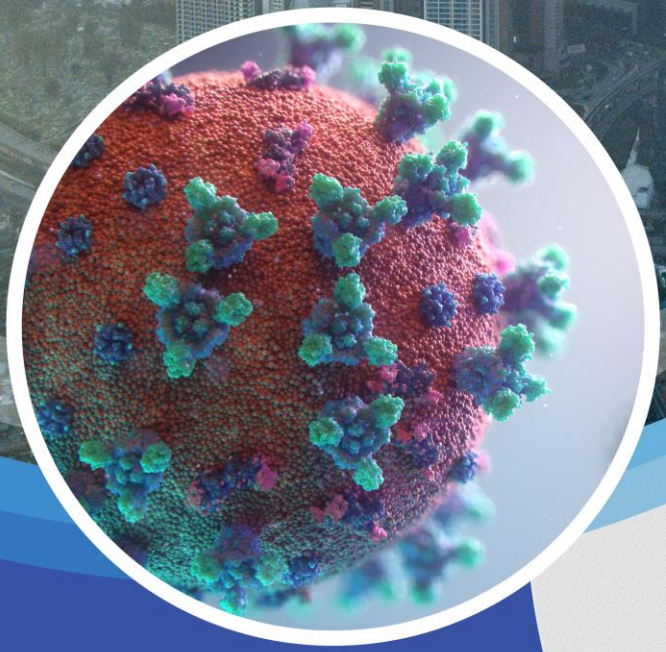
biomed 2021

ENGINEERING FUTURE HEALTHCARE

6th KUALA LUMPUR INTERNATIONAL CONFERENCE ON BIOMEDICAL ENGINEERING 2021

VIRTUAL CONFERENCE



PROGRAM AND ABSTRACT BOOK

28 - 29 JULY 2021

EDITED BY

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Official website:
https://umevent.um.edu.my/BIOMED2021

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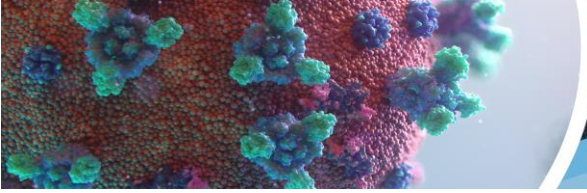

Foreword

On behalf of the Organizing Committee, we are honored and delighted to welcome you to the 6th Kuala Lumpur International Conference on Biomedical Engineering (BioMed2021) after a decade-long hiatus. We are proud to be able to host this virtual conference amidst the global outbreak of the Covid-19 pandemic.

The BioMed2021 Virtual Conference aims to promote the latest research and developments related to the integration of Engineering technologies in the fields of medical and life sciences. The virtual conference brings together leading academic icons, researchers, and industrial representatives to exchange and share their knowledge and research results in the latest innovations, research trends and concerns, challenges and adopted solutions in the field of Biomedical Engineering. This conference will be one of the platforms for us to share our thoughts and exchange ideas with leading researchers from different parts of the world.

The BioMed2021 Virtual Conference is organized by the Department of Biomedical Engineering, University of Malaya in cooperation with the International Federation for Medical and Biological Engineering (IFMBE). We are truly delighted to receive the endorsement from the Malaysia's Society of Medical and Biological Engineering (MSMBE) and supports from the Centre for Applied Biomechanics (CAB) and the Centre for Innovation in Medical Engineering (CIME). Special thanks go to our sponsors Abex Medical System Sdn Bhd, Malaysia and BioApps Sdn Bhd, Malaysia, and to Springer for supporting the publication of the conference proceedings.

My highest appreciation goes to all the honorable plenary speakers, the forum panels and the expert talk speakers for making this conference a globally recognized event. I take this opportunity to extend my heartfelt gratitude to the BioMed2021 organizing committee members for their enthusiasm, commitments, dedications and hard work, and the distinguished International Advisory Committee members for their invaluable support and assistance. Last but not least, I would like to thank all the authors, the reviewers, session chairs and the delegates for their contributions and participation. The conference will not be a success without your expertise and active participation.

To all participants of BioMed2021, we hope that this conference will foster the exchange of new ideas and networking among researchers along with the joyful academic experience of BioMed2021.

Dr. Juliana Usman
Conference Chair

Welcome Address

Dear Presenters, Participants & Esteemed Readers,

It is with great honor we welcome you to the 6th Kuala Lumpur International Conference on Biomedical Engineering 2021 (BioMed2021) held virtually on 28th and 29th July 2021. The theme for BioMed2021 virtual conference is "Engineering Future Healthcare". This conference provides a platform to promote the latest research and developments related to Engineering technology in medical fields and life sciences. The objective of the conference is to encourage the sharing of knowledge, expertise, medical technologies updates and scientific discussions by bringing together leading academic icons, researchers, engineers, early career academics, industrial representatives, and research students. We would like to express our gratitude for your participation and valuable contribution, and sincerely hope that you will enjoy the two days of presentations, forums, and networkings. We strongly believe that the knowledge you have shared will help and develop the field of Biomedical Engineering. We hope this event will spark new ideas, give new impetus to stimulate additional studies and research collaborations, and bring Biomedical Engineering to the next higher level!

Ir. Dr. Nasrul Anuar Abd Razak
Conference Director

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Program Schedule

Overview of 2 Days Program

DAY 1	28th July 2021 (Wednesday)
9:00 – 12:30 p.m.	Parallel Sessions - Oral Presentations - Live
12:30 – 1:30 p.m.	Plenary Speaker – Prof. Dr. Ng Kwan Hoong (Malaysia) – Live *Chair: Assoc. Prof. Dr. Nahrizul Adib Bin Kadri*
1:30 – 2:00 p.m.	BioMed Expert Talks – Pre-recorded Corporate Message from Abex Medical System Sdn Bhd
2:00 – 3:00 p.m.	Opening Ceremony – Live *Emcee: Pn. Norita Binti Mohd Zain*
3:00 – 3:30 p.m.	BioMed Expert Talks – Pre-recorded Corporate Message from BioApps Sdn Bhd
3:30 – 4:30 p.m.	Forum: Wearable Sensor Systems: From Enabling Technology to Biomechanical Applications – Live *Moderator: Dr. Nooranida Binti Arifin*
4:30 – 5:30 p.m.	Plenary Speaker – Scientia Prof. Dr. Nigel Lovell (Australia) – Live *Chair: Assoc. Prof. Ir. Dr. Lim Einly*

DAY 2	29th July 2021 (Thursday)
9:00 – 10:00 a.m.	Plenary Speaker - Prof. Dr. Rajendra Acharya (Singapore) – Live *Chair: Dr. Juliana Usman*
10:00 – 12:00 p.m.	Parallel Sessions - Oral Presentations – Live
12:00 – 1:00 p.m.	Plenary Speaker - Prof Dr. James Goh (Singapore) – Live *Chair: Assoc. Prof. Ir. Dr. Ting Hua Nong*
1:00 – 2:00 p.m.	BioMed Expert Talks – Pre-recorded Corporate Messages from Abex Medical System Sdn Bhd & BioApps Sdn Bhd
2:00 – 3:00 p.m.	Plenary Speaker - Prof. Dr. Raymond Tong (Hong Kong) – Live *Chair: Assoc. Prof. Dr. Nur Azah Binti Hamzaid*
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Parallel Sessions for Oral Presentations

Day 1 (28th July 2021 Wednesday)

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Plenary Speakers

28th June 2021, Wednesday **Time: 12:30 p.m.** **Live**

Prof. Dr. Ng Kwan Hoong is a Professor at the Department of Biomedical Imaging, University of Malaya. Kuala Lumpur, Malaysia. He received his M.Sc. (Medical Physics) from the University of Aberdeen and Ph.D. (Medical Physics) from the University of Malaya. He is certified by the American Board of Medical Physics. He is a Fellow of the Institute of Physics, the International Organization for Medical Physics (IOMP), and the Academy of Sciences Malaysia. His main research contributions are in breast imaging, radiation dosimetry, computer applications in medicine, and risk communication. He is actively collaborating with international research groups on breast density, image processing, radiation dosimetry, and radiogenomics. Prof. Ng has authored/ co-authored over 260 papers in peer-reviewed journals, 80 conference proceedings papers, 25 book chapters, co-edited 8 books. He has presented over 550 scientific papers: more than 300 of them are invited lectures. He has served in the editorial board and advisory board for more than 12 journals. Prof. Ng has been teaching and supervising students in both medical physics and biomedical engineering. In 2013, Prof. Ng was honoured as one of the top 50 medical physicists in the world by the IOMP. N June 20198, he received the prestigious IOMP Marie Sklodowska Curie Award at the World Congress 2018, Prague.

Plenary Title: Technologising in the era of COVID-19

Technological innovation in healthcare has accelerated since the beginning of the COVID-19 pandemic. In this talk, I will discuss the innovations to solve various health issues. They are telehealth, data analytics / artificial intelligence, hardware, COVID-19 testing devices and COVID-19 vaccine development with selected examples. Various initiatives by the international, professional, industrial and commercial organizations will be highlighted. It is pertinent that we reflect on the creativity, resilience, courage, perseverance of the biomedical engineers, scientists and many others who have labored to bring such technologies to fruition. We hope to learn from these successful innovations to bring about the common good for all humanity, as well as contributing to the recovery and rejuvenation.

28th June 2021, Wednesday **Time: 4:30 – 5:30 p.m.** **Live**

Scientia Prof. Dr, Nigel Lovell B received the B.E. (Hons) and Ph.D. degrees from UNSW Sydney, Australia. He is currently at the Graduate Scholl of Biomedical Engineering UNSW Sydney where he holds a position of Scientia Professor and Head of the School. He has authored 280+ journal papers and been awarded over $82 million in R&D and infrastructure funding. Over his career has mentored 70 PhD students and delivered more than a hundred keynote presentations. He is a Fellow of seven learned academies throughout the world including the IEEE and AIMBE. His research work has covered areas of expertise ranging from cardiac and retinal modelling medical informatics and data analytics especially related to telehealth technologies, biological signal processing, and visual prosthesis design. Through a spin-out company from UNSW, TeleMedCare Pty. Ltd., that he co-founded he has commercialized a range of telehealth technologies for managing chronic disease and falls in the older population. He is also one of the key researchers leading an R&D program to develop in Australia a retinal neuroprosthesis or 'bionic eye'. For 2017 and 2018 he was the President of the world's largest biomedical engineering society – the IEEE Engineering in Medicine and Biology Society.

Plenary Title: Biomedical Engineering Contributions in COVID-19 Times

As a response to the increasing burden of chronic disease and the ageing population on health care expenditure, considerable focus has been placed on appropriate technologies for promoting self-care and for supporting ageing-in-place. Such technologies are even more critical in the face of emerging health threats such as the COVID-19 pandemic. A number of medical device technologies aimed at relieving the burden of disease and improving quality of life will be explored. These devices, developed at the Graduate School of Biomedical Engineering (GSBmE), UNSW over the past two decades include telehealth monitoring and decision support systems for chronic disease management; wearable ambulatory technologies based around triaxial accelerometry for estimating risks of falling and for automatically detecting falls; and a range of neural interface technologies for restoring and potentially augmenting sensory loss. The talk will also highlight the future of implantable, wearable and telehealth technologies in future models of patient care and health service delivery especially in the current global pandemic.

29th June 2021, Thursday **Time: 12:00 – 1:00 p.m.** **Live**

Prof. Dr. U. R. Acharya, PhD, DEng is a senior faculty member at Ngee Ann Polytechnic, Singapore. He is also (i) Adjunct Professor at University of Malaya, Malaysia, (ii) Adjunct Professor at Asia University, Taiwan, (iii) Associate faculty at Singapore University of Social Sciences, Singapore and (iv) Visiting Professor at Kumamoto University, Japan. He received his Ph.D. from National Institute of Technology Karnataka (Surathkal, India) and DEng from Chiba University (Japan). He has published more than 500 papers, in refereed international SCI_IF journals (345), international conference proceedings (42), books (17) with more than 27, 000 citations in Google Scholar (with h-index of 86), He has worked on various funded projects, with grants worth more than 5 million SGD. He is ranked in the top 1% of the Highly Cited Researchers for the last four consecutive years (2016, 2017, 2018, and 2019) in Computer Science according to the Essential Science Indicators of Thomson. He is o the editorial board of many journals and has served as Guest Editor for many journals. Hid major academic interests are in Biomedical Signal Processing, Biomedical Imaging, Data mining, Visualization and Biophysics for better healthcare design, delivery and therapy.

Plenary Title: Application of machine learning methods for automated detection of ASD

Autism Spectrum Disorder (ASD) is a neurobiological disorder that affects children's behavior, social interaction, and communication. This is due to the abnormal brain wiring in autistic individuals which causes a reduction in learning rate and language impairment. ASD is influenced by a variety of factors from genetic to environmental such as exposure to radiation during pregnancy. Globally, 1 in 160 children is expected to have ASD, and boys are generally five times more likely to suffer from ASD as the mutation causing autism is found in the X chromosome. Hence, the mutation became dominant in males who possess XY chromosomes, and recessive in females if the mutation exists in only one of the XX chromosomes.

Fortunately, learning therapies are available to enhance neural connectivity and improve social communication. Learning therapies are extremely important for ASD children who are entering the adolescence stage as hormonal changes during puberty have a direct effect on brain development, thereby enhancing their speech integration ability. Thus, early diagnosis and intervention are crucial for ASD children to improve their quality of life and facilitate faster integration into society.

Currently, diagnosis of ASD relies on clinical assessment to determine if children possess ASD symptoms such as abnormal behavior and lack of interactive skills. However, the heterogeneous nature of ASD increases the difficulty for early diagnosis of ASD children, resulting in delayed treatment. Therefore, this warrants the need for a much more sensitive and reliable diagnostic tool that relies on biomarkers instead of clinical features. Electroencephalograms (EEG) which reflect the activity of the brain serves as a potential biomarker for ASD diagnosis. As such, researchers have explored a variety of machine learning models to detect ASD patients using EEG signals. These machine learning models extracted salient features from the EEG recordings to train their classifier to recognize abnormal EEG patterns pertaining to ASD. Many machine learning studies have yielded good performance for automated ASD detection based on EEG, hence reflecting its potential as a powerful diagnostic tool that can be used as an adjunct tool by the clinicians to confirm their manual screening.

29th June 2021, Thursday **Time: 12:00 – 1:00 p.m.** **Live**

Prof. Dr. James Goh is Professor in the Department of Biomedical Engineering, Faculty of Engineering, National University of Singapore (NUS) and Research Professor in the Department of Orthopaedic Surgery, Yong Loo Lin School of Medicine, NUS. Prof Goh is the President of the International Union of Physical and Engineering Sciences in Medicine (IUPESM), Past-President of the International Federation of Medical and Biological Engineering (IFMBE) and President of the Biomedical Engineering Society (Singapore). He is Fellow of the Institute of Engineers, Singapore (IES) and chairs IES' Technical Committee on Biomedical Engineering (AIMBE) as well as Fellow of the ASEAN Academy of Engineering and Technology (AAET). He is a member of the Biomedical and Health Standards Committee (BHSC) and chairs its Technical Committee on Medical Devices. Prof Goh has been actively involved in organizing international conferences and had served on numerous International Advisory Boards and Scientific Committees. He chaired the World Congress of Biomechanics (2010), TERMIS-AP (2011) and ICBME (2015). Prof Goh has a strong research interest in musculoskeletal tissue engineering research and actively promotes the field of biomedical engineering.

Plenary Title: Silk-based Biomaterial for Tissue Regeneration

Innovative approaches to different fields within biomedical engineering and life sciences have largely been biologically inspired. This is especially so in the field of tissue engineering and regenerative medicine, whereby researchers have looked upon nature for inspiration in strategies and design parameters for scaffold materials and architectures for specific tissues. Biopolymers have been largely studied and silk fibroin has shown to be an excellent example due to its unique molecular and supra-molecular structure, its customizable ligands-based bioactivity, its ability to self assembles and its ability to be manipulated into various forms and structures. There exists an array of techniques to process silk fibroin into various forms with tailored mechanical and biological properties, to provide the necessary cellular, architectural, and chemical cues for the specific tissue types. The material can be processed into powders, films, gels, sponges, foams, yarns, knitted, woven mats as well as 3D printable bio-inks for various interesting tissue engineering applications. Numerous research have investigated applying the material in regeneration of tissues such as bone, cartilage, tendon & ligament, intervertebral discs, skin and cardiovascular tissues. However, limitations persist in its widespread use due to source-based variations and lack in standardization of processing protocols.

29th June 2021, Thursday **Time: 2:00 – 3:00 p.m.** **Live**

Prof. Raymond Kai-Yu Tong is the Professor and Chairman in the Department of Biomedical Engineering, the Chinese University of Hong Kong. His research interests include Rehabilitation Robotics (e.g. Hand of Hope), Brain-Computer Control Interface (BCI), Neural Engineering, Medical Neuroimaging, Functional Electrical Stimulation (FES) and Cognitive Assessment Software. Projects have been funded by Innovation and Technology Fund and UGC CERG/GRF as principal investigator. His research, innovation and service have received Awardee of the 2013 Ten Outstanding Young Persons (Hong Kong); the Grand Prix Award (the highest honor) of the International Exhibition of Inventions of Geneva 2012; Winner Award(e-Health) (the highest honor) in the Asia Pacific ICT Award 2012; and HKIE innovation awards for young members (2008), gold awards in international invention exhibitions (2004, 2007, 2010, 2015, 2016). Webpage: http://www.bme.cuhk.edu.hk/kytong

Plenary Title: Innovation in Stroke Rehabilitation: Reconnecting and Rewiring the Brain and Limbs

Neuroplasticity refers to the brain's ability to form new connections throughout life, which is particularly evident in response to stroke. Brain lesions are a long-term consequence of stroke, resulting in deficits in language, motor, or cognition, depending on the lesion location. Through neuroplastic processes, the lesioned brain can reorganize its structure, function, and connections to adapt to such damage. Innovations in stroke rehabilitation may facilitate reconnect and rewire the brain and limbs. We investigate the characteristics of brain waves (EEG), brain activities (fMRI) and muscle activities (EMG) related to the paretic upper limb movements after stroke. Understanding how brain structure and function reorganize after stroke is crucial in managing stroke recovery. Then we developed interactive control strategies to control different rehabilitation training systems for hand training in clinical trials, such as functional electrical stimulation (FES) and rehabilitation robot (Hand of Hope). The system incorporated the EMG and EEG as the bio-parameters to indicate the voluntary effort from a subject. We applied these engineering-based technologies in the field of Neurorehabilitation, robotic system to provide external assistive force during the rehabilitation training. The clinical studies showed functional improvement in the clinical outcome measures on the upper limb and lower limb after the exoskeleton robotic training for 20-session on stroke survivors, and changes have been observed in the resting-state functional MRI (rs-fMRI).

Forum Panels

Wearable Sensor System: From Enabling Technology to Biomechanical Applications

28th June 2021, Wednesday 3:30 – 4:30 p.m.

Assoc. Prof. Dr. Mohd Haidzir Abd Manaf
UiTM, Malaysia

Assoc Prof Dr Haidzir Manaf is the Head at Centre of Physiotherapy, Faculty of Health Sciences, Puncak Alam Campus, Universiti Teknologi MARA (UiTM). He obtained his PhD from UiTM in 2015, BSc (Hons) in Applied Rehabilitation (Physiotherapy) from the University of Teesside in 2007, Diploma in Physiotherapy from UiTM in 2002, and work as a physiotherapist for 6 years in University Malaya Medical Centre. He left his clinical practice and joined UiTM in 2008 till now.
A.P Dr Haidzir is also the President of Malaysian Physiotherapy Association. He has involved in various national and international games as Classifier such as ASEAN Paragames, 2017, SUKMA PARALYMPIC 2014 and World Archery Championship, Bangkok. His research interest includes neurological rehabilitation and gait analysis.

Assistant Professor Che-Wei Lin
National Cheng Kung University, Taiwan

Assistant Professor Che Wei Lin graduated with B.S. Electrical and Control Engineering in 2006. He completed his M.S in Information Technology in University of Milan, Italy and later his Ph.D in Electrical Engineering in National Cheng Kung University (NCKU), Taiwan. He has been as Assistant Professor in the Department of Biomedical Engineering, NCKU since 2011. His research interests are in the Artificial Intelligence and Machine Learning-based, Wearable Device Design and Virtual Reality Medical-based Assistive System. He has won various awards of new Instrument and Innovation in Taiwan such as Taiwan AI & Robotics Accelerator (TAIRA), Young Designers' Exhibition and Team Supervisor in Global Student Innovation Challenge-Rehabilitation Engineering and Assistive Technology, 2020.

Medical Device Industry: Opportunities for Innovations

29th June 2021, Thursday 3:00 – 4:00 p.m.

Dr. Hyzan Mohd Yusof
Chief Executive Officer
OSA Technology Sdn. Bhd.

Dr Hyzan is an orthopaedic surgeon and currently practising at the Sunway Medical Center. He also is an Associate Professor in Hospital Universiti Kebangsaan Malaysia (HUKM) under Orthopaedics Department. Involve in humanitarian and relief works in Malaysia and various countries such as Pakistan, Syria, Indonesia, Afghanistan and more to help during important disaster. He is the CEO of OSA Technology Sdn Bhd, a company that producing locally the basic trauma products such as orthopaedic trauma implants and instrumental sets. Having their own manufacturing plant is a real advantage because they acquire the learning processes to produce the best quality products.

Prof. Ir. Dr. Fatimah Ibrahim
Advisor
Center for Innovation in Medical Engineering (CIME)

She was the founder and currently the advisor of the Center for Innovation in Medical Engineering (CIME), as well as the former director of the University of Malaya Centre of Innovation and Commercialization (UMCIC). Under her leadership, she introduced UM Deep Tech (UMDT) UMCIC program and nurtured 14 research towards university spin-off company. She received training on commercialization and technology transfer from Oxentia Oxford's Global Innovation Consultancy and University of Cambridge Enterprise and the University of Nottingham. She owns 18 Intellectual Property Rights; and two of her Patents have been commercialized. Her SMARTMF innovation received Malaysia Commercialization Award (MCY) in 2020, and UM Excellence Awards (ACUM) in 2019. In fact, she has delivered many talks on technology transfer. She was the consultant for leaders on innovation under the Technology Transfer Implementation program organized by the Royal Academy of

Engineering, United Kingdom. Under the program, she has given a talk and shared a module on 'Sustainability in Technology Transfer' for the British Council and Ministry Of Education Malaysia, and Technology Transfer Landscape, Settings, and Best Practices in Malaysian Universities.

Puan Salbiah Yaakop
Ketua Penolong Pengarah Kana
Cawangan Garis Panduan
Medical Device Authority

Puan Salbiah Binti Yaakop graduated with a BSc in Biomedical Engineering from Marquette University, USA in 1992. She has more than 27 years of working experience. She is currently the Senior Principal Assistant Director in the Guidelines Division of Medical Device Authority. Here, her main functions are development of policies, guidance documents, guidelines, regulatory documents; managing international affairs and inter-agency agenda, industry assistance, events and specific projects: performing registration and licensing evaluations and verifications; and giving trainings and consultancy. She is currently the Chairperson of various Guidance Document Development Committees in Medical Device Authority, and AHWP WG & Chair on Standards for Medical Devices. She is also a member of various Industry Standards Committees, Technical Committees, and Working Groups related to medical devices in the national standards system.

Ts. Dr. Ng Sing Kwei
Vice President, Strategy & Investment
Cradle Fund Sdn. Bhd.

Dr. Ng is well experienced in the translation of R&D investment into revenues. He is analytical, creative and is well experienced in early stage investment, technology evaluation, market due diligence and facilitation of commercialisation activities. A graduate from Manchester Metropolitan University, Dr. Ng has more than 13 years' experience in innovation and technology investment.

As the Vice President of Strategy & Investment, Dr. Ng holds overall responsibility in assessing organizational performance, developing achievable goals and implementing processes that improve organizational effectiveness and build a sustainable competitive advantage. He is also equally responsible for a multitude of responsibilities under Cradle investment portfolio.

Before joining Cradle, he was the Head of Technology Commercialisation at PlaTCOM Ventures Sdn Bhd, a wholly owned subsidiary of Agensi Inovasi Malaysia (AIM). He managed a national funding programme for SMEs, overseeing a portfolio of RM 100 Million commercialisation fund under PlaTCOM. He also led the consultancy and capacity building division. He administered the evaluation of new technologies through technical & market due diligence, identification of investment risks and business planning analysis. Dr. Ng is a Registered Technology Transfer Professional (RTTP). He is well experienced in grasping technology and business concepts quickly and helps translate them into practical commercial solutions that are commercially viable. He focused on providing essential services nationwide to commercialise technologies developed by local universities, other federal agencies as well as private entities.

Before returning to Malaysia, Dr. Ng worked as a Knowledge Transfer Associate under the Knowledge Transfer Network (KTN) in the UK. Dr. Ng holds a PhD in Microwave Instrumentation from Manchester Metropolitan University (United Kingdom) and a Bachelor of Electronic & Telecommunication Engineering from Universiti Teknologi Malaysia (UTM).

Expert Talks & Corporate Messages

Day 1 (28th July 2021 Wednesday)

Parallel Sessions 1:30 – 2:00 p.m.

Room 1: Dr. Wan Safwani Wan Kamarul Zaman

Title: Stem Cells Technology: The Hope, The Hype and The Reality

Room 2: Ir. Dr. Nasrul Anuar Abd Razak

Tilte: Virtual Rehabilitation for Upper Extremities and Prosthetics' User During Pandemic Covid-19

Room 3: Dr. Farina Muhamad

Title: Current Advances in Tissue Engineering

Room 1-3: Corporate Message from Abex Medical System Sdn Bhd

Parallel Sessions 3:00 – 3:30 p.m.

Room 1: Assoc. Prof. Dr. Nahrizul Adib Kadri

Title: Electrophysiological Characterization of Mesenchymal Stem Cells Using DEP

Room 2: Prof. Ir. Dr. Noor Azuan Abu Osman

Title: RoMicP© Foot Prosthesis - A new generation of robotic prosthetics will be for everyone

Room 3: Norita Mohd. Zain

Title: Carbohydrates: From Food to Biomedical Applications

Room 1-3: Corporate Message from BioApps Sdn Bhd

Day 2 (29th July 2021 Thursday)

Parallel Sessions 1:00 – 2:00 p.m.

Room 1: Dr. Salmah Karman

Title: MIP Based Biosensor for Halal Status Monitoring in Food Product Supply Chain

Room 2: Ir. Dr. Mas Sahidayana Mohktar

Title: Biomedical Engineering: A STEM career Path with A Bright Future

Room 1-2: Corporate Message from Abex Medical System Sdn Bhd

Room 1: Dr. Mohd Yazed Ahmad

Title: Wireless Power Transfer for Biomedical Devices

Room 2: Assoc. Prof. Dr. Nur Azah Hamzaid

Title: Touching Lives Through Biomechatronics: When Specialist and Generalist Unite

Room 1-2: Corporate Message from BioApps Sdn Bhd

Room 1: Prof. Ir. Dr. Fatimah Ibrahim

Title: Microfluidics CD and BioMEMS in Medical Applications

Abstracts for Oral Presentations

Day 1 (28th July 2021 Wednesday)

Parallel Session Room 1 *(AI & Computational Modelling)*

Chair: Prof. Alberto Avolio

Paper ID: 19 9:00 a.m.

Formulation of Sensor Ranking Associated in Categorical Perception: A Pilot Study Using Machine Learning

Abdul Rauf A Bakar[1][0000-0001-8173-9496], Khin Wee Lai[1][0000-0002-8602-0533](✉), Nur Azah Hamzaid[1][0000-0002-4277-2813]

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The concept of categorical perception has been enormously investigated to digitalize the process of auditory processing when perceiving speech stimulus at higher brain neurological signal. Despite the nature non-stationary property of electroencephalography (EEG) during any task processing, scientists and clinicians find it to be not well fitted in the healthcare setting application without professional monitoring, and even worst, the hearing aid device functionality was also reported at a low success rate. In this study, we embraced machine learning technology and extracting contribution into our auditory research area. The present pilot work aims to create a robust computational framework to formulate the sensor ranking principle in auditory speech perception. The ranking for sensors could facilitate in identifying the minimal set sensor-of-interest (ROI) that are sufficient in specific auditory task processing using an optimally trained model. The trained Support Vector Machine (SVM) highest performance reported at random 2 training dataset with scoring of 92.3% using 70% triple-random training dataset. Based on the sensor ranking, the C_Z electrode outperformed the other electrodes with scoring of 96.74%, followed by P_Z and F_{PZ} for the 2nd and 3rd rank (95.66% and 95.34% respectively). Our pilot study anticipated that the sensor ranking formula able to underline more precise neural correlates based on current auditory categorical perception response. The excellence sensor ranking in delivering a minimal set of sensor-of-interest (SOI) drive the capability of the SVM model in classifying auditory brain response in high-performance prediction metrics and possible reliability in the healthcare setting application.

Paper ID: 44 9:15 a.m.

Analysis of Carotid Artery Ultrasound Images Using Gabor Filter, Maximally Stable Extremal Regions and Convolutional Neural Network

Soumyajyoti Dutta[1], Viththal Khandelwal[1], Rohan Sood[1], Samiappan Dhanalakshmi[1,2] [0000-0002-6970-2719](✉), Latha Subbiah[1]

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Stroke is considered as one of the leading reasons for death at present. The presence of plaque in the carotid artery (CA) is a factor that can be utilized to foresee the risk of diseases related to it (such as cerebral ischemia). Due to fat deposition or plaque formation in the wall of Carotid Artery, blood circulation system gets damaged resulting change in blood flow to brain. For a period of time, an increase in deposition can totally obstruct blood flow resulting reduced patency of the lumen. The purpose of this article is to provide a comprehensive overview of procedures used to investigate the carotid artery for the aim of detecting stroke, atherosclerosis, and other cardiovascular diseases which primarily suggests detection of wall thickening or plaque formation the lumen. For morphological evaluation of CA, ultrasound imaging has been the most clinically useful process. We go through the strategies for artery wall monitoring, intima–media segmentation, and lumen segmentation, which aids in determination of the magnitude of mentioned disease. The report images tend to contain speckle noise due to the photographic modality's properties, which degrades image clarity. For image denoising, the Anisotropic Diffusion Filter was used. Denoising techniques which prioritize edge preservation and have an edge seeking function as the diffusion coefficient is more accurate for the files to be examined for this study. A detailed parametric study of some filtering techniques is considered as the first step towards the approach. The second step of the process is feature extraction of the datasets. Two different approaches have been listed to round out this study. This includes maximally stable extremal regions (MSER), local binary pattern (LBP), image matrix study of region of interest (ROI) and application of Gabor Filter. The supporting argument regarding the recommended feature extraction process is strengthened by training a Convolutional Neural Network (CNN) model with the created database.

Paper ID: 48 9:30 a.m.

A Combinational Approach to Generate Nonlinear Foot Trajectories for Robotic Prosthesis with Elementary Clinical Results

Mouaz Al Kouzbary[1[0000-0001-9678-875X]], Hamza Al Kouzbary[1[0000-0001-6597-1041]], Lai Kuan Tham[1[0000-0002-8636-3552]], Jinjing Liu[1[0000-0001-6015-3867]], Hanie Nadia Shasmin, Nooranida Arifin, Noor Azuan Abu Osman[1[0000-0002-2853-4421]](✉)

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One problem in the field of robotic prostheses' control is the generation of dynamic trajectories to be tracked by a low-level control system. In this work we are suggesting a combinational approach to estimate the foot trajectory for a robotic below-knee prostheses. The two-stage estimation is to identify foot angular speed based on tibia angular speed and acceleration using cascade neural network (CNN). Then, the foot angular position will be estimated from the first stage estimation using nonlinear autoregressive network with exogenous inputs (NARX). In this paper we are presenting the elementary results from a clinical trial for long distance treadmill walking. The two-stage method shows an average correlation of 0.986 in three walking speeds. Moreover, the average of root mean square errors (RMSEs) and mean absolute errors (MAEs) are 0.0517 and 0.0403 (rad), respectively. The result only shows the performance of the estimation method for one healthy participant. However, more analysis is required on the method ability to provide generalized subject-independent trajectories.

Paper ID: 57 9:45 a.m.

Eye-Controlled Wheelchair Improves Quality-of-Life on Paraplegic Patients in Home-Care Setting: A Case Study

Kamala Krishnan[1(✉)], Tan Lee Fan[2], Danny Ng Wee Kiat[2]

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A powered wheelchair is usually controlled with a joystick, but there are other input devices that can be used if the user lacks either coordination or the use of their hands or fingers. This study purposed to evaluate the impact after using the eye-controlled wheelchair in short term. Two elderly female subjects who suffer from stroke and spinal cord injury were recruited from a local

old folks home-care. Both of them were manual wheelchair bounded and needs the assistance of their caregivers to wheel them around their home-care. Subjects' QoL after the eye-controlled usage was assessed using a self-designed questionnaire. The data were collected and analyzed descriptively. The collected data was interpreted as such to show the subjects' QoL progress during the 8 weeks of data collection. As in the fourth week, the QoL scores were: subject A (21/32) and subject B (22/32). In contrast, the QoL score increased from the 4th week to the 8th week. In the 8th week, the scores were: subject A (30/32) and subject B (29/32). Interpretation: The final week scores denoted that the subject's QoL has increased as in contrast to Week 1 scores with Subject A with 9 scores difference and Subject B with 7 scores difference. There was visible QoL score improvement in both subjects comparatively. In conclusion, this study achieved the study aim which is to evaluate the impact after using the eye-controlled wheelchair in short term.

Paper ID: 75 10:00 a.m.

Fusion of Deep Features for Classification of Breast Cancer using Multi-Deep CNNs

Sannasi Chakravarthy S R[1](✉), Bharanidharan N[2], Harikumar Rajaguru[1]

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Breast cancer remains a deadly disease that frightens women in several parts of the world. At the same time, deep learning becomes the widely used and fast-growing area of traditional machine learning. The work experiments a newer computer-aided diagnosis (CAD) tool that comprises of feature extrication and classification through deep learning for assisting radiologists in breast cancer classification in mammogram images. And this is done by three different experimentations for determining the optimum way of robust classification. Herein, the first one makes use of pretrained Deep CNNs namely AlexNet, GoogleNet, Res-Net50, and DenseNet121. The second one is based on the experimentation of extracting features using the Deep CNNs and applied to a support vector machine (SVM) model. The last one is based on fusing the deep features for designing a robust classification framework. All these experimentations are evaluated using MIAS database. And finally, the results reveal that the fusing of deep features enhanced the classification performance of SVM, i.e., this deep feature fusion (feature set_3) with SVM provides a maximum classification accuracy of 96.739% than other approach.

Paper ID: 83 10:15 a.m.

Improved Bald Eagle Search Optimization for Enhancing the Performance of Supervised Classifiers in Dementia Diagnosis

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Evolutionary algorithms are widely used to improve the performance of machine learning techniques through various approaches. This paper focuses on increasing the accuracy of the machine learning techniques in diagnosing dementia through the usage of Improved Bald Eagle Search Optimization as a transformation technique. In the proposed Improved Bald Eagle Search Optimization, the control parameters are updated using the entropy-based gradient to reduce the error rate of the classification algorithm. Magnetic resonance images of 52 dementia & 52 non-dementia subjects obtained from the OASIS database are considered in this research work. Raw intensity values are taken as features and given as input to the transformation technique based on Improved Bald Eagle Search Optimization. Then the transformed values are classified through one of the three different supervised classifiers namely Naïve Bayes, Linear Discriminant Analysis, and Support Vector Machine. The accuracy of Support Vector Machine is 64% when no transformation technique is used and it is increased to 88% when Improved Bald Eagle Search Optimization is used for transforming the features.

Chair: Prof. Alberto Avolio

Paper ID: 18 11:00 a.m.

Classification of Walking Speed Based on Bidirectional LSTM

Wan Shi Low[1], Chow Khuen Chan[1], Joon Huang Chuah[2][0000-0001-9058-3497], Khairunnisa Hasikin[1][0000-0002-0471-3820], and Khin Wee Lai[1][0000-0002-8602-0533](✉)

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Walking speed is a powerful predictor of health events which are related to musculoskeletal disorder and mental disease. One of the established computerized technique which employed to perform the gait analysis is motion analysis system. This system allows researchers to perform quantification or estimation on human pose and body shape from multiple camera with or without markers. However, it was reported that the high degree of variability within the data

representation of gait has resulted important patterns to be undetectable. Through this study, we have developed a stacked bidirectional LSTM (Bi-LSTM) to interpret human walking speed based on kinematic data. A Bi-LSTM has higher training capability compared to a unidirectional LSTM, whereby it enables additional training by traversing the data forward and backward. We employed this model to classify the gait patterns of different walking speeds from 27 sets of gait data with total of 453 gait cycles collected from the walking trial, captured via Vicon Motion System (Vicon MX, Oxford Metrics, UK). Kinematic parameters of the gait cycles were employed as the input layer of the Bi-LSTM deep learning architecture. Our proposed framework has achieved a prediction accuracy of 77% to classify different speed (slow, normal and fast) conditions. It was also observed that with the prediction accuracy is improved with an increased number of stacked Bi-LSTM layers.

Paper ID: 4 11:15 a.m.

Automated Segmentation of Metal and BVS Stent Struts from OCT Images using U-Net

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Percutaneous Coronary Intervention (PCI) is an effective treatment for coronary artery diseases. PCI treatment is usually carried out with stent implantation to provide structural support to balloon dilated blood vessel, reducing risk of re-narrowing. Intravascular Optical Coherence Tomography (OCT) can provide a series of cross-section images depicting the internal structure of the artery and residing stent during PCI treatment. Stent struts segmentation for OCT images is necessary to provide quantitative data regarding quality of stent deployment during PCI and severity of restenosis during follow-up examination. Manual segmentation of stent struts is not efficient and infeasible due to large number of stent struts presented in each pullback of OCT images. Thus, automated stent struts segmentation is necessary to help clinicians in getting quantified data from OCT images within intraoperative time frame. In this paper, an automated stent strut segmentation algorithm was developed, utilizing 3D information of stent structure and state-of-the-art U-Net. The implementation of the algorithm preserves the spatial resolution of the full-size OCT images without down-sampling. The algorithm was trained and tested on both Bioresorbable Vascular Scaffold (BVS) and metal stent images. It achieved Dice's coefficient of 0.82 for BVS images, precision of 0.90 and recall of 0.85 for metal stent images. This algorithm works for both BVS and metal stents OCT images and adapts to different stent conditions.

Paper ID: 72 11:30 a.m.

Comparison of Blood Rheological Models in Patient-Specific Left Coronary Arteries with Varying Degrees of Stenosis

Noushin Anana[1], Nusrat Sadia Khana[1], Samreen Tahia Mahmudb[2], Tahura Hossaina[1], Muhammad Tarik Arafatb[2(✉)]

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For computational analysis, it is essential to select a suitable blood model to depict the blood flow of healthy and atherosclerotic arteries uniquely as they tend to differ. In this study, four different blood models- Carreau, Casson, Herschel-Bulkley, and non-Newtonian power law have been compared by performing computational fluid dynamics (CFD) simulations in healthy and atherosclerotic patient-specific arteries. Hemodynamic parameters - wall shear stress (WSS), relative residence time (RRT), and global non-Newtonian importance factor (I_e factor) were analyzed for evaluating the blood models. All the blood models exhibited noticeable changes in the hemodynamic parameters with an increasing degree of stenosis. WSS had a similar distribution over a cardiac cycle for all models but showed different magnitudes. Casson and power law model exhibited risk-identifying RRT range for high and low stenosis degrees. Analysis of the I_e factor revealed that the Carreau model represented blood viscosity more appropriately by exhibiting both Newtonian and non-Newtonian behavior of blood in both healthy and diseased arteries. Extensive analysis of the concerned parameters demonstrated that Carreau and Herschel-Bulkley models could predict the variation of blood flow in healthy and diseased arteries more precisely than Casson and non-Newtonian power law models, which either overestimated or underestimated the values of these parameters at different degrees of stenosis.

Paper ID: 80 11:45 a.m.

Wall Stress Analysis of Patient-Specific Left Ventricular Hypertrophy Models

Wei Jan Goh[1], Bee Ting Chan[1(✉)], Wan Naimah Ab Naim[2], Shoon Hui Chuah[3], Einly Lim[3], Yih Miin Liew[3]

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Left ventricular hypertrophy (LVH) is a complex heart disease characterised by abnormal heart wall. A wall stress analysis may provide insight on ventricular wall mechanics, and it should be conducted with patient-specific geometry for accurate assessment. This study aims to investigate the distribution of stress on the left ventricular (LV) wall of LVH patients in diastolic filling phase using the finite element method. The patient-specific LV geometries of two LVH patients were compared with two healthy subjects. The effect of individual factors in contributing to wall stress was also studied by adapting the model settings for investigation. Our results showed that the excessive wall stress observed in LVH patients (σ_c: 6068±342 Pa, σ_z: 3785±161 Pa, σ_r: 384±649 Pa), when compared to healthy subjects (σ_c: 2662±82 Pa, σ_z: 1486±239 Pa, σ_r: 0.1±47 Pa), were mainly contributed by the elevated filling pressure. Besides, an abnormal stress variation was also observed in LVH patients, especially near the region with wall thickening and distinct local wall curvature. A high convexity area was observed to have high circumferential stress and low longitudinal stress, while the opposite was noted at the local high concavity area. These findings indicate the importance of patient-specific models in wall stress assessment of LVH patients.

Paper ID: 98 12:00 p.m.

Computational Analysis of Newtonian and Non-Newtonian Rheological Models for Patient-specific Intracranial Aneurysm

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This computational study is conducted to compare different blood models using a patient-specific intracranial aneurysm. A proper blood rheological model with varying viscosity gives a different analytical result than assuming blood to be of constant characteristic. Computational analysis is done on a patient-specific intracranial aneurysm model to compare the results of the Newtonian model with the non-Newtonian power-law model (NNPL) and Herschel-Bulkley (HB) model. The results are presented in terms of wall shear stress (WSS), oscillatory shear index (OSI), dynamic viscosity, and strain rate. The peak WSS inside the aneurysm for the Newtonian model is 65.84% higher than the peak value obtained for the non-Newtonian power-law model. Moreover, the area percentage of the aneurysm covered with low WSS (less than 5 Pa) for the HB model is 6.28%lower than that of the Newtonian model. On the contrary, 6.55% of the aneurysm shows OSI values of higher than 0.45 for the HB model and the area percentage is 6.72% for the Newtonian model. Three different viscous models showed that viscous models influence the

outcome of computational analyses to a great extent and an appropriate viscous model must be identified which can be used to simulate proper blood behavior during computational analysis.

Paper ID: 99 12:15 p.m.

Electro-mechanical Finite Element Model of Left Ventricular Hypertrophy

Zhi Chin Hew[1], Bee Ting Chan[2(✉)], Wan Naimah Wan Ab Naim[3], Socrates Dokos[4], Wah Yen Tey[1,5], Yih Miin Liew[6]

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Left ventricular hypertrophy (LVH) is one of the common heart diseases that con-tribute to global morbidity and mortality. LVH can be further classified into concen-tric LVH (cLVH), eccentric LVH (eLVH) and concentric left ventricular remodeling (cLVR) based on the changes in wall structure and cardiac function. This study sim-ulated LVH cases by using an electro-mechanical left ventricular (LV) model. The simulation was performed on three LVH cases, with a healthy model used for base-line reference. The pressure-volume loops, LV wall thickening index (TI), shorten-ing strain (SS) and thickening strain (TS) were evaluated. Although all LV models had a preserved ejection fraction, differences in TI, SS and TS were noted. The cLVH (TI: 24.4%, SS: -20.2%, TS: -52.5%) and eLVH (TI: 10.3%, SS: -81.2%, TS: 9.4%) models showed remarkable difference compared to the healthy model, where-as less significant discrepancy was noted in cLVR (TI: 5.1%, SS: -0.6%, TS: -7.3%). Distinct geometric features of increased wall thickness and chamber enlargement were observed to affect the operative chamber stiffness in cLVH and eLVH. The TI, SS and TS results indicate wall mechanics impairment in cLVH and eLVH patients.

Parallel Session Room 2 *(Biomechanics, Rehabilitation & Education)*
Chair: Assoc. Prof. Dr. Nur Azah Hamzaid

Paper ID: 28 9:00 a.m.

The Effects of Prosthetic Knee Joints during Walking on Different Types of Surfaces: A Preliminary Study

Nur Amira Adlan[1], Nooranida Arifin[1,2], Noor Azuan Abu Osman[1,2,3], Hasif Rafidee Hasbollah[4], Saari Mohamad Yatim[5], Yusniza Mohd Yusof[6], Chan Chow Khuen[1]

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Individuals with transfemoral amputation continue to face mobility challenges despite the advancements in prosthetics technology. Generally, a mechanical prosthetic knee joint is prescribed to replace the important role of the anatomic knee joint in providing an effective walking process. However, research on assessing the biomechanical advantages or disadvantages of various mechanical knee joint designs is yet to be conducted. The objective of this study was to analyze the dual-task gait assessment of transfemoral amputees between two groups of prosthetic knees (polycentric, TFA_P; and fluid-controlled, TFA_{FC}) on different types of surfaces (even and uneven), by comparing them to the age-matched able-bodied group. All participants walked at their self-selected pace along a 5-meter walkway. Primary outcomes consisted of temporal-spatial, kinetics, kinematics of the lower limb and descriptive analysis was performed in this study. The findings demonstrated that people with TFA walked slower with longer stride and step times, shorter stride and step lengths, with reduced vertical GRF and range of motion compared to the able-bodied participants in all conditions. The effects were much greater in the TFA_P group than the TFA_{FC} group in most conditions. In comparison between types of surfaces, the performance in dual-task gait assessment on the even surface is better than the uneven surface for all participants. The stance phase duration of the prosthetic leg was shorter than the able-bodied. Results indicated that the quality of gait deteriorates in challenging walking conditions for both able-bodied and people with TFA, but fluid-controlled prosthetic knee users have better performance compared to polycentric prosthetic knee users.

Paper ID: 62 9:15 a.m.

Ground Reaction Force of Trilateral Amputee During Walking with and without Upper Limb Prosthesis: Case Report

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Human walking has been extensively studied but less research has been done on the gait of trilateral amputee. Trilateral amputee is a person with three missing limbs. This study investigates the effect of upper limb prostheses on vertical ground reaction force of a trilateral amputee during level walking. A subject with bilateral transradial and unilateral transtibial amputation participated in this study. The subject wore prostheses both for upper and lower limb. Kristler force platform was used to collect data while the subject walked with and without upper limb prosthesis. The determined mean values of normalized components of trajectory of vertical ground reaction force were compared with able-bodied data. Three vertical GRF measures (F1, the first peak force; F2, minimum force; and F3, the second peak force) were extracted and analyzed. Ground reaction force, loading rate and unloading rate generated by the trilateral amputee is greater than able-bodied person. When donning upper limb prosthesis, the value of F1 and F3 increased by 11.93% and 9.90% respectively, but the value of F2 reduced by 8.75%. The gait of trilateral amputee wearing upper limb prosthesis were characterized by high impact peak, low force value during mid stance and steeper loading rate and unloading rate. The use of upper limb prostheses affects the vertical ground reaction force of trilateral amputee subject in this study during walking.

Paper ID: 53 9:30 a.m.

A Low-Cost Human Gait Analysis System

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To analyze the gait movement in detail, assistance of software-based motion analysis systems is required as some parameters such as forces and moments of the joints are not directly measurable. However, most of the software systems require certain level of technical expertise to operate and expensive tools such as motion capture systems to collect the input parameters. The goal of this project is to develop a simple and cost-effective gait analysis system to compute

the ankle joint moments of lower extremities in the sagittal plane with available tools and software. The proposed gait analysis system involves three devices which are a digital camera, an instrumented treadmill embedded force plates (H/P Cosmos™ Instrumented Treadmill), a personal computer equipped with Gaitway software and SkillSpector software. The digital camera and SkillSpector software were served as motion capture system to acquire the trajectories of the markers and perform knee and ankle kinematic analysis to obtain linear and angular kinematic parameters. The ankle joint moment was calculated based on the coordinates of the markers and the vertical ground reaction force (VGRF) data measured from the treadmill. Two healthy subjects (one male and one female) were recruited and the outputs of the system were then validated against existing data. In overall, the system produces kinematic and kinetic results comparable to those experimental results.

Paper ID: 55 9:45 a.m.

Qualitative Study of Prosthetic Liner Materials on Transtibial Amputees' Satisfaction in term of Positional Pain and Discomfort

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The objective of this study is to find out the relationship of the type of prosthetic liner materials and the usage of the prosthesis on the satisfaction of the transtibial prosthesis user in term of positional pain and discomfort. This study included 50 transtibial amputees that using transtibial prosthesis (29 males, 21 females; mean age 55.4±14.7 years; range, 18 to 78 years). The respondents were required to answer a set of questionnaire regarding the types of liner used, the prosthesis usage, and the positional pain experienced. Based on the result obtain, the most prone area that experienced pain and discomfort is the end of the residual limb for both liners. Which Pelite liner users shows a greater amount over silicone liner users by 18% and 6% respectively. Prosthetist can reduce the discomfort and pain experienced by the user by prescribing softer material as the prosthetic liner. This study gathered that silicone liner users rate their prosthesis higher than Pelite liner user, 18% silicone liner users rate 5 for their prosthesis and only 8% for Pelite liner user.The prosthetic liner materials is one of the factors affecting the satisfaction with prosthesis use which in this study shows that the user prefer silicone liner over Pelite liner.

Paper ID: 61 10:00 a.m.

Restoration of Gait Spatio-temporals After Anterior Cruciate Ligament Reconstruction

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The purpose of this study was to evaluate symmetrical alternations in gait spatio-temporal parameters among athletes after ACL reconstruction. Motion analysis was used to analyze the gait of 22 athletes with ACL reconstruction at three different times of rehabilitation program and 15 healthy subjects. Asymmetry indexes of cadence, step length, weight acceptance time, and stance time (STT) were assessed. One way and repeated measure multivariate analyses of variance were applied to analyze the data. There was a significance difference (P=0.007) in combination of measured variables of patients comparing to control group. Stance time asymmetry index was the only parameter that demonstrated a significant reduction from initial to final test (P=0.004). By performing the rehabilitation program, asymmetry restoration of the gait spatio-temporal parameters towards the range of control group was achieved three months after ACL reconstruction. The results also suggested to consider the inter-correlation of parameters for gait improvement evaluation.

Paper ID: 67 10:15 a.m.

Surface Electromyography: A New Indicator of Fatigue Level

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Prolonged high intensity physical activity induces fatigue at the central and peripheral system, and inadequate recovery process lead to the emergence of maladaptation symptoms. Usually in tracking fatigue level, lactate test, heart rate and self-evaluation questionnaire are utilized. Surface EMG is known as one of the electrophysiological techniques, which physiological information of human body can be extracted from sEMG signals. This paper proposes a new indicator known as surface electromyography (EMG) to track fatigue level with the existence of

maladaptation symptoms muscle soreness, unexplained lethargy and performance reduction. An experiment has been conducted on twenty participants to investigate the behavior of surface EMG during five days of intensive training that was based on Bruce Protocol treadmill test. The intension was to induce maladaptation signs on biceps femoris (BF), rectus femoris (RF), vastus lateralis (VL) and vastus medialis (VM). Results demonstrate that ΔFmed of BF, RF, VL and VM tend to decrease under normal fatigue condition, and increase under fatigue with maladaptation signs ($P<0.05$) for RF and VL. Thus, this study successfully demonstrated that inception of maladaptation signs can be observed based on surface EMG.

Chair: Prof. Ir. Dr. Wan Abu Bakar Wan Abas

Paper ID: 12 11:00 a.m.

Relationship between Handedness and Cognition Performance of University Undergraduates

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Human were born to be left-or right-handers. Left-handedness are rare and only consists of around 10% of population. Some lefties facing lots of problem in daily life and may need to declare their left-handedness as one of the disabilities but some lefties show excel in music and mathematics. One of the common theories about left-handers is their brain are structure differently than common right-handers, and thus resulted in different cognition ability. This study aimed to investigate the relationship between handedness and cognition performance among 108 young adults in a local university. Results are considered to support the view that handedness may have significant impact on two cognition test, Symbol Coding and Maze test. Right-handed participants able to complete the task faster than left-handers in both cognition tests, which indicates their better ability in speed of processing and problem-solving skills. There was no significant difference been found on Working Memory and Social Cognition test.

Paper ID: 122 11:15 a.m.

Parents Involvement in Young STEM Learners and Talent Development: A Pilot Study

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The need to promote genuine interest for learning is especially required for STEM based understanding, knowledge and skills in very young learners. Parents involvement in STEM learning has been established as a critical factor that would move the students' interest and adoption into STEM field and STEM related careers later in the future. This is critical even in the early childhood years where curiosity and interest are at its peak. Play based learning at home and in informal settings are one of the most effective way to experience STEM and this has been reflected in the literature especially where parents are involved. While the efficacy and usefulness of play-based learning is clear among children, the acceptance and thorough adoption among parents still requires clear method and direction. This research aims to explore and identify key factors of effective STEM learning for young children. Parents' background and STEM career could influence their children's interest and ability in STEM, while utility values by parents are key in nurturing children's interest as children are independently evoked and may be influenced by their perceived utility-values by the parents.

Paper ID: 6 11:30 a.m.

Practice Analysis: The Service Delivery and Domains of Prosthetic and Orthotic Practitioners in Malaysia

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Malaysia has a database for physiotherapist and occupational therapist, however, the statistic for manpower in Prosthetic and Orthotic (P&O) practitioners are yet to be reported. The aim of this research is to establish the database of P&O practitioners in Malaysia according to the Standards of Prosthetics and Orthotics of service delivery and domains using Practice Analysis (PA). PA is a strategy or technique used to explore and expand the content and description of the profession P&O practitioners. A total of fifty-one (51) respondents were selected in this research by using purposive sampling via hospitals and private practices companies in Malaysia. This number of respondents are divided into two which were twenty-one (21) Certified Prosthetists Orthotists (CPOs) and thirty (30) technicians. The data is collected using a questionnaire adapted from American Board for Certification in Orthotics, Prosthetics and Orthotic. The findings of the questionnaire are analyzed and interpreted via descriptive statistics such as percentages and frequency. Prosthetic Fabrication (PF) has recorded the highest total frequency of CPOs and Technicians with 48 practitioners. The result of this study showed that the top three domains are

patient assessment (Domain 1), implementation of the treatment plan (Domain 3), promotion of competency and enhancement of professional (Domain 4) were the most domains performed by the practitioners. These elementary findings of this study are useful for higher education and training providers in planning for a proper clinical and technical programme for future and existing practitioners as well as serve as a support evidence for the policy maker in ensuring the high quality of P&O service provision. This study has concluded that, P&O Practitioners have practiced the PA according to the Standards of Prosthetics and Orthotics of nine primary service delivery based on the four main domains.

Paper ID: 7 11:45 a.m.

A Conceptual Design and Control of a Novel Powered Ankle-Foot Prosthesis (RoMicP^{TM}) for Heavy Amputees

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A novel powered ankle-foot prosthesis (RoMicP^{TM}) is designed for heavy amputees. A novel elastic actuator, namely, a unidirectional parallel elastic actuator with series elastic element (SE+UPEA), is implemented by the employment of a harmonic reducer and a two-level cable-drive system and the application of planar torsional springs. The results of mechanical design declare that the designed structure can achieve outstanding performance on both the height of installation position and the motion range of the ankle joint. The mass of all mechanical components can meet the requirements of design. A double-loop impedance control system is developed with two constant parameters and two time-varying parameters. With optimal parameters of parallel and series springs and tuned parameters of the control system, RoMicP^{TM} is verified by simulation under different loads. The simulation results show that the performance is remarkable in tracking the ankle position reference with small errors during walking on level ground, where the torque load on the ankle is equivalent to that of an amputee whose weight is 100 kg.

Paper ID: 32 12:00 p.m.

The Treatment Impact of Partial Body Weight Supported Treadmill (PBWST) on Cerebral Palsy Kid using Physio-Treadmill (*PhyMill*): A Case Study

Rabiatul Aisyah Ariffin[1(✉)],Mohd Azrul Hisham Mohd Adib[1(✉)], Nurul Shahida Mohd Shalahim[2], Narimah Daud[3] and Nur Hazreen Mohd Husni[4]

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Cerebral Palsy (CP) prevalence has remained stable in the global population over the last few years. This case study aims to examine the impact of the Partial Body Weight Supported Treadmill (PBWST) on gait control in kids with cerebral palsy. Kids with CP completed a gait training protocol two-session between two weeks' intervals. Outcome measures included a Berg balancing scale, Dynamic gait index, Katz index of independence in activities of daily living, and several steps. The individual results indicated there were improvements in balance, dynamic gait, and step count. After the second session, the number of steps improved. The step length of the second session is better. There were more active movements during the second session. Additional research is needed to determine the treatment parameters and the long-term effects of PBWST on gait performance in CP children.

Paper ID: 134 12:15 p.m.

Design and Testing of an Interim Transfemoral Prosthetic Leg for Amputees Living in Rural Areas: A Case Study

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An interim prosthesis is proposed to be used by amputees living in rural environment in situations where the amputee is in between prescribed prosthesis by an endorsed organization. The design and development of using the Polyvinyl Chloride (PVC) pipe as socket, bamboo to replace the common aluminum pylon and hand-crafted foot prostheses for people living in the rural area was performed and its performance were tested. Corn starch flour were used inside the socket to provide pressure distribution and cushioning effect in place of silicon gel. Tensile test on bamboo specimens revealed that the bamboo with tape could hold higher flexural load than bamboo without tape, and approximately 6kN higher in the compression test. An amputee from a rural village performed gait testing with the interim prosthesis. The gait test revealed that despite the high strength of the bamboo pylon and the wooden foot, the breaking point of the prosthesis during gait was at the adapted which connected the socket and the pylon. Better load bearing adapter materials should be considered for the interim prosthesis, and further investigation is required in the actual rural setting to determine whether the prosthesis is appropriate for a rural patient to use.

Parallel Session Room 3 *(Biosensors, Biosignals & Biomedical Imaging)*

Chair: Assoc. Prof. Ir. Dr. Ting Hua Nong

Paper ID: 37 9:00 a.m.

Infant-Wrap (*InfaWrap*) Device as Pediatric Technology Tool: The Heart Rate and SpO² Monitoring for Neonates

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Today, advances in science and technology may contribute to the resolution of medical devices for pediatric. This research focused on the development of the *InfaWrap* device; a tool to monitor neonate's heart rate and SpO². *InfaWrap* is designed to help the clinicians and parents to observe the baby's heart rate and oxygen saturation. The *InfaWrap* device uses a pro mini Arduino as a microcontroller, a MAX30100 oximeter sensor to measure SpO² and heart rate, and an LM35 to measure body temperature. Besides, we focus on the design and convenience wear criteria, including design characteristics, and structures to ensure the device is lightweight and more comfortable. The proposed *InfaWrap* device embedded an advanced wireless network sensor system. The data will be appeared in the mobile application installed on the doctor's or parent's mobile phone via Bluetooth module. Overall, based on three different babies as a subject in this study, we obtained that the *InfaWrap* device accuracy results reach the average of 96% for SpO², 81 bpm for baby heart rate, and 36.4°C for baby body temperature.

Paper ID: 47 9:15 a.m.

Optimization and Performance Evaluation of Apodization Function for Fiber Bragg Grating as Vital Sign Sensor

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Sensing is the recent and most widely executed implementation of Fiber Bragg Grating (FBG). In this paper, a comprehensive investigation of various apodization functions based on Reflectivity, Maximum side lobe (MSL), Side lobe suppression ratio (SLSR), Full width Half maximum (FWHM), Sensitivity, Detection Accuracy and Quality parameter are evaluated and a novel apodization function was proposed which can be implemented in FBG to use it as vital sign sensor for measuring temperature and heart rate. The simulations were carried out for the grating parameters of L=10mm and Δn= 0.0001. From the results, peak reflectivity of -0.564754dB was achieved in Uniform apodization function but it also has larger side lobe level and less sensitivity. The highest side lobe suppression ratio was achieved by Gaussian function which is -32.58601dB. Based on the sensing characteristics, the proposed apodization function has lower FWHM of 0.06nm and the highest sensitivity of 5.9698AU/RIU, thus having a better detection accuracy of 26114. Higher sensitivity and narrow FWHM, leads to greater quality parameter of 99.49667 AU/nm-RIU which is a desirable characteristics of sensor. Also the proposed function proved to have better wavelength shift for the measurement of heart rate and temperature compared to other apodizations with 1.3pm/με and 13pm/°C.

Paper ID: 73 9:30 a.m.

Analysis of Heart Rate and Heart Rate Variability for Stress Evaluation

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Heart rate (HR) and Heart rate variability (HRV) have been proposed as useful indicators for stress evaluation. The reliability and ultra-short-term analysis of these parameters require further investigation. This study aims to: (1) identify the reliable parameters for stress evaluation and (2) determine the surrogacy of ultra-short-term HR and HRV for conventional recording using the recommended standardised tests. Electrocardiograms (ECG) from the WESAD database consisting of 15 subjects were processed and analysed. In-dividual response to stress was evaluated. The reliability of ultra-short-term recording was examined by evaluating both the correlation and limits-of-agreement of ultra-short (1-min) and conventional short-term (5-min) re-cording. Our results showed that mean RR_i and the mean HR were reliable in identifying stress condition. In the ultra-short-term analysis, most of the HRV parameters showed significantly high correlation ($r>0.7$, $p<0.05$) with only the mean RR_i and mean HR having good agreement (PE<30%) and were statistically consistent between the 1-min and 5-min recordings. In conclusion, the ultra-short mean RR_i and mean HR from 1-min recording could be potential surrogates for the standard 5-min recording.

Paper ID: 85 9:45 a.m.

Fabrication of Carbon Nanofibers using MEMS Technique for Future Electrochemical Biosensors

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This paper presents the fabrication of the inter-porosity carbon nanofibers (CNFs) obtained by the Carbon Microelectromechanical Systems (C-MEMS) method using electrospinning of SU-8 2100 photoresist polymer, photolithography, and pyrolysis techniques. The optimized electrospinning parameters identified in this research produced smooth inter-porosity CNFs with an average fiber diameter range between 167 ± 58 nm to 197 ± 104 nm. The CNFs samples were subsequently investigated using the cyclic voltammetry (CV) technique at sweep rate 50 mV s^{-1} with Zobell's solution as a redox probe in three-electrode configuration (CNFs as working electrode (WE), counter electrode (CE), and reference electrode (RE) from the screen-printed electrode (SPE)). Based on CV analysis, the inter-porosity CNFs showed that the CV curve obtained at high sweep rates proved that the consumption of redox species rate at the electrode surface is very high. Additionally, the high surface area of our developed CNFs has the potential to be used as massive regions for bacteria detection with further modification of electrode configuration; leading to an increase in the detection sensitivity.

Paper ID: 90 10:00 a.m.

The Study of Polarization Properties of Agarose Gel in Normal Line of Light Transmission

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Most conventional techniques utilize the degree of polarization (DOP) feature for quantitative analysis rather than the angle of polarization (AOP). There are very limited journals constantly publishing and reporting both AOP and DOP as reliable and significant parameters for imaging or

detection approach in current biomedical technologies. Hence, such an approach is highlighted in this paper for the fundamental concept to understand light polarization manners for future research and applications in the development of new imaging technologies in the medical field. This study highlights important parameters of both light polarization features (DOP and AOP) in the development of high-performance medical imaging abilities for a successful diagnostic or prognostic approach in medical applications. Hence, the main objective of this study is to propose a fundamental basis of light polarization manners for monochromatic light as a framework for successful future research, especially for cancer research and the development of new imaging technologies.

Paper ID: 131 10:15 a.m.

Design of Rectifier Circuit to Harvest the RF Energy for Wearable Medical Devices

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In this paper, we focused on the essential part of the RF energy harvesting system by designing a rectifier circuit capable of harvesting the ambient RF energy to power the wearable medical devices. The bridge rectifier along with the impedance matching network has been designed. The simulated results show that conversion efficiencies of 36% and 65% for the input power of 5 dBm and 10 dBm consecutively at 2.45 GHz. The maximum conversion efficiency of 93% has been achieved when the input power was 15 dBm at 1 kΩ load resistance. The Simulated DC output voltage of this rectifier is 4.662 V which is adequate to energize low-power medical devices.

Chair: Assoc. Prof. Ir. Dr Einly Lim

Paper ID: 15 11:00 a.m.

Assessing Clinical Usefulness of Readmission Risk Prediction Model

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Readmission manifests signs of degraded quality of care and increased healthcare cost. Such adverse event may be attributed to premature discharge, unsuccessful treatments, or worsening comorbidities. Predictive modeling provides useful information to identify patients at a higher risk for readmission for targeted interventions. Though many studies have proposed readmission risk predictive models and validated their discriminative ability with performance metrics, few examined the net benefit realized by a predictive model. We compared traditional logistic regression against modern neural network to predict unplanned readmission. An added value of 7% on discriminative ability is observed for modern machine learning model compared to regression. A cost analysis is provided to assist physicians and hospital management for translating the theoretical value into real cost and resource allocation after model implementation. The neural network model is projected to contribute 15x more savings by reducing readmissions. Aside from constructing better performing models, the results of our study demonstrate the potential of a clinically helpful prediction tool in terms of strategies to reduce cost associated with readmission.

Paper ID: 16 11:15 a.m.

Prediction of Spine Decompression Post-Surgery Outcome through Transcranial Motor Evoked Potential using Linear Discriminant Analysis Algorithm

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Transcranial motor evoked potential (TcMEP) is one of the modalities in intraoperative neuromonitoring (IONM) which has been used in spine surgeries to prevent motor function injuries. Studies have shown that improvement to TcMEP could be a potential prognostic information on the actual improvement to the patient after surgery. There is no objective way currently to identify which TcMEP signal is significant to indicate actual positive relief of symptoms. The proposed method utilized linear discriminant analysis (LDA) machine learning algorithm to predict the TcMEP response that correlates to relieve of symptoms post-surgery. TcMEP data were obtained from four patients that had pre surgery symptoms with post-surgery actual relief of symptoms, and six patients that had no pre surgery and post-surgery symptoms which were divided into training and prediction test. The result of the proposed method produced 87.5% of accuracy in prediction capabilities.

Paper ID: 20 11:30 a.m.

Restoring Lesions in Low-Dose Computed Tomography Images of COVID-19 using Deep Learning

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The use of Low-dose Computed Tomography (LDCT) in clinical medicine for diagnosis and treatment planning is widespread due to the minimal exposure of patients to radiation. Also, recent studies have confirmed that LDCT is a feasible medical imaging modality for diagnosing Covid-19 cases. In general, X-ray tube current is being reduced to acquire the LDCT images. Reduction of the X-ray flux introduces the Quantum noise into the generated LDCT images and, as a result, it produces visually low-quality CT images. Therefore, it is challenging to differentiate the lesions in the diagnosis of Covid-19 patients using the LDCT images due to low contrast and failure to preserve the subtle structures. Therefore, in this study, we proposed a Deep Learning (DL) model based on the Generative Adversarial Network (GAN) for post-processing the LDCT images to enhance their visual quality. In this proposed model, the generator network is designed as a U-net to generate the restored CT images by filter out the noise. Also, the discriminator network follows a patch-GAN model to discriminate the real and generated images while preserving the texture details. The quantitative and qualitative results demonstrated the effectiveness of noise suppression and structure preservation of the proposed DL method. Hence, it provides an acceptable quality improvement for LDCT images to discriminate the lesions for diagnosing the Covid-19 positive cases.

Paper ID: 21 11:45 a.m.

Detection of Covid-19 on Chest X-Ray Using Neural Networks

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Coronavirus of 2019 is an ongoing pandemic that has infected millions of people and costed the life of more than three million people. It is a highly transmitting disease that has exhausted all the healthcare facilities trying to contain its spread. It has exposed the need for more health facilities and experts to cope with this pandemic without impacting on the safety of healthcare workers. The hardworking and struggling healthcare sector is in need of automated diagnostic devices that could lift the burden off the limited practitioners and also ensure their safety from coming in direct contact with the infection. This pandemic has made the world realize the need of automation for an infectious disease like COVID-19. Deep learning in radiology is an extensively researched topic over the last decade and has the potential to provide the much-needed automation required for COVID-19 diagnosis. In this paper we have fine-tuned three deep learning models -ResNet50, DenseNet121 and InceptionV3- for classification of COVID-19 CXR from regular pneumonia cases. Our models achieved an accuracy of 99.45, 99.50 and 98.55 respectively.

Paper ID: 52a 12:00 p.m.

The Concept of Miniaturized Surface Plasmin Resonance for In Situ Viral Detection

Sharifah Norsyahindah Syed Nor[1](✉), Nur Syafiqah Rasanang[1], Hamzah Arof[2], Salmah Karman[1](✉), Wan Safwani Wan Kamarul Zaman[1], Sulaiman Wadi Harun[2]

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Surface plasmon resonance (SPR) technique has been incorporated in the advancement of numerous fields such as the biology, biochemistry, molecular interactions monitoring and medical diagnostics. In recent years, SPR biosensing has emerged and catch attention of researchers for rapid detection of viral infection. This paper demonstrates the concept of miniaturization of SPR for in-situ early screening of viral infection. The fundamental principle ranging from the total internal reflection, evanescent wave, surface plasmons and surface

plasmon oscillations are summarized and highlighted. The integration of miniaturized fiber-optic SPR biosensor with mobile phone device is proposed for future in-situ screening. The sensor is fashioned by a light-guiding silica capillary coated with 50 nm gold thin film as a sensing layer. The flash of the phone act as the light source and the camera act as the detector where it captured change of light intensity. The captured images are then analyze using a simple software application installed in the phone. The potential of advanced miniaturized system as an alert system for viral viability in public places was also overviewed in this paper. By implementing the real-time alert system of viral infection in public places, the management on controlling the disease transmission could be improved.

Paper ID: 49 12:15 p.m.

Assessment of LV Myocardial Function in Aortic Stenosis using Personalized 3D+time Cardiac MRI Modelling

Shoon Hui Chuah[1], Wen Dee Thong[1], Nor Ashikin Md Sari[2], Li Kuo Tan[3], Khairunnisa Hasikin[1], Yih Miin Liew[1(✉)]

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Left ventricular hypertrophy (LVH) in aortic stenosis (AS) is known as an adaptive response affected by pressure overload as a result of the progressive narrowing of the aortic valve orifice. Both systolic and diastolic function of the left ventricular (LV) could be affected due to the structural remodelling as a sequel of AS. Therefore, this study utilized 3D+time personalized LV modelling algorithm which was developed in-house to evaluate the LV function throughout the 20 cardiac phases of short- and long-axis cine MRI in different severity of AS patients. A total of 9 healthy cohorts and 13 AS patients with different degrees of severity were analyzed. This study demonstrated that majority of the AS patients have systolic dysfunction accompanied by deterioration of radial strain (RS) and longitudinal strain (LS) when compared against healthy cohorts (p<0.05). Only those with concomitant concentric LVH (i.e. 38% of the AS patients) exhibited normal systolic and diastolic functions with a couple of exceptions observed. LVH was found developed in those with moderate and severe AS. No clear correlation was found between diastolic dysfunction and the severity of AS.

Parallel Session Room 4 *(Tissue Engineering & Clinical Management)*

Chair: Dr. Wan Safwani Wan Kamarul Zaman

Paper ID: 5 9:00 a.m.

Feasibility of using Saliva Samples and Laser-induced Breakdown Spectroscopy for Dental Screening during Pandemic

Syafriandi[1], Siti Norhayati Md Yassin[1], Siti Norbaieah Mohd Hashim[1], Maheza Irna Mohamad Salim[1(✉)], Rania Hussein AlAshwal[1], Asnida Abdul Wahab[1], Mariaulpa Sahalan[1], Hum Yan Chai[3], Lai Khin Wee[2]

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Recent studies show that dental caries affect more than half of the adult population globally, with the socially disadvantaged groups being majorly affected. The purpose of this study is to investigate the feasibility of using Laser-Induced Breakdown Spectroscopy (LiBS) as a method of early caries screening in adults through the detection of caries elements dissolved in saliva. This experiment involved 25 students of School of Biomedical Engineering and Health Sciences, Universiti Teknologi Malaysia. Parameters that are considered in this study are pH of the saliva and spectroscopic analysis of other elements such as Na and Ca. The data were statistically analysed to evaluate the significance differences of these elements in all group levels by using One-Way ANOVA. Results show that there is a significant difference in Calcium and Sodium intensity values between the mild, moderate, and severe caries groups. Additionally, pH level also shows a significant difference between the groups. This research concluded that LIBS allows for absolute and quantitative analysis of elements contained in saliva without examining patients' teeths and is useful as a fast and accurate oral health screening method for the community as LiBS could provide not only caries detection but also determining the caries severity level. Thus, this investigation proves that analysis of saliva samples using LiBS can be an alternative or future method in screening dental caries and applicable especially during pandemic situations.

Paper ID: 200a 9:15 a.m.

Optimisation of the Thermal Oxidation Growth Parameters of the In-Situ Titania Nanowires onto Titanium Surface

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Modification of metallic surfaces is of great interest to researchers for various aspects. It is vital to improving cell adherence, haemocompatibility, osseointegration or other essential properties in their respective biomedical applications. In this work, a surface modification method via thermal oxidation has been proposed to improve the bioactivity of commercially pure titanium (CP Ti) grade 2. We aimed to grow titanium dioxide (TiO_2) nanowires (NWs) structure in-situ on the CP Ti and study their growth behaviour. The role of different process parameters, including Argon (Ar) gas flowrate, oxidation time and temperature, were investigated in order to achieve proper crystalline TiO_2 phases with suitable morphologies favourable for biomedical implants. The different crystalline phases were precisely characterised by X-ray Diffraction (XRD) study, and the surface morphology was analysed by Field Emission Scanning Electron Microscopy (FESEM). The potential cell-adherence behaviour of the surface-modified CP Ti was predicted by hydrophilicity from Water Contact Angle (WCA) measurement. The surface hydrophilicity of the sample increased as the crystal structure size decreased. The best process parameters for the *in-situ* growth of TiO_2 nanostructures on the CP Ti were optimised as 950 ml/min gas flow rate, 700 °C oxidation temperature and 4 h time. Therefore, combining these three best process conditions, the surface-modified CP Ti could be used as potential biomedical implants.

Paper ID: 58 9:30 a.m.

Determination of Suitable Bioactive Glass-Polymer Film Conditioned Medium Extracts for Potential Applications in Tissue Regeneration: A Preliminary Study

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Composite film combining bioactive particles with natural and synthetic polymer has received greater attention for enhanced cytocompatibility properties. The current study aimed to determine human mesenchymal stem cells (HMSC) responses towards different concentration

of bioactive glass/poly-Ɛ-caprolactone/chitosan (BG/PCL/CS) films conditioned medium extract using Alamar Blue assay. The samples were incubated in simulated body fluid (SBF) and the pH was assessed during the 21 days of incubation. Briefly, BG/PCL/CS at optimize weight percentages in acetic acid solution were prepared using solvent casting method and left to dry under fume hood for 48 hours. The BG/PCL/CS films were incubated in culture medium at 200 mg/ml for 24 hours at 37°C and was serially diluted until 0.78 mg/ml with culture medium and supplemented before exposure to HMSC. The effects of the conditioned mediums are not consistent and not in dose dependent order towards HMSC cell's viability and proliferation. Higher conditioned medium extracts concentration tends to reduce cell proliferation. The pH of the samples tends to approach equilibrium at pH 7 for 21 days duration when incubated in SBF that may be contributed by the sample's compositions. Thus, suitable concentration or dose ratio of the samples is important to reduce cytotoxicity before further biocompatibility assessment is conducted.

Paper ID: 70 9:45 a.m.

Cellulose Isolation from Oil Palm Empty Fruit Bunch (OPEFB) via Alkaline Hydrogen Peroxide Treatment

Nurul Athirah Syafiqah Mohamad Zulkifli[1], Farina Muhamad[1,3](✉) and Bee Chin Ang[2,3]

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Waste-derived biomaterial is one of the approaches to support environmental sustainability by practising waste recycling and reducing the use of natural, raw materials. In Malaysia, oil palm empty fruit bunch (OPEFB) is one of the underutilized lignocellulosic waste which is commonly disposed due to its large production from palm oil extraction milling. Its high cellulose content makes it suitable for waste-derived cellulose whereby it can be extracted via alkaline hydrogen peroxide mechanism. The OPEFB waste was treated with 5% (v/v) hydrogen peroxide at pH 11.5, 70℃ for 90 minutes. The colour change of the sample was observed and its chemical structure was analyzed using FTIR. The result revealed that the colour of the sample changed from brown to white after the chemical treatment. The FTIR analysis showed that there was bound lignin and hemicellulose on the sample based on the weak intensity of the compounds indicative peak, suggesting that the cellulose obtained via this method was not 100% pure. This research work suggests more study on the percentage of the residual lignin and hemicellulose and its effect on the cytotoxicity of the cellulose as a biomaterial for biomedical application.

Paper ID: 71 10:00 a.m.

Identifying Bioglass and Liquid Exfoliation of Graphite/MWCNT Mixtures through UV Vis Spectroscopy

Siti Fatimah Samsurrijal[1], Nik Syahirah Aliaa Nik Sharifulden[2], Nur Syazana Azizan[1], David Yi San Chau[2], Siti Noor Fazliah Mohd Noor[1,3](✉)

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Carbon allotropes such as graphene and multiwalled carbon nanotube (MWCNT) are studied for extensive range of applications, in which various exfoliation techniques were employed to yield the best form of generated allotropes. Liquid phase exfoliation utilizes the technique of sonication of these allotropes in solvent, results in best desired form of high quality, safe, simple and economically viable final product. This study discusses on liquid phase exfoliation of graphene and MWCNT in chloroform, where their absorbance intensity shown a contrast solubility profile with respect to different weight percentages of each allotropes. The comparative study was further analyzed with modification of BG within the suspensions, of which hazards in agglomerations of allotropes' particles as concentration increases could potentially give a prevention insight for a better preparation and processing of materials formulation. Hence the study aims in reporting absorbance intensity via UV-Vis of a range of weight percentages of liquid exfoliated graphene and MWCNT particles, with addition of BG, in chloroform and their exploitation in diverse potential applications including biomedical engineering field.

Paper ID: 79 10:15 a.m.

Increasing the Bacterial Cellulose Yield by Supplementation of Static Culture Medium

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High production costs and low production rates often restrict the use of bacterial cellulose (BC) at the industrial scale despite having tremendous unique properties and potential. In this study,

BC was produced by *Enterobacter amnigenus* GH-1 which was isolated from rotten apples and identified by gram staining reaction. Attempts had been taken to enhance yield by supplementing the culture medium with two water-soluble polysaccharides: gelatin and acacia and oil, one acts as a growth factor for bacteria and the other facilitates the supply of sufficient oxygen and nutrients to the microorganisms, respectively. Results showed that the yield of cellulose increased significantly by 900% over the standard medium when the medium contained gelatin in the presence of oil by the dual effect of polysaccharide and oil. Enhancement of yield using medium thickening polysaccharides in the static culture medium could be possible due to the presence of oil as oil could continue to supply oxygen and nutrients to bacteria while it was restricted when gelatin and acacia were used alone. They alone made the medium viscous resulting in a shortage of oxygen and nutrients in the medium. ATR- FTIR result confirmed the presence of functional groups of cellulose at the obtained white pellicle.

Day 2 (29th July 2021 Thursday)

Parallel Session Room 1 *(AI & Computational Modelling)*

Chair: Assoc. Prof. Dr. Nahrizul Adib Kadri

Paper ID: 95 10:00 a.m.

Modified Spotted Hyena Optimizer Based Leukemia Microscopic Images Classification

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Applications of accurate machine learning techniques in medical field are increasing every day. This research paper proposes a novel Modified Spotted Hyena Optimizer as transformation technique to improve the performance of popular machine learning algorithms in classifying the Leukemia microscopic images. In the proposed transform, control parameter of Spotted Hyena Optimizer is found using Weightless Swarm Algorithm iteratively. Microscopic images of 26 leukemia and 26 normal subjects are obtained from C-NMC website and considered in this study. Statistical features namely mean, variance, skewness and kurtosis are extracted from microscopic images and given as input to the proposed transform. Then the transformed values are given as input to any one of the four supervised classifiers: K-Nearest Neighbor, Decision Trees, Random Forest, and Stochastic Gradient Descent. When the Modified Spotted Hyena Optimizer is for transforming the features in Stochastic Gradient Descent classifier, highest accuracy of 90% is achieved while the accuracy offered is only 65% when no transform is used.

Paper ID: 96 10:15 a.m.

Application of Bayesian Network for Renal Failure in The Intensive Care Unit

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Renal failure in the intensive care unit (ICU) is associated with high morbidity and mortality. The Sequential Organ Failure Assessment (SOFA) score is applied in the ICU to track progression of organ dysfunction. The renal component of the SOFA score employed serum creatinine and urine output to define the stage of its dysfunction. The aim of this study is to discover the relationship between commonly available variables in the ICU together with patients' gender and comorbidities to renal failure employing Bayesian Network. The process of building Bayesian Networks involved variable selection, data discretization and aggregation before structural learning method. The dataset discretized using equal distance discretization technique into 3 intervals was fed into several structural learning techniques including unsupervised, semi – supervised and supervised learning methods. The highest overall precision of 98% was achieved in the testing dataset employing the supervised Sons & Spouses method and unsupervised Maximum Spanning Tree technique.

Paper ID: 101 10:30 a.m.

A Strategic Corrective Maintenance Prioritization Assessment for Medical Equipment

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The utilization of effective medical equipment significantly contributes to the quality of healthcare services. Breakdown of medical equipment can jeopardize the healthcare delivery, maintenance expenditure, and resources. The implementation medical equipment assessment for corrective maintenance throughout the equipment life cycle during maintenance phase may enhance the. The study aims to develop the corrective maintenance prioritization assessment system in managing the rectification work of breakdown medical equipment. The proposed system was developed by considering nine medical equipment features, which involve 1,028 equipment with 19 categories located in public health clinics. The assessment of medical equipment uses the machine learning of k-Means clustering technique to analyze the equipment database to generate priority level. The assessment by applying the k-Means clustering algorithm classifies the medical equipment into three priority level. The corrective maintenance prioritization assessment system can assist the clinical engineers in managing the rectification expenditure, reporting, preparation, workforce, and material. This prioritization system can be incorporated with real-time asset management database system in healthcare institution for continuous supervision.

Paper ID: 104 10:45 a.m.

Detection of Knee Osteoarthritis and Prediction of Its Severity Using X-Ray Image Analysis and Patients Assessment Data: A Hybrid Design

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Knee osteoarthritis (KOA) is a degenerative disease associated with cartilage loss, causes limitations in the range of movement, and known to be one of the most disabling age-associated diseases around the world. It is vital to predict its presence and severity at early stage to tailor the interventions and treatments properly. Traditionally, X-ray Images are graded by radiologists to quantify KOA severity; however, this approach suffers from high levels of subjectivity due to the semi-quantitative nature of grading systems. Numerous attempts have been made to recruit automated X-ray image analysis to quantify KOA severity, but few studies have used pertinent assessment data such as symptoms and medications being used to establish accurate predictive model. So, we proposed a statistical model built on combination of features extracted from X-ray images and patients' data using ordinal regression analysis. The results revealed that the developed model based on combination of KOA X-ray key features and patient assessment data is able to predict the severity of KOA with high level of accuracy (89.2%) and acceptable level of inter-rater reliability with quadratic weighted Cohen's Kappa coefficient (QWK) of 0.8337. The study outcomes suggested that variables showing impaired knee functions are the best indicators to quantify knee OA presence and severity that may be used in conjunction with X-ray biomarkers for developing intervention and targeted treatment.

Paper ID: 120 11:00 a.m.

Depression Detection Using Natural Language Processing on Bahasa Malaysia Non-Clinical Text

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Depression is viewed as the largest cause of the world mental illness statistic, and it keeps increasing globally including Malaysia. Two main issues that prevent early diagnosis of depression in Malaysia are the limited number of psychologist ratios to patients and the stigma from the society that relates depression with insanity. In addition, research have shown that technology using bio-signals can be an alternative method that supports clinician's decision for early diagnosis of depression. The main objective of this study is to develop an automatic detection depression via the language usage in written text using Natural Language Processing (NLP). This work will be examining the text file of 51 subjects with depression and 53 non-depressed subjects. In the initial investigation, we identified the common and frequently used word used by each class. Subjects in the depressed group often use the word such as words "penat" and "bosan". These texts were then classified using common classifier models. Using Term Frequency, Inverse Document Frequency, Multinomial Naïve Bayes produces the best accuracy of 95%.

Paper ID: 136 11:15 a.m.

A Preliminary Study of IVOCT-based Atherosclerosis Plaque Classification Technique

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Atherosclerosis is a type of cardiovascular disease (CVD) that affects the coronary artery by build-up of plaque which can potentially cause stroke or ischemic damage to the surrounding tissue. Intravascular Optical Coherence Tomography (IVOCT) is able to capture detailed images of arteries affected by atherosclerosis which contain identifiable characteristics. These characteristics can assist clinicians to differentiate certain plaque types such as, fibrous, calcific and lipid, and diagnose appropriately. However, clinicians face challenges in manual visual plaque identification from IVOCT images such as fatigue and IVOCT artifacts. The aim of this study is to produce an automated IVOCT-based plaque segmentation method to assist clinicians in their diagnosis. This preliminary study covered only two plaque types, which are fibrous and calcified plaque as they are much more prominent to be labelled manually. The image dataset was pre-processed with Otsu binary thresholding and Gabor filters before training the models. The results demonstrated that the XGBoost model performed slightly better than the Random Forest model with 82.0% and 80.9% accuracy respectively. This shows that machine learning techniques can be applied to produce an automated IVOCT-based plaque segmentation method with decent accuracy.

Paper ID: 201a 11:30 a.m.

A Deep Learning Model for the Detection of COVID-19 Infection on a Multinational Computed Tomography (CT) Imaging Dataset

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The Coronavirus disease 2019 (COVID-19), was first discovered in 2019 and has since been declared a pandemic by the World Health Organization (WHO). For over a year, the COVID-19 pandemic has become a serious threat to world health and economy. The Reverse Transcription Polymerase Chain Reaction (RT- PCR) is currently the standard diagnosis for COVID-19. However, it is time consuming, and subject to low sensitivity. To address this problem, Computed tomography (CT) scan images can be used as a complementary diagnostic test in conjunction with RT-PCR to detect COVID-19. In general, CT scan equipment is available in most hospitals and the result of a CT scan can be obtained in a matter of hours. However, manually reviewing CT scans is time consuming. To alleviate the heightened workload of the radiologists during the pandemic, this paper proposed a deep learning model trained on a multinational dataset, for detection of COVID-19 infection with CT images. The purpose of this paper is to design and implement a deep learning model that can assist the radiologists and doctors to detect COVID-19 infection, and subsequently, this model can be extended to assist in triaging the patients' condition. For this research, we use the multinational dataset, RICORD released by RSNA recently. The images were then normalized and scaled during preprocessing. Data augmentation was also used to enrich the data, and these images were then used to train the prediction model. We designed and trained a novel deep learning model which utilizes a 3D convolutional neural network (CNN) to achieve better results than traditional 2D CNN. The proposed model is evaluated using the accuracy metric. The proposed model is tuned and evaluated with different parameters. The final CNN model obtained high validation accuracy on the RICORD dataset. Originality/value – The dataset used in this work is the RICORD dataset, a dataset recently released by RSNA, that is widely regarded as reliable and contains multinational samples. Majority of the existing works employed 2D CNN to detect COVID-19 using individual CT images. In this work, we proposed a 3D CNN that takes in the full volume of a CT-scan as the input to the neural network for the prediction of COVID-19 infection.

Parallel Session Room 2 *(Biomechanics, Rehabilitation & Education)*

Chair: Prof. Raymond Kai-Yu Tong

Paper ID: 82 10:00 a.m.

Immediate Effect of Flexing the Toes during Performing Salat on Hemodynamic Status

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Salat is a routine for Muslims and involves some physical movement. The process of *Salat* promotes many physical and psychological benefits. One of the movements is the foot in flexion position during prostration and sitting. According to reflexology, flexing the foot and toes in foot massages techniques may increase blood flows and lead to the immediate hemodynamic effect. Thus, this paper investigates the immediate effect of flexing toes during performing prostration and sitting position in *Salat* on hemodynamic status. Fifty-two subjects have been recruited in this study and divided into two groups; control (n=33) and uncontrolled (n=19). Both groups were taught to perform *Salat* movement, but the proper movement and postures during prostrating were only emphasized in the control group, while it was not emphasized in the uncontrolled group. The subjects were required to perform two cycles of *Salat* movement. Systolic and diastolic blood pressure, heart rate, and electrocardiograph signals were recorded before and after the *Salat* movement. Our finding indicates that the toes flexion movement shown a significant effect on the hemodynamic status by lowering blood pressure both systolic and diastolic. Thus, it can be suggested as a supplementary to mimic the effect of reflexology massage.

Paper ID: 113 10:15 a.m.

Automatic Physio-Walker (*PhyWalk*) as a Rehabilitation Therapy for Children with Lower Disability

Mohd Azrul Hisham Mohd Adib[1(✉)], Mohd Hanafi Abdul Rahim[1], Rabiatul Aisyah Ariffin[1], Idris Mat Sahat[2], Mohd Hafiz Hasan[1], Nurul Anati Basirah Sulaiman[1], Siti Nurfarhana Mohamad Wahid[1], Mohd Firdaus Mak Nayan[1], Mohammad Fitri Abdullah[1], Suraya Najiha Mohd Ishak[1], Nurul Shahida Mohd Shalahim[2], Narimah Daud[3]

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Nowadays, the number of cases of cerebral palsy (CP) is shown an increase. One in approximately 345 kids in the world has CP and 70%-80% of them is Spastic CP. Commonly, CP is caused by abnormal development of the brain or damage to the developing brain that affects a child's ability to control his or her muscles. It is the most common cause of childhood disability and as individuals with CP grow, the children with greater physical involvement often have few options for functional mobility. Therefore, in this study, the physio-walker (*PhyWalk*) is well developed to provide rehabilitation therapy for CP kids. *PhyWalk* is used to maintain the balance of the trunk and pelvis for children. It's also can be used for forwarding and backward movement, speed control. *PhyWalk* is fully automatic control and comes with a multifunction device. The preliminary walking distance test on kids has been done once every two weeks. The results show a significant improvement in the number of steps from the first training to four sessions of training. It also provides opportunities to stand and bear weight in a safe, supported position using a combination of formal and informal user-centered design methods. However, the modest speed adjustments were dependent on the capacity of the child to control their gait pattern. *PhyWalk* was developed for children with special needs and offers greater balance support and weight support than a conventional walker.

Paper ID: 117 10:30 a.m.

A Preliminary Study of Ankle Muscular Strategy during Single Leg Stance

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Ankle contributes a significant role during dynamic movements in the double legs and single leg (SL) balance activities. The subject specific balance performance can be evaluated using SL stance as it has narrow base of support, which is able to detect plausible impairment during the balance abilities. Hence, the aim of this study was to apprehend the electromyographic activity of ankle muscles among healthy participants. This preliminary study was proposed in addressing the

muscle quantification during SL stance. Eight participants were recruited from the sports background. Participants stood on dominant leg on the unstable Lafayette stability platform for two conditions: with eyes open (EO) and eyes close (EC). Three successful trials for 20s were recorded respectively. The electromyographic activities from three ankle stabilizer muscles namely Peroneus Longus (PL), Tibialis Anterior (TA) and Gastrocnemius Lateralis (GL) were compared during the SL stance. The key findings revealed greater balance performance in SL stance during EO compared to EC. PL was seen to be activated foremostly among the three muscles in all conditions. Moreover, PL also demonstrated the highest frequency of total contractions followed by GL and TA during the 20s task in EO and EC conditions. From this study, we can infer that PL imparts a role of evertor in balance control.

Paper ID: 138 10:45 a.m.

The Prevalence of Lower Limb Musculoskeletal Pain Symptoms during Stop and Driving

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The prevalence of musculoskeletal pain among drivers during stop and go driving can be regarded as a common public health predicament. The action of frequent and prolonged driving in traffic congestion were distinguished as the prime contributors towards the musculoskeletal problem among drivers. This study emphasised on the importance to comprehend the relationship of the contributors towards the occurrence of musculoskeletal pain. Three hundred and twenty (N = 320) drivers responded in this cross-sectional survey study aimed to investigate the widespread of musculoskeletal pain symptoms specifically the knee pain symptom experienced by drivers during congested driving conditions. However, only one hundred and eighty (N = 180) drivers frequently drive during peak time and in congested driving conditions. The 180 drivers were segregated as targeted drivers and were tested for the relationship of two variables (frequency and prolonged driving in traffic) towards the prevalence of knee pain. The findings showed that the targeted drivers have experienced foot pain (64.4%) and knee pain (51.1%) more commonly while driving in the tested condition. A Pearson Chi Square statistical test was used to analyse the association of frequent and prolonged driving variables towards the prevalence of drivers experiencing knee pain had showed statistically non-significant relationship. Thus, other contributing risk parameters should be necessarily investigated for their influence towards the

prevalence of knee pain among drivers to minimize and prevent the musculoskeletal pain symptoms.

Paper ID: 139 11:00 a.m.

The Effect of Physical Non-operative Modalities on Pain in Osteoarthritis of the Knee

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Knee osteoarthritis is the most common cause of a painful joint. Transcutaneous electrical nerve stimulation (TENS) is a method that simulates the production of natural pain relievers by transferring electrical pulses. However, some problems affect the conventional TENS performance. An intervention called GNEEZAP was fabricated to solve these problems. Meanwhile, elastic knee sleeves help in relieving the knee OA symptoms by providing partial pain relief and greater sense of joint stability. It is a cost-effective and easy solution. However, its effect increases when it is combined with other treatments. Previous studies indicated that knee sleeves achieve better proprioception when it is combined with electrical stimulation. This study aims to analyze the efficacy of both TENS electrode types, and knee sleeves in knee OA pain management by doing pre-post treatment tests on 18 patients divided into two groups. The research instruments include Stair Climbing Test, Timed Up and Go Test, and 6 Minute Walk Test. At the end of this study, a comparison between both treatment methods' combinations was done. The results indicated that the knee sleeve enhances the effect of TENS both by traditional electrodes and by GNEEZAP, but its effectiveness when it is combined with GNEEZAP is larger. Therefore, the more effective treatment combination is wearing a knee sleeve in addition to receiving TENS by GNEEZAP.

Paper ID: 76a 11:15 a.m.

Development of a New Electromyography Cuff System for Prosthetic Interface

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Amputation is an operation that involves partial or total removal of a limb. Amputations are limited to the two main parts of the body (upper limb and lower limb) and each limb has its amputation levels. This study will focus on designed a new cuff EMG system by using 3Ds Max design program and EMG Arduino to enhance in investigating the positional parameter of EMG for prosthetic users to be effective in multiple movement activities. Three sensors were included to the design and each one detects the data by three electrodes that contact with skin surface on the muscle by the special tape. It was considered that the cuff should be stretchable and designed in a range of length 35 to 55 centimeters, and 10 centimeters for width to be suitable for users. The receptors integrated with adhesive tape led to more stability, have good conductivity and strong source of the data.

Parallel Session Room 3 *(Biosensors, Biosignals & Biomedical Imaging)*

Chair: Assoc. Prof. Dr. Nur Azah Hamzaid

Paper ID: 81 10:00 a.m.

Development of Automated Segmentation of the Thigh Muscles from Dixon MRI for Fat Fraction Quantification

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Sarcopenia, an age related condition is associated with decreased in lean muscle mass and increased in muscle fat. As a result, there is a decline in muscle strength and function in older adults. Diagnosis can be performed using bio-electrical impedance analysis (BIA) though accuracy is influenced by factors such as age, gender, hydration and ethnicity. Image based biomarkers have emerged as potentially more objective for diagnosis and from several possible modalities, MRI is considered a reference. In particular multiecho sequences for chemical shift imaging such as the Dixon method can be used to enhance muscle and fat contrast and calculate intramuscular fat (IMF) infiltration. In image based analysis, there is a need for automation, specifically in the segmentation of the muscles. In this work, we propose an automatic segmentation pipeline for a multipoint Dixon sequence. We evaluated the method with a publicly available dataset and compared it with the ground truth. We also demonstrated the method using local data from an MRI scan of the thigh muscles of an older person. The results showed that the mean PDFF of the right thigh muscle segmented by the proposed method correlates well with the mean PDFF from the ground truth segmentation, with a correlation value of 0.877. Qualitatively, the proposed method also produced a good segmentation of our local data. This suggests that the proposed method of muscle fat quantification can be used in future studies.

Paper ID: 64 10:15 a.m.

Longitudinal Assessment of Optical Properties in Early Demineralization of Enamel using pH Cycling Model

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Over the decades, examination of caries lesion has been performed conventionally by visual assessment where assessment methods such as ICDAS, and Nyvad Criteria were used as a reference to determine the severity of the caries. However, the conventional dental diagnosis was unable to detect early demineralization accurately due to the indistinct physical appearance of caries lesions at early stage. The objective of this research is to study the ability of optical coherence tomography (OCT) in diagnosing early demineralization of enamel layer without involving ionizing radiation. Sound human molar teeth samples were subjected to pH cycling for 3, 7, 14, 21 and 28 days to induce caries at the region of interest. Samples were scanned using OCT to assess the progression of demineralization, whereby the optical mean attenuation coefficient for each of the samples were extracted and compared. We found that the normalized mean attenuation of samples increased with the length of pH cycling, i.e. 1.33, 1.52 and 1.79 for 3, 7, and 14 days of pH cycling. The changes could be due to the increase of porosity in enamel layer. Irregular trend started to occur after 14 days, where to the normalized attenuation coefficient decreased on day 21 and then increased again on day 28, i.e. 1.46 and 1.65 respectively. Hypermineralization was suspected to happen after 14 days of pH cycling, causing irregular mineral concentration on the tooth surface. This study shows the potential use of optical properties from OCT system to detect early demineralization of the tooth.

Paper ID: 22 10:30 a.m.

Investigate the Velocity Difference between MRI Measurement and CFD Simulation on Patient-Specific Blood Flow Analysis

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This paper tends to investigate the velocity difference between magnetic resonance imaging (MRI) measurement and computational fluid dynamics (CFD) simulation on patient-specific blood flow analysis. Three patients diagnosed with particular cerebral aneurysms are involved in the current investigation. The raw image data from patients have been processed through image segmentation for model reconstruction using several threshold coefficients, C_{thres} from 0.2 to

0.6 according to the threshold value determined using threshold determination method. Besides, the velocity profile is extracted from the MRI measurement and applied in the inlet boundary condition setup. Meanwhile, pressure-fixed (*P*-fixed) approach is applied at all the outlets prior to CFD simulation. Based on the comparison made between the MRI measurement and CFD results, the model geometries reconstructed with threshold coefficients, C_{thres} of 0.3, 0.4, and 0.5 are considered to be the optimized model geometries which have shown significantly small velocity difference between 0.3 % and 12 %, in term of average velocity among the model geometries of respective patient. The results also depict that the artery branch and the bifurcation regions, which are subjected to high velocity concentration could be the hemodynamics factor contributing to cerebral aneurysm growing and rupturing.

Paper ID: 25 10:45 a.m.

A Preliminary Assessment of Neuro-Salutogenic Landscape Stimuli in Neighbourhood Parks: Theory-based Model for Stress Mitigation

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Salutogenesis works on a prospective basis by considering how to create, enhance, and improve physical, mental, and social well-being. The purpose of this research is to identify the best landscape stimuli that complying the criteria of both cognitive and salutogenic aspect for reducing stress. This research was conducted by first developing the theory-based model and assessment checklist, followed by site preliminary studies that assessed18 parks in Klang Valley based on neuro-salutogenic landscape checklist. The results indicated that Taman Aman, Petaling Jaya recorded the best neuro-salutogenic landscape stimuli with highest score for all three aspects of adaptive, restorative, and assertive elements. The findings of this research conclude an interesting theory for design professionals about how neural potentials could explains specific human response to different design settings.

Paper ID: 33 11:00 a.m.

Development of a Mobile Augmented Reality System for Radiotherapy Practitioner Training

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Radiotherapy (RT) is the use of radiation to treat diseases in particular cancer. Recent advancements of imaging in RT and improved precision in treatment delivery require extensive training among the team. A good training approach need to be applied which aims to equip healthcare practitioners with a combination of essential understanding, clinical professional skills and technical competencies. This will provide accurate, precise and effective RT delivery. However, the expensive nature of high energy RT delivery systems and rapid introduction of new technology has until recently made their use in an academic training environment unfeasible. Augmented reality (AR) platforms, which can be run on mobile devices today constitute a possibility for academic training at lower cost. This paper describes the development of a proof of concept for an Android based device. We showed that the developed app can track small objects as well as a large object with a superimposed LINAC (Linear Accelerator) model. This proof of concept can thus be developed further for actual RT practitioner training.

Paper ID: 77 11:15 a.m.

Visual Directed Deep Breathing with Heart Rate Variability Measurement in Mobile Application

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Deep breathing produces positive physiological effects. There is numerous, existing mobile application that measures heart rate variability. However, the study on reporting the unknown changes of the total time interval at the resting stage before and after the deep breathing at 6 cycles per min for 3 min and data mining with the mobile application is novel. In this work, the measurement of the blood flow changes on the fingertip was employing the mobile camera and developed into an android-based mobile application for measuring the heart rate variability for pre-and post-effect of a directed 6 cycles in a min deep breathing video for 3 minutes. To date, a total of 204 respondents shows a total of increment of Standard Deviation of normal to normal (SDNN) 43.1 with video-directed deep breathing for 6 cycles per min for 3 min in breathing length for 3 years after the android App has launched in the google Appstore. Data mining concept with the mobile application which integrated with physical measurement enables the huge sample size recruitment globally.

Paper ID: 115 11:30 a.m.

Feature Selection for Identification of Fake Profiles on Facebook

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Technology is advancing at a breakneck speed these days. Online Social Network (OSN), which has become a part of everyone's life in terms of making new friends and keeping track of friends and their interests. Social networking sites make social life better, but there are many problems when using these Social Media sites, especially Facebook. Problems i.e., privacy, offline, hacking are mainly done through fake profiles. Researchers found that 20 to 40 percent of profiles on social networking sites such as Facebook are fake profiles. So, the problem is to build an accurate model to detect if a Facebook profile is a fake profile based on the user's social activity using machine learning techniques. As it is an automatic detection technique, machine can make it easier for the sites to manage the huge number of profiles, which cannot be done manually. There are many previous works on the identification of fake profiles. So this paper proposes the minimal set of generic features to identify the fake profiles on Facebook and the study determines that minimized set of main features are significant in the detection of the fake accounts on Facebook.

Parallel Session Room 4 *(Tissue Engineering & Clinical Management)*

Chair: Prof. Dr. James Goh

Paper ID: 84 10:00 a.m.

Novel Method of Producing Free Standing SU8-Based Carbon Scaffold as Biomedical Engineering Application

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This paper described the method of detaching SU-8 based carbon scaffold from substrates by using acid treatment method. This finding provide method to detach pyrolyzed scaffold from substrate without the need to scrap the pattern. Briefly, the scaffold patterns were fabricated by using photolithography and pyrolysis method. Then, various attempts of detaching the carbon scaffold by using acids were investigated include H_2SO_4, HNO_3, H_2O_2, and H_2SO_4/HNO_3. It was shown that the treatment of HNO_3 under stirring and non-stirring conditions provide the best structure of the resulting detached scaffold under 60 minutes treatment. By using this approach, the surface area of the free standing SU8-based carbon scaffold surface is improved which increased the cells attachment area and densities of cells. Plus, it could be then easily embedded into hydrogel or other composites materials to form a conductive 3D scaffold of in vitro model for biological application. Hence, the novel detachment methods provide a new knowledge to detach SU-8 based carbon scaffold and at the same time performing surface treatment to improve the surface properties of carbon scaffold. The findings of this study improve the potential of SU-8 based carbon scaffold as tools in future biological applications.

Paper ID: 130 10:15 a.m.

The Effect of MicroRNA Targeting IL-17RA in Regulating the Expression of RANKL and OPG in Stem Cells from Human Exfoliated Deciduous Teeth

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MicroRNA is a small RNA molecule that able to regulate gene expressions at post transcription level via either mRNA degradation or translational repression. This study is aimed to determine the potential microRNA targeting IL-17RA and its effects towards OPG and RANKL expressions in SHED. Potential microRNA was predicted by using latest algorithmically programs (DIANA-micro T CDS, TargetScan v7.1, and mirWalk v2.0) through complex filtration process via in silico. The concentration of 25nM, 50nM, and 100nM microRNA targeting GAPDH were optimized to determine the most efficient downregulation activity. The result showed that 50nM microRNA mimic transfected for 48 hours resulted in the lowest level of GAPDH mRNA expression as measured by quantitative real time PCR. Following microRNA optimization, SHED was cultured in complete α-mem supplemented with osteogenic reagents and treated with 50ng/mL of IL-17A to enhance osteogenic differentiation for 7 days. Treated cells were then transfected with 50nM of predicted microRNA (hsa-miR-6761-5p and hsa-miR-4524a-3p) for 48 hours. The expressions of IL-17RA, OPG and RANKL were measured by qPCR and normalized with β-actin. The microRNA mimic hsa-miR-4524a-3p downregulated the IL-17RA expression more than the microRNA mimic has-miR-6761-5p ($p<0.01$). In addition, both OPG and RANKL expression were downregulated by both mimics, although only OPG expression was significantly decreased. These findings highlight the importance of microRNA targeting IL-17RA and its effects on regulating the expressions of OPG and RANKL in SHED, implying a role in the bone metabolism process.

Paper ID: 132 10:30 a.m.

Synthesis of Polycaprolactone Using Novel Crude Lipase: Parameter Optimization

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Polycaprolactone was synthesized through a ring opening polymerization process by using a novel enzyme lipase from *aspergillus niger sp*. A statistical approach with D-optimal design was used to optimize the reaction parameters for the synthesis of polycaprolactone. The variables selected were temperature (30 °C - 70 °C), time (30 minutes - 150 minutes), mixing speed (100 rpm - 500 rpm) and enzyme volume (5ml - 9 ml). The response variable chosen is the number average molecular weight, Mn. Using the D-optimal method in design of experiments, the interactions between parameters and responses were analyzed and validated. The result shows a good agreement with a minimum error between the actual and predicted values.

Paper ID: 36 10:45 a.m.

Experimental Study between TPU Flex and Silicon Materials Mechanical Properties as an Alternatives in Development of the *CardioVASS* Heart Model

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The development of a heart model for medical training purposes in the current market is still new. The mechanical properties and the selection of materials become the main elements in determining the type of materials used. This paper highlighted to study of the mechanical properties between TPU Flex and silicon to determine the suitability of the material for the development of the *CardioVASS* heart model. Both of the materials were assessed by utilizing the tensile, compression, and hardness test methods to prove the validity of the materials for the *CardioVASS* heart model. Results suggested that the TPU was superior to the silicon materials in terms of strength and durability.

Paper ID: 74 11:00 a.m.

Assessment of the Cardiac Response to Sleep Arousal

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Sleep arousal or transient unconscious wakefulness is a part of normal sleep. However, once its frequency increases, it may disturb the sleep and make it fragmented. The objective of this study is to assess the effect of sleep arousals on cardiovascular function. We investigated cardiac responses to sleep arousal in a large sample comprising 2656 older men. We quantified beat-to-beat QT and RR time intervals on ECG 15 seconds prior and following to arousal onset. Obtained results show that in more than three-quarters of the men, the average RR interval shortened

during arousal compared to pre-and post-arousal intervals, while less than half of the men experienced average QT interval shortening during arousals. The QT and RR variability increased significantly during arousal, where RR variability changes were more prominent than QT variability changes. The QT variability index was weakly correlated with the apnea-hypopnea index and arousal index. In conclusion, arousal episodes trigger cardiovascular function, and their effect can be measured and quantified through cardiac QT and RR time intervals.

Paper ID: 38 11:15 a.m.

Achieving Carbon-Balanced Ecosystem: Case Study of Carbon Sequestration Analysis in Universiti Malaya

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As part of promoting an eco-campus facility in University of Malaya, this project has developed an automated carbon sequestration monitoring system using few sensor modules and analysis of tree growth. The tree growths (i.e., diameter and height) has been monitored to quantify carbon sequestration. The calculated carbon sequestration is also compared with the data collected from the proposed sensor. The study area was conducted at Rimba Ilmu, UM and the prediction of the carbon sequestration for the next 10 years is also presented in this paper. We hoped that by having this sensor module, a carbon balanced ecosystem in the campus can be achieved since the tracking and quantification of the carbon stored in the tree are known.

Paper ID: 51 11:30 a.m.

Surface Water Quality Assessment: A Case Study of Merbok River, Kuala Muda, Kedah

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This paper presents a case study on surface water quality assessment at Merbok river, Kuala Muda, Kedah. The study provides an insight on the feasibility of environmental pollution monitoring through in-situ water quality measurement. The study was conducted in the span of five months from November 2020 to March 2021 where the water quality samples were taken twice daily using water quality system and turbidity probes of EUTECH CyberScan PCD650 and EUTECH-TN100 respectively. The measured water quality parameters are pH, dissolved oxygen, conductivity, total dissolved solids, salinity, resistivity, and turbidity. Results from the sampling analysis have shown that water quality parameters of Merbok River are categorized as Class III according to the National Water Quality Standards (NWQS). The study identified a spike in pH (8.9) and dissolved oxygen in February possibly caused from dumping of industrial waste. Turbidity shows an increase during monsoon season followed by an increase in conductivity, resistivity and salinity in the dry season which implies surface runoff from industrial discharges. The state of Merbok River requires necessary attention from authorities and policy makers, to prevent future contamination that degrades the diverse ecosystem.

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