Her interest lies in interdisciplinary research in neuro-engineering for developing innovative rehabilitation strategies, biomedical devices and its clinical validation, with a special focus on brain stimulation for neurorehabilitation of patients with stroke. She has published few international patents and copyrights. Her research area also includes biomedical signal processing, neurophysiology and neuroimaging.

Dynamics of Cellular Signaling Networks: Lessons from Quantitative Imaging

Dr. Rahuman S. Malik Sheriff

Abstract:

A living cell is a highly dynamic system that uses complex signalling network to sense extracellular signal and intracellular states, processes the information and responds with appropriate cellular function. The cell signalling network includes sensor subsystem (such as receptors), processing subsystems (downstream signalling cascade) that modulate diverse response subsystems (such as gene regulation and cytoskeletal reorganization). Understanding how a complex signalling network orchestrates a well-tuned robust physiological response is increasingly important, as they will provide the basis to study their dysregulation in diseases such as cancer. Recent advancement in quantitative multicolour imaging techniques allows us to monitor the signalling networks in single cells as well as sub-cellular level. Quantitative imaging data can be processed and analysed using computational and statistical approaches to resolve the topology and the dynamics of cell signalling networks and elucidate how these systems work. In this talk, I will show how quantitative imaging enabled us to investigate the evolution of signalling networks during embryonic to somatic transition at single cell level and their regulation at the sub-cellular level in cell-matrix adhesion sites.

Dr. Rahuman S. Malik Sheriff
Project Leader (BioModels), European Bioinformatics Institute, European Molecular Biology Laboratory (EMBL-EBI), Welcome Trust Genome Campus, Hinxton Cambridge CB10 1SD, UK, London, England, United Kingdom

Dr. Rahuman S. Malik Sheriff is an experienced scientist with a demonstrated history of working in the research industry. Skilled in Mathematical modeling, multivariate statistics, Bioinformatics, digital image processing, and Bigdata analytics. Leads a team of members to develop novel approaches, tools, and resources for modeling biomedical system. With a Doctor of Philosophy (Ph.D.) focusing on finding patterns in big and complex biological data set and modeling quantitative causal network from Max Planck Institute of Molecular Physiology & TU.

Dr. Sean J. Smith, is a Professor in the Department of Special Education at the University of Kansas. He is also the Past-President of the technology division for the Council for Exceptional Children, Innovations in Special Education Technology (ISET), and member of the Board for the National Down syndrome Congress. Dr. Smith's research interests focus on innovations and technology solutions to support struggling learners and those with disabilities, particularly interventions aligned with the Universal Design for Learning (UDL) Framework. At present, Dr. Smith is the Principal Investigator on a federally funded project exploring the impact of virtual reality on struggling learners in the area of social emotional development. Sean has authored over 100 books and articles, given hundreds of scholarly presentations both nationally and internationally, and serves on various boards for journals, organizations, and parent groups focused on enhancing the lives of individuals with disabilities. Dr. Smith, with a variety of collaborators, has received and managed over $25 million of external research and development funds. Most importantly, Sean is the father of four children, one having Down syndrome. It is through this work as a father that Sean has sought to apply his knowledge of effective practices with parents, family members, and similar stakeholders as we look to enhance the lives of our children, ALL of our children!

Optical Coherence Tomography for Clinical Applications

Prof. Renu John

Abstract:

This talk gives a brief overview of Spectral-Domain Optical Coherence Tomography (SDOCT) and some of the applications of OCT in clinics. In this talk, we will describe the translation activities and clinical trials that are being carried out at IITH in oral oncology and gastroenterology. OCT is a high-resolution volumetric imaging modality that is capable of imaging at micrometer scales with resolutions close to histopathology. Hence this technique find applications in in situ, ex vivo and in vivo applications in diagnosis of malignancies and surgical demarcation of tumor margins. We will present some of our latest results in the talk.

Prof. Renu John
Professor, Department of Biomedical Engineering
IIT Hyderabad

Dr. Renu John is a Professor in the Department of Biomedical Engineering at IIT Hyderabad. He has obtained a PhD in Physics (Optics) from Indian Institute of Technology Delhi, in 2006. He served as a Research Associate at the Fitzpatrick Center for Photonics, Duke University, Durham, NC, USA, from June 2006 to May 2008 and at Beckman Institute for Advanced Science and Technology, University of Illinois, Urbana-Champaign, USA, from May 2008 to Nov 2010. His journey with the department of Biomedical Engineering at IIT Hyderabad began in 2010 from Assistant Professor to Professor and Head of the department. He is the Co-Founder and Head of Centre for Healthcare Entrepreneurship (CfHE) at IIT Hyderabad which was established in 2016 with an objective to catalyze healthcare innovation with a focus on affordable solutions to address healthcare needs of India. His areas of expertise include biomedical imaging, optical coherence imaging and microscopy, nanoparticles and target-specific imaging.

Rehabilitation Robotics: Made as simple as possible, but not simpler

Dr. B. Sivakumar

Abstract:

The last three decades have seen a deluge of research activity in rehabilitation robotics for upper-limb therapy. However, their infiltration into routine clinical practice remains poor due to their complexity and cost. Do we need complex robots? Can we reduce the cost of these devices? Will that improve their chances of clinical translation? This talk will address some of these important questions to make rehabilitation robotics a clinical reality. I will present our recent work on a minimalistic approach towards, (a) the design of upper-limb rehabilitation robots for hand and arm training, and (b) the interaction between the robot and the user for assisted training of severely affected patients.

Dr. B. Sivakumar
Prof and HOD Bioengineering, Christian Medical College, Vellore

Dr. B. Sivakumar is a Professor and head of the department of Bioengineering at the Christian Medical College, Vellore. He was a postdoctoral research fellow in Human Robotics Group, Imperial College, London, UK, Feb 2010 - Oct 2012. He received his Ph.D. in Bioengineering, from ASU, Tempe, USA. He is the head of the Biological Learning and Rehabilitation (BioRehab) group, which focuses on human motor learning and rehabilitation. His main research interests include development and validation of tools and training methods for delivery of neuro-rehabilitation, and quantitative human analysis.

Breast Pathology and Hallmarks of Computational Evolution

Dr. Priya Lakshmi Narayanan

Abstract:

Breast cancer is the second most common cancer in UK and Europe, and although screening has drastically increased survival, a fraction of patients still develops recurrent disease leading to metastatic stage. These patients have a better survival rate when detected at early stage. For majority of cases, the primary tumour is successfully resected, but disease relapse arises due to recurring and dormant cell and tissue morphological and microenvironmental selective pressure influencing undetectable metastases over a period of time. Early stage lesion such as ductal carcinoma in situ (DCIS) is a non-obligatory precursor of invasive ductal carcinoma (IDC). It is the most common mammographically detected breast cancer, however, predicting DCIS progression to IDC remains a major clinical challenge. A recent study has categorised DCIS evolution to IDC into four models, highlighting its heterogeneity. The evolutionary potential of individual DCIS ductules/ducts may dramatically differ, determined by not only their genetic mutations but also microenvironmental selective pressure. Recently, Narayanan and colleagues analysed the relationship between breast ducts and the immune system using more than two datasets acquired at multiple institution employing high performance computational UNMaSk framework. The results demonstrated that the ecology of breast duct while computed in a high throughput fashion on the gigapixel images led to potential classification of lethality of breast disease in a subgroup of patients. This significant finding necessitates the investigation of breast biopsies during tumour development constrained by the strength of immune activity (immunoediting) and its role in recurrence which is not very well established in literature yet. Combining our approach with early and late progression stages such as metastasis will aid in evaluating the evolutionary trajectory in breast cancer.

Dr. Priya Lakshmi Narayanan
Postdoctoral Training Fellow
Institute of Cancer Research, London, United Kingdom

Dr. Priya Lakshmi Narayanan received her PhD degree in Biomedical Engineering for her work in developing an atlas of cerebellum for young children. She worked as a research scholar in MRC/UCT Medical Imaging Research Unit, University of Cape Town, South Africa from 2010 - 2015. She has also worked as a visiting academic in Athinoula A. Martinos center for Biomedical Imaging in Boston. Her expertise in image segmentation and cellular phenotype quantification along with complex data analysis and interpretation has resulted in significant research outputs in nature breast cancer and nature scientific reports. She won a Marie curie research fellowship and moved to the UK during her final year PhD research program. During her tenure at PathXL, UK she has been an active part of the patent for which she is recognised as an innovator while at PathXL in FastPath Project. She is actively working in understanding recurrence pathways and resistance mechanisms in breast cancer with Institute of Cancer Research for the past 4.5 years. Currently at UCL she is an active member of Department of computer science in building intelligent systems that help to predict acute myeloid leukemia.

Deep learning in Healthcare

Dr. David Belo

Abstract:

The healthcare system, which is ubiquitously recognized as one of the most influential systems in society, is facing new challenges since the start of the decade. The myriad of physiological data generated by individuals, namely in the healthcare system, is generating a burden on physicians, losing effectiveness on the collection of patient data. Information systems and, in particular, novel deep learning (DL) algorithms have been prompting a way to tackle this problem.This presentation has the aim to show the impact of how DL solutions can impact and impact the biosignal research and industry. For this purpose, an extensive study of how to incorporate and implement Convolutional Neural Networks (CNN), Recursive Neural Networks (RNN), and Fully Connected Networks in biosignal studies is discussed. Examples of different architecture configurations for signal processing and decision making will be explored in three different scenarios: (1) Biosignal learning and synthesis; (2) Electrocardiogram (ECG) biometric systems, and; (3) Electrocardiogram (ECG) anomaly detection systems. While these systems are shown to be capable of producing novel results, they suggest that the incorporation of several AI systems into one could be the next generation of preventive medicine. As machines have access to different physiological and anatomical states, they could produce more informed solutions for the issues that one may face in the future, increasing the wellbeing when used in innovative prevention systems. These could even be used in every-day life in remote places where the access to medicine is limited. These systems could also help the study of the signal behavior and how they are made in real-life context with explainable AI. Consequently, it could trigger a new perception of the inner mechanisms of the biosignals when linking them with the inner states of a network during a specific task.

Dr. David Belo
Fraunhofer Portugal AICOS, Portugal

Dr. David Belo is a Portuguese Biomedical Engineer with a vast and multidisciplinary experience. David Belo has received his Ph.D. in Biomedical Engineering from the NOVA University of Lisbon in 2021 in applying deep learning algorithms for several biosignals' paradigms. His research activity was mainly in biosignal processing and machine learning to extract meaningful information and make automatic decision support systems, and, on the industry side, he earned experience in programming mobile applications, reporting services, and administration software. His specialization includes Deep Neural Networks, Tensorflow, Theano, Biosignal Processing, and Machine Learning. In addition to this, he has participated in the summer of 2019 in the NASA Frontier Development Lab in developing AI tools for aiding the Astronaut Health program.

TRACK 1

Smart Glass with Multi-functionalities for Assisting Visually Impaired People

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Abstract

Smart glass is a device that is obliging for visually impaired people. It becomes difficult for impaired people to recognize objects in front of them, study, etc. They may always have to take the help of a guide for most of the activities that are mentioned above. It is almost impossible to have a guide for every impaired person. The objective of the work is to design and develop a device that is obliging for visually impaired people. Though, there are many approaches to help them, the major disadvantage of some of the products that are currently present in the market is that they are very costly and some are bulky. Also, some of the proposed systems either perform only object recognition or only help in reading the text. Almost all proposed systems did not help the visually impaired people to write or to have a hardcopy in the form of braille code which then helps them to read offline. To overcome the disadvantages mentioned above the paper discusses various techniques- Seeing mode, which can recognize 550 classes of objects along with object's position (Left, Right or Centre). Moreover, in the reading mode, it recognizes the text in front of the person which is then read out loud to the user along with creating a copy of the braille script. Further, in the writing mode, speech is converted to a file containing braille codes.

Gender Differences in Postural Stability in a Cohort of Adolescent Age

S Varsha, Deepa Anbalagan, K Adalarasu, M. Jagannath, and A Celestin Jerald

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Abstract

Daily tasks necessitate improved locomotive abilities and movements, which are determined by an individual's balance control. Body postures allows us to stay in a stable and balanced stance without falling. Falls can be caused by a person-related or by factors in the environment, such as the floor, lighting, and so on. Most earlier postural-related studies focused on determining how person-related characteristics such as age, visual acuity, gender, curriculum vitae, and other factors affect postural stability, as well as how to improve it to avoid people from falling and suffering serious injuries. The primary objective of this work was to examine postural stability in males and females using centre of pressure (CoP) metrics (body swaying frequency and velocity) in antero-posterior (AP) and medio-lateral (ML) directions) for the adolescent group. Force data was collected in three directions (Fx, Fy, and Fz) using a standard force platform (SENSIX force plates) under two support and two visual conditions, including eyes-open, standing on two limbs (OB), eyes-closed, standing on two limbs (CB), eyes-open, standing on one limb (OO), eyes-closed, standing on one limb (CO). After pre-processing the force data, a filter with a range of frequency (0-10) Hz was used to determine the center of pressure measure in both the antero-posterior and medio-lateral directions. Two features were derived from the CoP data: sway and average velocity in both directions. The collected features were subjected to statistical analysis in order to investigate the postural balance of male and female participants. The findings demonstrate that for all three experimental conditions in both directions, male gender CoP characteristics (sway and velocity) were significantly ($p<0.05$) higher than female gender CoP characteristics. This work concludes that male adolescent groups have higher postural stability than female adolescent groups of similar age, indicating that hormonal variables such as thyroid, estrogens, and others reduce postural stability.

Human Violence Detection using Deep Learning Techniques

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Abstract

The world's average annual fatality rate from human violence is 7.9 per 10,000 people. Most of this human violence takes place in an isolated area or of sudden. The information delay here is a major impediment to stopping these acts. To thrive on this issue, the inception technique is used in this study. One of the most important tasks in computer vision is to detect moving objects from closed-circuit television (CCTV). CCTV cameras are now in local homes and every corner of the streets; these are extremely useful in solving cases. Some techniques of deep learning are used as computer vision to predict and detect the action, properties from video. This study is deliberately designed to detect violent acts from CCTV cameras. In real-time police force reach violent destinations and start an inquiry, check CCTV cameras, and investigate to proceed further. The Inception – v3 and Yolo – v5 models detect the violent act, the number of persons involved, and also the weapons used in the situation, which are classified using the deep learning models. The study consists of various deep learning models, which are used to form a video detection model. First, the model is trained with various videos where human violence and non-human-violence take place. After repeated training, the model is tested with test data. The classification report is generated, which will be a great help to the investigation branch. This model can be used in real-time as an application programming interface (API) or software. The study results showed the proposed model achieves an accuracy of 74%.

SIGNAL PROCESSING FOR HYBRID BCI SIGNALS

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Abstract

The brain signals can be converted to a command to control some external device using a brain-computer interface system which connects the brain signals, a computer and an external device. The current unimodal BCI system has certain limitations like the compensation of the accuracy with the increase in the number of classes. In addition to this many of the acquisition systems are not robust for real-time application because of poor, spatial or temporal resolution. To overcome this, a hybrid BCI technology that combines two acquisition systems has been introduced. In this work, we have discussed a preprocessing pipeline for enhancing brain signals acquired from fNIRS (functional Near Infrared Spectroscopy) and EEG (Electroencephalography). The data consists of brain signals for four tasks – Right/Left hand gripping and Right/Left arm raising. The EEG (brain activity) data were filtered using a bandpass filter to obtain the activity of mu (7-13 Hz) and beta (13-30 Hz) rhythm. The Oxy-haemoglobin and Deoxy-haemoglobin (HbO and HbR) concentration of the fNIRS signal was obtained with Modified Beer Lambert Law (MBLL). Both these signals were filtered using a fifth-order Butterworth band pass filter with a range between (7-30 Hz) for EEG and between (0.01 Hz and 0.2 Hz) for fNIRS signal. The performance of the filter is compared theoretically with the estimated signal-to-noise ratio. These results can be used further to improve the feature extraction and classification accuracy of the signal.

Analysis And Evaluation Of Consumers' Cognitive Responses To Visual And Gustatory Stimuli For Neuromarketing Application

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Abstract

Neuromarketing merges viewpoints of marketing, neuroscience, economics, choice hypothesis that are required to analyze the psychology of consumers' preference to product development. The traditional methods involve product ratings, conducting questionnaire surveys that stumble upon the walls of verbal declarations of the vendees. By assessing the psychological conditions of purchasers, Consumer Neuroscience explains the cognitive and emotional aspects that form the base of human decision making. To detect successive changes in brain activity continuously in time, a versatile approach such as Electroencephalogram (EEG) can thrive to be a compass for patron thoughts. Our study aims to utilize the neuroscientific information that distinguishes contrasts between healthy subjects' EEG signals for examining the brain activity during visual and gustatory stimuli of different flavours of a beverage brand. The EEG montage assigned according to brain-region-specific localization draws out the subjects' true elicited subconscious response regardless of whether the subject attempts to control his/her affective state. The results showed the activation of theta and delta bands of EEG signals during the given stimuli. These elicited signal variations can be used to identify the best favoured item for successful product dispatch and reduction in loss. Another major application of this study is directed towards the customization of liquid food intake of locked-in, comatose, vegetative state patients by observing their brain response to the various fluid intake and determining the best response among them. This aids physicians to put the patients on a path to recovery.

Design and Development of a Health Monitor System Using Eye Blink Detection

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Abstract

The patient who are bedridden because of weakening of muscle with relevance to hands, feet or voice, which makes them difficult to precise their needs. These type of condition usually arises due to an issue in signal messages passage between the muscles and therefore the brain. Due to this condition, paralyzed or bedridden patients were not able to move any part of the body except their eyes. Therefore, the most aim of the work is to style a true time interactive system that leads in assisting the paralyzed or bedridden patients to interact with caretakers using pre-defined messages and an alert buzzer to grab the attention using eye blinks. Once the patient blinks eyes, supported with the pre-defined conditions eye sensor senses and if condition is true then corresponding pre-defined message are going to be appear on the display, if the condition is false, then it checks for next condition respectively. Hence the system is employed to control, manage and communicate with the other people through eye blink action.

TRACK 2

Medication Adherence Manager and Its Clinical Application

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Abstract

Adherence to prescribed medication affects global clinical practice especially on chronic disease management resulting in adverse medical and economic burden. Reliable standard and practice in measuring adherence among patient is yet to be established clinically although aspects from user behavioural, clinical needs and technology-assisted devices design have been studied. Lack of real-time monitoring and inefficient method of medication consumption validation has been identified as the challenges in monitoring patient medication consumption's pattern. The aim of this study is to design and deploy an IoT driven medication adherence manager. The proposed IoT architecture enabled by real time monitoring through a multi-sensor alert option in medicinal compartment to ensure adherence integrity. The reliability of the proposed device further enhanced with the mobile application and cloud storage and usage analytic support application. The medication adherence manager expected to digitize the medication consumption process thus improving the patient health and well-being at the same time reduce pharmaceutical wastage due to nonadherence.

Adaptable Medical Device With 3D Printing Facilities

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Abstract

3D printing technology has breakthrough many long pending medical challenges. In this study the researchers are addressing epilepsy, a disability that limits mobility freedom, that can appear at any age but usually start in childhood or people over 60 years old. Diagnosing epilepsy quickly can be challenging due to the fact other conditions such as migraines, panic attacks and fainting possess similar symptoms. Regularly, it cannot be confirmed until seizure is detected. Electroencephalogram (EEG) is the most common test used to diagnose epilepsy. Epileptiform brain activity presence is used as a change seen on an EEG recording among epilepsy patients. The availability of EEG device for epilepsy diagnosis is currently limited to clinical settings which restricts the treatment process. The objective of this study is to offer an option for personalized home-based EEG device for epilepsy diagnosis and monitoring. A customized 3D printed EEG headset with 8 channel dry electrodes device is assembled and configured. The customization is managed by offering three different printable headset sizes with material selection options. The device is supported with an OpenBCI application connected through Bluetooth for recording and further processing options. The proposed device has potential to address number of limitations including the recent pandemic's challenge where hospitalization option is restricted. The outcome of the research is expected to bring a new breakthrough in brain activity related research and clinical diagnosis in patient monitoring. The customization option of this device is also expected to offer a new trend in managing treatment compliance and adherence in clinical practice.

Voice Controlled Home Automation, Security System and Virtual Joystick-Controlled Robot for Patients in Home Quarantines

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Abstract

The threat of COVID-19 is increasing by the day, while those who are infected must quarantine immediately. Since the disease is lethal and spreads by direct or indirect human contact, it is critical to disinfect all contact surfaces on a regular basis. Since continual direct exposure to chemicals promotes antibiotic resistance, it is less likely to be considered as a long term solution. As COVID-19 had such a negative impact on people's health, even regular commuting inside the house became a difficult and time-consuming activity for a variety of reasons, including the fact that the person is isolated alone and has a strong inclination to leave things neglected. This paper consists of a quarantine home automation system that allows the user to remotely turn on and off the appliances in the room as well as monitor the temperature in the rooms. The proposed system has incorporated an intruder alarm system, which sends notifications to the user's mobile phone whenever some unexpected movement is detected near the entrance. The entire system is voice-enabled, which means that instead of completing the work manually, the user may give Alexa the directions. The quarantine home automation system also includes a robot that can be operated by the user virtually using the joystick present in the common user interface.

MEMS Biosensor Design and Simulation for Diagnostic Purposes

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Abstract

A Biosensor is a device detects a chemical substance that combines a biological component. Micro cantilevers are used as sensors, transducers, probes, needles, transport mechanisms, resonators, latches, switches, and relays. The main concept in bio sensing application is antigen-antibody binding. When the magnitude of the force exerted is small, the sensitivity of the micro cantilever becomes high, so that the device can sense the presence of antigen even if the magnitude of the surface stress over the cantilever is very small. With the help of COMSOL Multi Physics, micro-cantilever is designed as MEMS biosensors that diagnose various diseases accurately and rapidly when compared to other techniques. This biosensor is capable to detect HBV and N1H1 by immobilizing particular antibodies on the surface of the cantilever. The Moment the patient samples are sensed by sensors sensing element contains antigen; biochemical interactions found on the sensing part. Biochemical interactions occur between the antigens of HBV, H1N1, and the antibodies attached to the sensing element's surface; as a result, the diseases are detected. In the current paper dual cantilever is designed for diagnosing two diseases in single step at the same time accurately. Here the cantilever can sense even a minute deformation 1.6x10-06 mm, hence it can be applied in designing MEMS based biosensor for diagnostic purpose. The dual-beam cantilever is simulated by choosing a suitable polymer to fabricate biosensor to detect swine flu and jaundice with the help of COMSOL Multi physics.

Design of an automated oxygen flow control system for hypoxemic patients

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Abstract

Hypoxemia is a condition for which there is a lack of oxygen in the blood. Which might range from minor issues like dizziness and shortness of breath to more severe problems like interfering with heart and brain functions. The amount of oxygen in a person's blood indicates how efficiently the body transports oxygen from the lungs to the cells. The present research aims to design continuously monitor the blood oxygen level and to regulate the opening and closing of the oxygen flow meter valve using a servo motor. If the blood oxygen level is normal, the valve remains closed. If the blood oxygen level falls below the normal range, the valve is opened. The system employs a SpO2 sensor for monitoring the heart rate and oxygen saturation. The output of the sensor is sent to the microcontroller that comes up with an in-built analog to digital converter. A servo motor is used to control the flow meter valve to deliver the required oxygen to the patient during abnormal detection of blood oxygen saturation level. When the blood oxygen level falls below 94%, the oxygen valve is opened to allowing for oxygen flow. The blood oxygen level detected as normal that is 97% and hence the oxygen flow is at off state. The output is sent to an LCD unit, which keeps track of the SpO2 level. This microcontroller-based oxygen supply control device can prevent the adverse effects of hypoxemia. The present research reduces the time and a caretaker requirement to oxygenate the patient by providing controlled delivery system.

GPU based epileptic seizure detection using deep autoencoder with particle swarm optimization

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Abstract

Epilepsy is a long-term neurodegenerative disorder that impacts the brain and causes at least two gratuitous convulsions. It is frequently diagnosed using electroencephalograms (EEG). Existing models were unable to accurately predict the seizure due to the signal's non-stationary nature. Deep learning techniques have recently gotten a lot of attention from researchers working on a variety of signal processing problems. A deep learning approach was used in this analysis to retrieve relevant features from a raw form EEG signal. Furthermore, the metaheuristic swarm-based algorithm to optimize the deep autoencoder's hyperparameters. Experiments are carried out on Bonn dataset with the CUDA-enabled GPU version P100. To assess the efficacy of the constructed model, the computational results are compared to other benchmark classifiers and obtained the accuracy of 93.6%.

TRACK 3

Psoriasis Skin Disease Identification Using SVM Image Classification and Determining the Growth Rate

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Abstract

In the Indian population, a larger part is under the subsistence level. Most of the people are living in areas of poor sanitation and have very little access to good medical facilities. From time to time, they don't have the notice to go to a doctor at the right time. This has been determined particularly within the case of skin disorders or diseases wherever there is a failure to induce the right identification and treatment in time typically ends up in consequences. Skin diseases tend to be itchy and cover the body easily. Among them, Psoriasis exists as a common chronic, inflammatory disease of the skin characterized by scaly patches. The proposed system focuses on SVM segmentation and scaling of 2D processed skin pore images of Psoriasis. The Feature Scaling Technique uses colour, contrast and image texture along with a combination of SVM classification features to diagnose and come up with a treatment solution. This computer-assisted image processing system removes erythematous from the psoriasis image for analysis and determination of growth rate. Therefore, earlier identification cuts back the symptoms of the illness and can incorporate lifestyle habits and coping strategies that help to live better with psoriasis.

Detection of Liver Dysfunction using Microfluidics Analysis

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Abstract

The body fluids are an important clinical diagnostic marker, considered by the physicians for diagnosis, monitoring and treating various diseases. Bilirubin, orange-yellow coloured pigment, an end-product of heme metabolism is a biomarker for liver dysfunction primarily jaundice. Similarly, blood pressure is one amongst the main parameters raised in most of the abnormalities including liver dysfunction. Hence, screening of blood pressure and concentration of bilirubin in the blood stream helps to detect the pathological conditions. In COMSOL Multiphysics, fluid flow simulation task is taken into account to analyze the flow of blood, blood pressure, bilirubin and also their range of concentration. In the present work, liver dysfunction can be detected in early stage with the help of physiological behavior of hepatic artery by measuring the flow rate, blood pressure and bilirubin levels in the arteries with the aid of COMSOL Multiphysics simulation software. Also, the impact of obstruction due to the presence of blocks of various sizes in the arteries on the flow rate, bilirubin as well as blood pressure is explored.

Analysis of Sleep apnea Considering Electrocardiogram Data Using Deep learning Algorithms

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Abstract

Sleep is a vital component of every human being. Adequate restful and restorative sleep reenergizes the body, enhances overall health and psychological well-being. Sleep hygiene, chaotic lifestyles, disorder breathing, stress, and anxiety contribute to poor sleep quality. Obstructive sleep apnea (OSA) sleep respiratory disorder causes temporary lapses of breathing results in gasping, choking, snoring sounds during sleep. The individual does not consciously wake up, but the brain has to start breathing again which disrupts the sleep quality. Polysomnography (PSG) sleep study is employed to diagnose sleep disorders by using either in-home or laboratory-based comprehensive tests. The untreated OSA leads to deterioration in health, performance consequences with severity including daytime sleepiness, motor vehicle accidents, workplace errors, cardiovascular morbidity, and mortality. The paper focuses on three types of deep learning classifiers-based prediction models for detection of apnea from the ECG signal. The pre-processed, interpolated and segmented ECG signal is considered for examination. The accuracy value of Long Short Term Memory model (LSTM) is 85 percent and classifier's ability to distinguish between normal and apnea events is 0.88.The Convolution Neural Network (CNN) and Gated Recurrent Unit (GRU) has an f1-score value of 0.80. The proposed LSTM model provides the optimal performance in comparison to other deep learning models used for classification with respect to area under the curve (AUC) and accuracy metrics.

Smart Glove for Elderly Patients

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Abstract

Each and everyone in this world should take care of elderly patients and treat them how they need to be treated. In spite of having lots of orphanages, homes, etc.... for elders, it doesn't stop their insecurity to overcome, assaulters or molesters. This article comes up with a solution for the elderly patients around by assisting them and helping them to be fearless. Here the proposed system makes use of six parameters like Pulse Oximeter, GPS and GSM modules, Touch Sensor, Accelerometer, Bluetooth that interface with the Arduino. If elderly patients are facing any health-related troubles, this device which is in the form of a glove will help these patients to escape by altering the caretaker.

Effective Minutiae Extraction and Template Creation in Fingerprints

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Abstract

Despite years of research in using the fingerprint as a biometric entity, there remains a niche to improve the underlying accuracy, specifically on enhancement, feature extraction and classification consideration. Attempted in this paper is a ridge compensation filtering technique for enhancement, followed by minutiae extraction and false minutiae removal and eventually a procedure for template creation. The extracted features are evaluated using metrics like accuracy, error rate and goodness index. These values were found to be better when compared with the results of some state-of-art algorithms, which endorse the effectiveness of the first two stages. Mahalanobis distance (MD) is used to recognise the fingerprints through the generated features that resulted in accuracy above 92%. Finally, convolution neural network (CNN) is used to cross-examine the recognition capacity. Though CNN also able to give a similar accuracy, the proposed algorithm is simple and robust and hence easily embedded in hand-held devices.

Experimental Analysis of Biometric System using Various Multimodal Fusion Algorithms

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Abstract

Demand for high end privacy and security in human computer interaction, telecom environment is very high in the era of digital world. Multibiometric system combines information from multiple biometric traits of an individual and has an exceptional ability to address these demands with add-on customer satisfaction. It also overcomes intra class variations, non-universality, noisy data and attacks during authentication process. This paper proposes a multibiometric system suitable for secure access of data, devices and services. A database has been constructed using real time multiple biometric samples acquired from 500 individuals in an unconstrained environment. Existence of noise in the samples captured in an unconstrained environment are removed using filtering techniques, and the contrast is adjusted using dark channel priorities and scattering model. Then, the region of interest and features appropriate to each trait are extracted and fused in various forms like multiple samples, instances and traits in recognizing an individual. The proposed system is analysed by computing genuine and false acceptance rates. With the promising experimental results of various fusion schemes, the authentication is tested using transfer learning process with automatic extraction of essential features using Convolution Neural Network and classifying the target using Support Vector Machine (SVM), which outperforms in identifying an individual through fusion of biometric features acquired even in an unconstrained environment. Hence this authentication process could be modified into an effective one to identify and monitor the user interacting with a security related application in online mode with their unique available unconstrained features.

TRACK 4

Silent Speech Interface: An Inversion Problem

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Abstract

When conventional acoustic-verbal communication is neither possible or desirable, silent speech interfaces (SSI) rely on biosignals, non-acoustic signals created by the human body during speech production, to facilitate communication. For people with severe speech problems, SSI attempts to provide innovative alternative and augmentative communication options. Despite considerable advances in sensing techniques that can be employed to capture these biosignals, majority of them are used under controlled scenarios in laboratories. One such example is Electromagnetic Articulograph (EMA), which monitors articulatory motion. It is expensive with inconvenient wiring and practically not portable in real world. Since measuring articulators is cumbersome, articulatory parameters may be estimated from acoustics through inversion. Acoustic-to-articulatory inversion (AAI) is a technique for determining articulatory parameters using acoustic input. Automatic voice recognition, text-to- speech synthesis, and speech accent conversion can all benefit from this. However, for new speakers with no articulatory data, inversion is required in many practical applications. Articulatory reconstruction is more useful when the inversion is speaker independent. Initially, we analysed positional data to better understand the relationship between sensor data and uttered speech. Following the analysis, we built a speaker independent articulatory reconstruction system that uses a Bi- LSTM model. Additionally, we evaluated the trained model using standard evaluation measures.

Air Ambulance Drone for Medical Surveillance

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Abstract

Rescue teams during a calamity or road accident on a highway and a lot more emergency type situations require proper and speedy communication between the rescue unit and the patient. Usually, the need for patient data like the vitals is very much important for the ambulance and the hospital to prepare for the necessary healthcare facilities. As cities develop traffic hinders the distribution of healthcare support to the needy. Hence drones/air ambulances can solve this issue by navigating to the exact location of the patient and collecting their vitals with the help of certain sensors. The acquired data is shared with the healthcare providers and paramedics via the Internet of Things. Cloud backup helps in retrieving the data anytime and anywhere with certain safety regulations.

Design and Development of Electrogastrograph wireless electrode module

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Abstract

Electrogastrography is a pain free diagnosing method for evaluating stomach myoelectric activity. People are drawn to EGG because it is painless diagnostic procedure. However, given to its non-invasive characteristics, there has been significant debate about the validity and applicability of EGG. The major goal of this project is to decouple the electrode-equipment probe connection. This enhances the patient's mobility (infant, athlete, handicapped) while lowering probe-to-electrode misconnection. This portable electrode system allows physicians and nurses to examine data of a patient from a distance, decreasing the need for them to be physically present behind the subject for examination. The signal capture, data acquisition unit and communication interface with the Wireless Fidelity module are utilized to quantify stomach activity. Arduino is used to take an analogue signal and convert it to a digital value. The Arduino programming language is used to build the programmers, which are subsequently embedded in the board. As a consequence, the value retrieved from the Electrogastrograph module is transferred over Wireless Fidelity module to the thing speak online platform. Arduino accepts an analogue signal and transforms it to a digital value. The Arduino programming language is used to build the applications, which are subsequently incorporated into the board. As a result, the value retrieved from the EGG module is transferred through Wireless Fidelity module to thing speak online platform.

Examining Depression, Anxiety and Stress amidst the Millennial Generation in the Era of COVID-19 Pandemic in India

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Abstract

It is important for everyone to maintain a healthy lifestyle. The term “health” refers to both physical and mental well-being. Mental health provides enough energy for a person to even move physically, and it should not be overlooked. Even grownups find it difficult to preserve their mental health. To maintain their psychological well-being, pupils should be observed, coached, and advised. During the era of COVID-19 pandemic in India, emotional states such as depression, anxiety, and stress (DAS) were studied amidst the millennial generation. This study enlisted the participation of 53 Indians. Through the DASS-42, questions regarding their demographics such as age, gender, weight, height, degree of education, and psychological status were asked. The DASS score was analyzed based on gender (males vs. females) and educational level (primary vs. secondary education). Females had substantially greater DAS score ($p<0.05$) than males, and secondary school students have substantially greater DAS score ($p<0.05$) than primary school pupils, according to the findings. Some even fall into the severe and extremely severe DAS categories. The findings of this study suggest that regular mental health checks should be made mandatory, as well as the need for free health care facilities for students in India throughout the period of COVID-19.

Analysis of MRI as a Screening Tool for the Diagnosis of Schizophrenia

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Abstract

Schizophrenia (SCZ) is a clinical disorder that affects 0.01% of the world population. It affects people in late teen hood or early maturity resulting in lifelong social and mental disturbance. At present, there is no cure, but this can be diagnosed and treated. Classification of SCZ imposes great challenges even for the most experienced neurologists. A non-intrusive technique like MRI is taken for diagnosing various diseases which are used as a base for our tool. Many researchers used large datasets of SCZ and normal for analyzing SCZ using various parameters like Grey matter, white matter, voxel-based morphometry, etc., This work proposes a simpler but effective approach to classify the same. This paper determined statistical and complexity features from 32 SCZ and 18 normal MRI images. Totally 9 features are determined out of these, novel features Hausdorff dimension and Euclidean distance played an important role in classification. Hausdorff dimension is selected as the most significant feature by student's t-test with $p<0.001$. Significant features obtained by the t-test are given as input to the back propagation neural network. Our promising approach, with a minimal dataset, classified the subjects with 100% sensitivity, 88.9% specificity, and 94.4% accuracy.

Biomechanical characterization of Human GAIT using EMG Parameters

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Abstract

Predicting and analyzing individual muscle forces during walking can give us a good perspective of the lower limb musculoskeletal system: anatomical, physiological, and neurological characteristics of the dynamics of human movement. It can also help analyze the neuromuscular impairments on the skeletal system. In addition to that, the muscle forces can also be used to understand and evaluate how the lower limb assistive devices affect the body of the person in both powered and unpowered conditions as these assistive devices are very much needed to assist people with disabilities to carry their daily activities with ease. Estimating force from EMG allows us to assess the contribution of an individual muscle to the over-all force applied by a group of muscles while performing an activity and the measurement of EMG helps in understanding the muscle dynamics during walking, and this, in turn, can serve as input for assistive devices. This is why EMG can be an excellent choice for force estimation in kinesiological studies. This study aims to predict individual muscle force from electromyography signals (EMG) during walking. The right gastrocnemius lateralis muscle of a 23-year old male subject with no neurological or muscular disorder was analysed during walking in his normal pace for 1000 meters. The analysis was done on 10-meter data. Here, two approaches were used to predict forces from EMG using the MATLAB software. The forces obtained were compared with the force predicted from computed muscle control (CMC) in OpenSim software. The main parameters used for the prediction were muscle length, muscle velocity, pennation angle, and isometric force, along with EMG. It is concluded that method I gave a better force prediction than method II.

TRACK 5

Prosthetic Arm With Functional Fingers And Wireless Recharge On Walk Function

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Abstract

The efficiency, tactile features, and weight of prosthetic limbs have all improved over time, but the long charging period that comes with these benefits reduces their overall appeal. The purpose of this study is to incorporate a portable power source into the prosthetic arm in order to decrease downtime and increase reliability. The use of special footwear that serves as a regenerative power source for the prosthetic arm's battery, a piezoelectric generator that generates energy while walking, and a charging station that transfers power directly to the prosthetic arm while on the move. The complete device allows the user to comfortably use the prosthetic arm for longer periods of time.

Designing a Mask for Obstructive Breathing Disorder

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Abstract

Constant Positive Airway Pressure (CPAP) is a method of painless mechanical ventilation to keep the aviation routes open in subjects unfit to do as such independently. It is utilized to treat different scopes of ongoing ailments emerging from obstructive aviation routes infections. Along these lines, this work means to address the plan and development of a veil and test CPAP gadget as verification of idea to be utilized by subjects experiencing different obstructive breathing illnesses. To plan a veil and the test CPAP gadget with tangible instrumentation for giving information to a miniature controlled framework, electro-pneumatic circuits and sign molding sheets of sensors have been fitted to accomplish streamlined CPAP work with low energy utilization. Every one of the boundaries are checked by the microcontroller once the microcontroller identifies any hardships in breathing circumstances it will turn on the steady framework for the subject. In this proposed work breathing pattern, rest design, temperature mugginess controls observing will be put away in mists. By utilizing the proposed work, steady framework subjects can be ready to inhale steadily.

Effect of grounding on hand grip strength and electromyogram in healthy young adults

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Abstract

Introduction: Handgrip strength has often used as a tool to measure upper body conditions including neuromuscular performance, frailty, weakness, and cardiovascular health. Grounding (connecting to the earth's natural electrons) has been a way of living in past and recent years have been demonstrated by researchers to speed wound healing, reduce inflammation, and balance excessive free radical charge in the body, which later acts as an antioxidant, among other benefits. All of these were beneficial to the human body, and it was reported that grounding improved human health in a variety of ways. Grounding is hypothesized to work in two ways- one by discharging the static field developed in the body by exposure to electrical devices and the other way by neutralizing the excess free radicals generated in the body due to improper lifestyle. This study aims to analyse the change in handgrip strength and EMG signals in young adults pre-and post- grounding. Our subjects are engineering students aged 22-28 having maximum exposure to mobile phones and laptop radiation especially due to the current pandemic situation for the necessity of taking online classes. We are trying to relate grounding and muscular performance (in terms of handgrip strength, fatigue time, electromyogram) to understand how Earthing for a few hours a day can make a person's life better and healthier.

Inducement of Artificial Sleep using Low Strength Magnetic Waves

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Abstract

Every human need eight to ten hours sleep every day for healthy and good functioning of brain and body. Proposed system induces sleep using low frequency, low strength magnetic waves produced by using coil circuitry. Majority of age people, people with anxiety, stress, depressed feel difficulty to get sleep due to few unknown factors. Our proposed system will induce sleep without drugs, meditation and other chemical-based methods having huge side effects.

Automatic Seizure Detection Using Modified Cnn Architecture And Activation Layer

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Abstract

An epileptology expert must visually inspect the EEG to identify abnormal neural activity, which is time-consuming and subject to human errors. The capability of convolution neural networks to extract visuospatial features and learn from these discriminative features make them useful for this task. This paper presents seizure classification based on long-term EEGs using pre-trained convolution neural networks. After filtering, EEG data was divided into a 1-second segment for which a scalogram is extracted. In this study, a recently published dataset (TUSZ v1.5.2) was used for the performance evaluation of various CNN-based deep neural networks. The best accuracy obtained for GoogLeNet and AlexNet is 95.88%, 95.79% respectively with 50 epochs and 32 mini-batch sizes by replacing the ReLU with the SWISH activation function. The proposed hybrid architecture (AG86) for epochs 40 and 50 with mini-batch size 32 has shown the best testing results in terms of accuracy (94.98%) as compared to the standard architectures SqueezeNet (93.19%), GoogLeNet (92.65%), and AlexNet (94.44%). Similar performance was observed using metrics specificity, sensitivity, Mathew correlation coefficient (MCC), and F1 score. A general inference based on evaluation can be drawn as proposed hybrid architecture (AG86) showed better test results compared to pre-trained CNN models. Moreover, by replacing ReLU with SWISH activation function significant improvement was observed with the same configuration AlexNet and GoogLeNet.

Design of transfemoral prosthesis for above the knee amputees

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Abstract

Transfemoral amputation is a condition where the person above the knee area is amputated due to some infection, cancer or trauma. Due to this their mobility is eminently compromised, their lifestyle gets affected and also the individual's self-confidence is distraught. The only way to aid this condition is to provide a prosthetic to provide support and mitigate easy movement. Usually, prosthetics are not selected due to high cost. In India there are around two lakh thirty thousand amputees in need of prosthetic care but are hesitant to opt for one, for the reason that they are expensive. Most of them go for cosmesis due to this demographic. In this work, we focus on developing a mechanical knee joint prosthesis where the pylon or the shank is replaced by a shock absorber in order to reduce the transient mechanical force acting on the artificial leg. By replacing the basic design with the shock absorber, it also enables the subject to perform other activities such as jumping and jogging with ease as the force is dispersed evenly on the prosthesis. In this we also perform von mises analysis, strain analysis and displacement analysis and carry through a comparative analysis between two commonly used materials in making the prosthetic against carbon fibre and prove the efficacy of carbon fibre.

TRACK 6

Pneumonia Detection in Chest X-Ray with Bat-Algorithm Selected Deep and Handcrafted Features

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Abstract

Pneumonia is one infectious disease caused by viruses/bacteria, and early screening is necessary for the detection and treatment. Furthermore, pneumonia causes severe problems in children with age 65 years. The proposed work aims to develop a disease screening scheme for efficiently classifying the chest radiograph (X-ray) pictures into the Normal/Pneumonia group. This scheme consists of the following phases; (i) Image collecting and resizing, (ii) Deep-feature extraction, (iii) Handcrafted feature extraction, (iv) Bat-Algorithm based feature selection and (v) Classification. In this work, the VGG16 scheme is considered to extract the deep features from the test images, and the necessary handcrafted features are mined using the Weighted Local Binary Pattern (WLBP). The necessary feature is then selected using the bat-algorithm supported feature selection. The experimental result of this study confirms that the classification accuracy of KNN is healthier (>98%) than other methods. Therefore, the proposed scheme can be considered to examine authentic clinical images in the future.

Extraction and Assessment of COVID19 Infection in Lung CT Images Using VGG-UNet

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Abstract

The infectious disease in humans is gradually rising for various reasons, and COVID19 is one of the recently discovered diseases caused by SARS-CoV-2. From early 2020, the infection due to COVID19 has gradually increased, and still, its infection exists. COVID19 will cause severe infection in the respiratory tract, and early detection and treatment are essential. The harshness of the infection needs to be examined before implementing the treatment. This research aims to build up and implement a suitable procedure to extract and assess the infected section in lung CT slices. This work extracts the infected section using the pre-trained VGG-UNet scheme. The separated section is validated against the ground-truth (GT) image, and the necessary presentation standards are calculated. The performance of the VGG-UNet is then compared and verified with the UNet and UNet+ schemes. The investigational product of this study authenticate that the effect reached with the proposed study confirms that the VGG-UNet provides better Jaccard, Dice and accuracy compared to UNet and UNet+.

Exoskeleton device for Left Hemiplegia patients with Electromyograph

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Abstract

Loss of motion is a condition in which muscle activity in a part of the body is lost; it is also known as paralysis. Loss of motion is most commonly caused by a severe stroke, in which the blood supply to a portion of the cerebrum is cut off. Hemiplegia is a sort of loss of motion which influences half of the body, i.e., one arm and one leg of same side of the body will not be functioning. Normally, left hemiplegia is a severe disease caused by a lack of blood supply to the cerebrum's right hemisphere. Fixed frameworks, such as Lokomat, are used in rehabilitation centres to assist patients in resuming their normal activities. However, the results provided by those frameworks are extremely time-consuming and will only benefit patients who can walk on a treadmill. However, these frameworks are not portable and cannot be used for home or day-to-day exercises. To overcome these disadvantages, this paper presents the ergonomic framework, which includes an exoskeleton that guides and assists in the development process of the left upper arm. The entire framework is powered by a compatible and miniaturized motor via a microcontroller, which aids in the development of patient flexion and augmentation. Meanwhile, EMG acquisition would be done by putting flexible pre-gelled electrodes to know the recuperation of physiological neuro-muscular activities of the subject.

Automatic Detection of Ischemic-Stroke-Lesion with CNN Segmentation: A Study

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Abstract.

The brain is the vital organ in human physiology, and abnormality in the brain will reasonfor various behavioural problems. Ischemic-Stroke is a medical emergency, and early detection and action will help the patient recover quickly. This scheme aims to implement Convolutional-Neural-Network (CNN) segmentation method to extract and evaluate the infected portion from the brain MRI slice. In this work pre-trained UNet scheme is employed to extract the stroke region from the Flair modality MRI slice with axial-, coronal- and sagittal plane. In this work, the ISLES2015 database is considered for the experimental investigation. The segmented portion is further evaluated to the ground-truth and the metrics such as Jaccard, Dice and Accuracy are computed. The experimental investigation is implemented using Python software. The experimental outcome of this research proves that the proposed CNN scheme aids to improve segmentation accuracy on axial-plane images compared with other images. The performance of the CNN segmentation scheme is then validated with other related results existing in the literature. The outcome of this study confirms that UNet supported.

Detection of Anaemia using Image Processing Techniques from microscopy blood smear images

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Abstract

The human blood includes Red blood Corpuscles (RBC), White Blood Corpuscles (WBC), platelets and plasma. The status of one's health is determined by a complete blood count, therefore segmentation and identification of blood cells are critical. A Complete Blood Count (CBC) is a test that counts all of the cells in the body to assess a person's health. The RBC and WBC count are vital in diagnosing disorders such as anaemia, leukaemia, tissue damage, and so forth. This paper focuses mainly on RBC counting and the detection of abnormality, anaemia based on the count of RBCs from a peripheral blood smear using digital image processing techniques. Anemia is an indicator, and the most important one at that, for many other diseases. Therefore, basic screening of anemia is very important, especially in regions prone to poverty. Malnutrition due to poverty is the major cause for anemia. The paper presents an algorithm to automatically count the RBCs present in the blood of a person. The count of RBC, in 1 microlitre if blood is considered and it is observed how the count varies in normal blood smears and the anemic blood smears. In remote places, where a lot of people are to be screened, using cell counters and hemocytometer is not feasible. A faster method of counting is one of major demand. Therefore, to reduce the computation time, an algorithm in digital image processing is developed to compute the number of red blood cells. Although anemia is a vast subject and there are various different characteristics to consider, this is a humble approach to automate the counting of the RBCs which would be useful for future research purposes.

Automatic Classification of Histology Images into Normal/Cancer Class withPre-Trained CNN

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Abstract

Deep-Learning-Scheme (DLS) based medical data assessment has been widely employed in recent years due to its improved accuracy. This work aims to study the performance of the pretrained DLS on RGB-scale breast-histology images. The implemented ideaholdsthese phases; (i) Data collection, pre-processing and resizing, (ii) Training the DLS with chosen test-pictures, (iii) Testing and validating the performance of the DLS with 5-fold cross-validation. This investigation considered the breast-histology pictures for the study anda binary classification is employed to achieve Normal/Cancer class grouping of images. The proposed work compared the classification performance of AlexNet, VGG16 and VGG19, the experimental outcome of this study authenticates that the AlexNetwith the Random-Forest (RF) classifier helps to get a higher classification accuracy (>87%) compared to VGG16 and VGG19.

TRACK 7

Deep Ensemble of Texture Maps for False Positive Reduction in Mammograms

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Abstract

Worldwide, breast cancer is a life-threatening disease attributing to increased mortality rates among women. Mammograms are commonly used for screening breast cancer in asymptomatic stages. However, the subtle nature of abnormalities in early stages makes mammogram analysis a cumbersome task. A computer aided diagnosis (CAD) system can complement subjective diagnosis of physicians with its objective assessment. Mass detection is the most important task in breast cancer diagnosis, as masses are the prominent indicators of the disease. Nevertheless, it is the most challenging task due to the ambiguity between masses and the surrounding normal tissues, especially in dense breasts. Though CAD systems are effective in detecting masses with high sensitivity, the price paid is usually high false positive rates (FPR). Texture analysis is normally employed to reduce the FPR in mass detection, where texture features extracted from suspicious regions are used to build a classifier model to discriminate between actual masses and false positives. Deep learning (DL) is a data-driven model that is gaining increased importance in diverse fields, including medical diagnosis, that involve voluminous amounts of data. In particular, convolutional neural network (CNN) plays an important role in image analysis in various applications, including mammogram analysis. Converting raw images to texture maps can enhance the performance of CNN for false positive reduction. In this work, textural image maps based on Hilbert curve, forest fire model, Radon transform, discrete wavelet transform (DWT) and curvelet transform are analysed using CNN. More specifically, an ensemble of CNNs based on these individual textural image representations is constructed. The proposed work is validated on CBIS-DDSM, a publicly available benchmark dataset, demonstrating 100% accuracy for mass detection with 0% FPR.

Computer aided diagnosis system for breast density classification in mammograms

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Abstract

Breast cancer is a deadly disease affecting women around the globe. Mass detection in the breast tissue at an early stage can lessen the mortality rate occurring due to breast cancer. Through mammograms, the presence of masses can be detected at an early stage, however, it's sensitivity and specificity are limited in the case of dense tissues. Identification of the breast density type prior to the detection of mass can lessen the chance of misclassifying a breast tissue as normal or abnormal, which eventually decreases the false negative and false positive rate. The proposed system classifies breast density on the basis of Breast Imaging Reporting and Data System (BI-RADS). The proposed method has explored the effect of local descriptors on breast density classification and various feature-classifier combinations have also been explored for the classification. The proposed method validated on 624 mammograms from the Image Retrieval in Medical Applications (IRMA) version of the Digital Database for Screening Mammography (DDSM) database has produced an accuracy of 73% for multi-class breast density classification using the speeded-up robust features (SURF) and support vector machine (SVM) classifier.

Detection and optimization of skin cancer using deep learning

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Abstract

Convolutional Neural Network (CNN) is a branch of deep learning which has been one of a popular methods in different applications, especially in medical field. In this study, an optimized CNN model is built using the random search optimization to classify seven types of skin cancer, namely, basal cell carcinoma, melanoma, dermatofibroma, vascular lesion, melanocytic nevus, actinic keratosis and benign keratosis. Total of 10,015 images were collected from the Human Against Machine dataset (HAM10000) which is available in Kaggle, Even though CNN has shown best results in many applications, the hyper-parameters that are required to build CNN model is difficult to choose. If the chosen hyper-parameters doesn't show good results, the model should be trained again with other set of hyper-parameter values. To avoid this circumstance, the hyper-parameter optimization is required and in this study, it is done using random search optimization. A base CNN model is initially created without using any optimization technique, so that the performance of the CNN model which is optimized by the random search method can be compared and analysed. The first model provided an accuracy of 73.34%, whereas the optimized model shown an improvement in accuracy of 77.17%.

Transfer learning Approaches in Deep Learning for Indian Sign Language Classification

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Abstract

Speech is the major way of human communication, but when it is limited, humans move to tactile kinaesthetic communication. People with speech-hearing impairments use sign language as an example of such adaptations. The deaf community uses Indian sign language (ISL) throughout India. In India, 250 licensed sign language interpreters are serving a deaf population of 1.8 to 7 million individuals. ISL interpreters are badly needed at institutes and places where persons with hearing impairments communicate. An Indian sign language picture database for English alphabets is established in this project. To prepare it for training, several preprocessing techniques were used. The effectiveness of deep learning neural networks is frequently influenced by the quantity of data available. As a result, data augmentation, a strategy for adding more and diverse samples to train datasets, was used to boost the effectiveness and outcomes of machine learning models. Our model is trained in CNN models utilizing transfer learning methodologies, with an accuracy of 95% for vgg16 and an accuracy of 92% for the inception model. More study on this research, as well as real-time implementation, has the potential to better connect people with hearing loss to society.

Detection of different types of Ear Diseases in Infants for Early Treatment

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Abstract

The loss or inability of auditory sense is the most common sensory organ deficiency. Out of every 1000 new-borns, 5-6 are deaf or hard of hearing. They will not be detected until they are two or three years old, after which permanent trauma would have happened. One of the most prominent reasons for deafness in infants is due to ear diseases. Early detection of ear diseases is the top priority to prevent deafness in infants. In this work, we have developed and applied modified deep learning architecture such as AlexNet, mini GoogLeNet, and LeNet and compared the training by the three architectures. Of the three, AlexNet architecture detected and identified the presence of five different ear diseases such as acute otitis media, glue ear, safe CSOM, otomycosis, other infections and also checked whether the ear is normal, with high accuracy.

Brain Tumour Classification Using Machine Learning Algorithm

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Abstract

A Brain tumour is formed by a gradual addition of abnormal cells, and this is one of the major causes of death among other sorts of cancers. It is necessary to classify brain tumours using Magnetic Resonance Imaging (MRI) brain tumour images for treatment because MRI images assist as to detect the smallest defect of the body. This paper aimed to automatically classify brain tumours using a machine learning algorithm. In this work, the input image of the brain was pre-processed using median filter, segmented from the background using thresholding and K-means clustering algorithm and its features were extracted using GLCM. Using the SVM classifier, the brain tumour in the image was detected as either benign or malignant. This image classification process helps the doctors and research scientists to detect the tumour during its early stages, thereby controlling the spread of cancerous cells.

TRACK 8

Science of Alzheimer's Disease in Technological Aspects

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Abstract

Alzheimer's disease (AD) is a familiar type of neurodegenerative disease, where people lose their memories, mental abilities. Together with the projected growth in the number of senior people during the upcoming decades, AD will become more prevalent. A lot of reviews investigated to assess anomalies in the brain and to diagnose AD stages utilizing features extracted from medical images, MRI is the more convenient. Yet, while delivering a quality picture, it likewise brings longer examining and recognizable proof. In this unique circumstance, biomimetic image processing has gone through a genuine development that turned into an integrative examination area that incorporates various fields. With the advancement of computer-aided frameworks, creating quality data that has the conclusion of illness in image processing approaches led to varying concerns. All such present patterns existing that help diagnostics in AD identification are investigated.

Dose response curve using chemically induced PCC assay in peripheral cells irradiated in-vitro to 5 MeV alpha particles emitted from radon source

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Abstract

Bio-dosimetry is defined as estimation of dose received by individuals based on biological end points induced by ionizing radiation. By using cytogenetic assay, it is possible to quantify the absorbed dose. High linear energy transfer (LET) radiations are more effective per unit dose than low LET in producing cellular effects. High LET produces dense ionizations along their path and causes more clustered DNA damage. Radon is a natural radioactive element present in the atmosphere mainly produced during decay of uranium. When radon is inhaled for many years, it causes lung cancer. The main objective of the present study is to construct dose response curve by using Premature Chromosome Condensation (PCC) techniques in blood cells exposed in-vitro to radon exposure. Blood samples were drawn from healthy non-smokers (n=4), aged between 28 to 42 years and exposed to twenty doses of radon ranged between 0 to 5.5 mGy. A total of about 24000 metaphase spreads were counted to find the DNA damages include ring chromosomes (RC), dicentric chromosomes (DC) and acentric fragments (AF). Rings include both acentric and centric rings. As the dose increases gradual increase was observed in RC, DC and AF with the slope of 0.001, 0.005 and 0.064 respectively. This study confirms the usefulness of PCC assay for reliable dose estimation even for very low doses. So far, no calibration reference curve was generated for low dose radon exposure using chemically induced PCC assay and hence this study is considered as first of its kind.

Active contour-based segmentation of normal and fetal spina bifida ultrasound images

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Abstract

Fetal spina bifida is a neurological disorder which occurs due to improper closure of the spinal column. Fetus identified with spina bifida suffers from various paralytic disorders throughout their lifespan. Early diagnosis of spina bifida aids in timely medical interventions. The ultrasound imaging is widely preferred for fetal monitoring. This study involves segmentation of the normal and abnormal fetal spine from ultrasound images using active contour algorithm. The images for analysis are collected from a diagnostic centre. The noise present in the images is removed using Wiener filter and anisotropic diffusion (AD) filter. The denoised images are evaluated with the metrics such as signal to noise ratio (SNR), peak signal to noise ratio (PSNR), structural similarity index measure (SSIM) and mean square error (MSE). The contrast enhancement is performed by histogram equalization (HE) and adaptive histogram equalization (AHE) techniques. The contrast enhanced images are validated by measures namely entropy and adaptive mean brightness error (AMBE). From the preprocessed image, the spine region is segmented using the active contour method. The results demonstrate that the AD filter with optimal parameters performs better than the Wiener filter for denoising. For the contrast enhancement, the AHE technique shows better performance compared to HE. The active contour technique is able to segment the spine regions in both the normal and spina bifida images. As early diagnosis of spina bifida is essential, this approach could be clinically significant.

Hardware Implementation of ECG signal Compression using SPIHT

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Abstract

Cardiovascular disorder is a primary cause of mortality throughout the world in both developed and underdeveloped countries. Continuous cardiac monitoring enables clinicians to identify arrhythmias and other heart conditions. Tele-cardiology introduces remote monitoring devices for tracking the cardiac activity of the patients. The large volume of Electrocardiogram (ECG) data needs to be stored, processed and transmitted by these portable health care devices. The implementation of efficient ECG compression technique in hardware platform is crucial for continuous health monitoring applications. The aim of this work is to implement field programmable gate array based set partitioning in hierarchical trees-based electrocardiogram compression. Discrete wavelet transform method is employed to break up the signal into sub bands. The transformed coefficients after discrete wavelet transform are passed through dead zone quantization which rejects low magnitude values of transformed coefficients lying around zero. These quantized coefficients are then encoded by lossless set partitioning used in hierarchical trees compression approach. The introduction of dead zone quantization in the proposed technique is found to be effective and yields a increased compression ratio of 10.33 with decreased distortion value of 1.04 percent for ECG record 117 of MIT-BIH arrhythmia database.

Development of a wearable social distancing device using ultrasonic sensors

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Abstract

Over the past year and a half, the globe has been facing the deadly Coronavirus disease (COVID-19), which is caused by the SARS-CoV-2 virus. COVID-19 can affect anyone at any age and cause serious illness or death. World Health Organization (WHO) recommends staying a minimum of one meter away from others to reduce transmission to stop and hinder transmission, which is known as social distancing. The government's directives or its guidelines are not followed by the people, which is unfortunate. Proximity sensors and ultrasonic sensors are used to measure distances between users and other people, so that an audio alert is generated if the distance is less than a predetermined limit. The Mobile Application displays the user's body temperature measured via a temperature sensor through Bluetooth.

Efficient Cardiac Arrhythmia Detection Using Machine Learning Algorithms

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Abstract

The most common type of chronic and life-threatening disease is cardiovascular disease (CVD). For the early prediction of arrhythmia, electrocardiogram (ECG) is recorded from the patients, non-invasively using surface electrode. In this approach, Empirical Mode Decomposition (EMD) is performed for noise removal followed by Pan Tompkins algorithm for feature extraction. To reduce the amount of signal characteristics and computation time, Principal Component Analysis (PCA) is utilized. Finally, two classifiers, The Support Vector Machine (SVM) and the Naive Bayes (NB) classifier is used to determine the cardiac abnormality from the ECG signal. The comparison is made between the two classifiers and their accuracy will be analysed. We obtained 89% accuracy for SVM and 99% for NB classifier. Lakhs of samples will be available in the Physionet. The amplitude of the signal is 0.1 Mv and time period (T) is 10ms and the frequency of 100Hz. The Confusion Matrix can then be used to assess how well an ECG signal is performing. A MATLAB program is used which has the capacity to observe the ECG bio-signal on a computer.

TRACK 9

DESIGN OF A MOBILE APPLICATION FOR THE VACCINATION REGISTRY OF CHILDREN UNDER 5 YEARS OLD

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Abstract

Information and communications technologies are allowing to improve the development of certain processes with the intention of optimizing the handling of information and making its application easier and more practical for users, in this sense, mobile applications are causing Many tasks that were previously carried out physically can now be carried out virtually, being always available. In our particular case, for the vaccination control process in children, where the vaccines administered to them over the first 5 years are recorded, in order to administer a vaccine, it is necessary that the mother or guardian can always carry the vaccination card, to know the history of the vaccines, in many cases the card deteriorates or is lost causing problems for both parents and health personnel, because there is no information on the history of the vaccines, this lack of information can lead to problems in the quantity of vaccines given to children. In the present work we develop a mobile application called Children's Vaccine, with the purpose of registering and storing vaccine data, such as the type of vaccine, the date of vaccination, the place of vaccination, as well as relevant information for the management of vaccines, the developed prototype was implemented in the Health Center: Juan Pablo II Maternal and Child Center located in the District of Villa el Salvador, in Lima, Peru, in order to improve the quality of care service, the The proposal presents favorable results, helping to reduce the technological gap and democratizing technology, for the benefit of the most vulnerable population such as children, the tests carried out provide ease in being able to visualize the information of the vaccines by parents and health personnel. The proposal is applicable and scalable for various health centers. We present results as performance tests to measure the influence of the application in the vaccination process, this evaluation was carried out by means of an observation sheet with the comparison of records before the use of the application called "pretest" (vaccination registration process without the application that is to say in a classical way) and with the use of the application called "post-test" (with the application), these results being relevant to verify the functionality and usefulness of the application.

METHOD FOR REGISTRATION OF VACCINES FOR COVID 19, THROUGH NFC TECHNOLOGY

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Abstract

In these times of pandemic caused by Covid-19, new ways of dealing with the effects of the virus emerge, for this reason multiple measures are being carried out with the intention of mitigating its effects in the event of a possible contagion, which is why vaccinations are being carried out massive in order to be able to defend oneself against potential contagions, in this work an application made using the NFC communication protocol that mobile devices have is shown, as a result the demonstration of the use of the application is presented, where it reflects the data to be entered and can be viewed from any device.

METHODOLOGY FOR THE MULTICHANNEL RECORDING OF UPPER LIMB MUSCLE ACTIVITY

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Abstract

In the study of the functioning of the muscle, the study standard is to be able to analyze its behavior or functioning, this behavior is represented by a continuous signal where the muscle signal can be recorded and visualized, to perform this registration a designed circuit is required For the capture of electromyography signals, there are many options of these circuits in the market, depending on the application, the part of the body that is required to be analyzed, the best option can be chosen, in this work, we present a methodology for recording in Simultaneous 8 signals, for the characteristic use of the arm muscles, due to its special shape, which allows it to be placed in the form of a bracelet, the signals that are acquired simultaneously and individually, can be used in many applications depending on the problem and challenge, recommending for use on the arm and providing a clean signal allowing Being used in the design of detection mechanisms for some pathologies related to the arm muscles and in the design of control mechanisms for the design of prostheses.

METHODOLOGY FOR MUSCLE RECOVERY, THROUGH MOTOR IMAGERY TECHNIQUES APPLYING VIRTUAL REALITY

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Abstract

Recovery of movement is a long and hard process for patients. One of the most common problems that occurs is the so-called "phantom limb", which induces the body to feel strange due to the failure to use the injured limb. This process is due to the lack of use of the leg that in most cases is fractured and the long recovery time, so the use of crutches makes the body in conjunction with the brain understand that normal movement of the body is with the leg suspended and always with the help of crutches. In the present work a technique for the retraining of the brain is presented by means of which the brain is taught through the presentation of images if it corresponds to the right and left side of the arms and legs. This retraining makes it possible for the brain to understand the coordinated movement between the arms and legs. In addition to the use of virtual reality, through the OCULUS GEST II lenses, allowing maximum concentration, the results allow to improve the recovery time of patients, the technique can be used both in rehabilitation centers and in the patient's own home patient.

LOW COST SYSTEM FOR RECORDING MUSCULAR ACTIVITY THROUGH INTERACTION WITH VIDEO GAMES

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Abstract

At present, information and communication technologies are acquiring considerable importance in all people's actions, from education, work and with a greater emphasis on health, mainly in the area of rehabilitation. It is in this area of knowledge that many applications arise based on the use of hardware and software that try to help medical diagnosis, in this work a method is presented to be able to record the muscular activity of any muscle, through the MyoWave device which records the muscular activity of a single muscle, because it has a single acquisition channel, in times of pandemic, it is difficult to take children to rehabilitation centers, the video game console "Nintendo Switch" is used so that the child can interact, by way of performing the exercises as if they were rehabilitation exercises, the video game "Just Dance" is proposed, where the child performs the game, but in reality he is performing rehabilitation exercises, the choice of dance will depend on the age and taste of the child, the method is practical, because the game can be achieved without problems and the recording of the activity of the muscle to be studied can be recorded. Using any data acquisition system, the method was tested with a 6-year-old child, achieving the performance of the exercise as well as recording the EMG signal of the muscle.

PROCEEDINGS OF 2022 EIGHTH INTERNATIONAL CONFERENCE ON BIOSIGNALS, IMAGES AND INSTRUMENTATION (ICBSII 2022)

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, through research.

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 save lives.

The Seventh International Conference on Bio Signals, Images and Instrumentation (ICBSII-2021) 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 103 papers. After a rigorous review process by an expert review committee, 24 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 they 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 facul- ty members and motivated students. Department also has foreign collaborations which includes Birmingham City University, UK, Drexel University Philadelphia, and several industries such as L&T Medical System, Sri Ramachandra Medical College, Indian Biomedical Skill Consortium (IBSC),NIEPMD. Department has successfully conducted a retreat on “How to make India ready for 21st Century Medical device revolution?” with International and National delegates presenting their views on the topic. To add feather to the crown, the department has conducted three International conferences (ICBSII) in 2013, 2015, 2017, 2018, 2019, 2020, 2021 and two national conferences (NCABES) in 2014, 2016.