Program & Abstract Book

KOTA KINABALU • SABAH

IICAIET 2025

IEEE INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE IN ENGINEERING AND TECHNOLOGY

26 - 28 August 2025

SICC, Kota Kinabalu, Malaysia

Organisers

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WELCOME MESSAGE

Conference Chair

It is my honour to welcome you to the 7th IEEE International Conference on Artificial Intelligence in Engineering and Technology 2025 (IICAIET 2025). Welcome to IICAIET 2025, and welcome to Sabah, the land below the wind!

This year's conference continues our tradition of promoting collaboration, innovation, and knowledge sharing in the field of Artificial Intelligence (AI). Over the next few days, we will engage in thought-provoking discussions, insightful presentations, and valuable networking opportunities that bring together researchers, practitioners, and industry leaders from around the world.

This year, IICAIET received a total of 307 submissions from 21 countries, including Australia, Bangladesh, China, India, Indonesia, Iraq, Japan, Lebanon, Pakistan, Philippines, Romania, South Korea, Sri Lanka, Thailand, Turkey, United States of America, and Malaysia. To uphold the standard of the conference, all the submissions went through a rigorous reviewing process, which resulted in 188 papers accepted (61%) for oral presentation. Over these three days, we will host 18 sessions with 135 papers presentation.

We are honoured to welcome Dr. Sazali Bin Yaacob, founder of ICAIET conference (the former name of IICAIET) established in 2002, along with 4 distinguished keynote speakers, namely Ir. Dr. Bernard Lim (Appscard Group AS, Malaysia); Associate Professor Ir. Dr. Hudyjaya Siswoyo Jo (Swinburne University of Technology, Malaysia); Associate Professor Ts. Dr. Mohd Ibrahim Shapiai @ Abd. Razak (Universiti Teknologi Malaysia, Malaysia) and Professor Dr. Porkumaran Karantharaj (Sri Krishna College of Engineering and Technology, India). Their expertise and insights will provide valuable perspectives and meaningful guidance for the advancement of AI technologies and applications.

On behalf of the Organising Committee, I extend my deepest appreciation to the invited guest, keynote speakers, authors, reviewers, session chairs, and participants. Your dedication and involvement make IICAIET 2025 a meaningful and impactful platform for advancing AI research and innovation. I hope you will find the conference enriching, the discussions stimulating, and the connections you make here lasting.

Thank you.

Dr. Tan Min Keng
Conference Chair
IICAIET 2025

ABOUT IICAIET

IEEE International Conference on Artificial Intelligence in Engineering and Technology (IICAIET) is the annual flagship technical event of IEEE Sabah Subsection. Over the years, the conference has attracted strong interest from scholars, researchers, academicians, professionals, and students from around the world, covering diverse areas related to Artificial Intelligence.

The origins of the conference go back to 2002, when the first ICAIET was held in Kota Kinabalu, co-organized by Universiti Malaysia Sabah (UMS) and the Artificial Intelligence Research Unit (AiRU). ICAIET was subsequently held in 2004 and 2006, providing an early platform for the exchange of ideas and significant scientific findings in Artificial Intelligence.

With the establishment of the IEEE Sabah Subsection in 2018, ICAIET was rebranded as IICAIET with IEEE sponsorship. Since then, the conference has grown into an annual event, with proceedings published in IEEE Xplore. All past editions — IICAIET 2018, 2020, 2021, 2022, 2023, and 2024 — have been successfully indexed in Scopus and EI Compendex.

This year, IICAIET 2025 received 307 paper submissions, of which 188 papers were accepted, yielding an acceptance rate of about 61%. A total of 135 papers will be presented over three days conference.

We are proud that IICAIET continues to serve as a meaningful platform for exchanging and discussing new ideas, perspectives, and innovations in Artificial Intelligence, while fostering collaboration among researchers and practitioners worldwide.

To learn more about IICAIET, visit our website: iicaiet.ieeesabah.org

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Mohammed Ahmed Mohammed Saleh
Mohd Helmy Abd Wahab
Monika Dangore
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Vinod Kumar Ancha
Wan Sieng Yeo
Waqas Bangyal
Yu Beng Leau
Yuheng Zhang
Yuvaraj S
Zaidatol Haslinda Abdullah Sani
Zatul Alwani Shaffiei
Zhenwei Wu
Zi Yi Lim

KEYNOTE SPEAKERS

Ir. Dr. Bernard Lim

IEEE Malaysia Section Chair
Chief Operating Officer, Appscard Group AS

INVENTIVE MINDS UTILIZE IEEE INTELLECTUAL RESOURCES LIKE ARTIFICIAL INTELLIGENCE TO IMPROVE WHAT MATTERS MOST IN OUR LIVES

Engaging with IEEE has been a transformative experience, providing access to a wealth of intellectual resources that have enhanced my knowledge and professional growth. Through IEEE's research publications, conferences, and collaborative networks, I have gained valuable insights into cutting-edge technological advancements that address real-world challenges. The opportunity to engage with like-minded professionals and innovators worldwide has fostered creativity, enabling me to contribute meaningfully to projects that improve lives. IEEE's resources have not only deepened my technical expertise but have also inspired a mindset of continuous learning and innovation, reinforcing the impact of inventive minds in shaping the future.

Ir. Dr. Bernard is the Chief Operating Officer and Co-Founder of Appscard Group AS, a company specializing in biometric smartcard technology. He holds a bachelor's degree in electronic and electrical engineering, an MBA, and a Doctor of Business Administration (DBA). He has over 30 years of industry experience, having held operational and senior management roles in the electronics manufacturing sector. He has founded or co-founded four technology startup companies in Malaysia, demonstrating a strong entrepreneurial drive. His leadership experience spans organizations of various scales—from small startups with five employees to large enterprises with over 4,000 staff. Bernard has been an active member of IEEE for over 26 years. He currently serves as Chair of the IEEE Malaysia Section, Chair of the IEEE Southeast Asia Council, and Chair of the IEEE Systems Council Malaysia Chapter. He is also a member of the IEEE Committee on Global Semiconductors. In addition, he is also a Fellow of the Institution of Engineers, Malaysia (FIEM), and a Fellow of the ASEAN Academy of Engineering and Technology (AAET). He currently serves as Vice President of the Institution of Engineers, Malaysia (IEM), and sits on the Board of Engineers Malaysia (BEM). In addition, he holds key leadership roles as Chair of the Engineering Technology Accreditation Council (ETAC) and Vice Chair of the Engineering Accreditation Council (EAC).

KEYNOTE SPEAKERS

Assoc. Prof. Ir. Dr. Hudyjaya Siswoyo Jo
Swinburne University of Technology, Sarawak Campus

PRACTICAL APPLICATIONS OF AI IN ROBOTICS AND AUTOMATION: BRIDGING THEORY AND DEPLOYMENT

The rapid development of Artificial Intelligence has led to its increasing application in robotics and automation. One of the key areas where AI has made a significant impact is in enabling machine perception by addressing challenges in tasks that typically require human sensing and decision-making. This talk will share practical examples of how AI is being implemented in real-world physical systems. Case studies will cover a range of applications, including automated processes in manufacturing, intelligent infrastructure in smart cities, and AI-driven solutions in agriculture.

Dr. Hudyjaya Siswoyo Jo is an Associate Professor in the Faculty of Engineering, Computing and Science at Swinburne University of Technology Sarawak Campus, where he also serves as the Director of the Centre for Digital Futures. He is actively engaged in research across the fields of robotics and mechatronics, industrial automation, digital transformation, and mechanisation. Dr. Siswoyo Jo has successfully led numerous digital transformation projects for companies and factories across Malaysia, contributing to the advancement of smart manufacturing and Industry 4.0 practices. In addition to his academic role, he is a seasoned trainer for professional development programs, specializing in the areas of Internet of Things (IoT), mechatronics, and industrial automation. His research interests include mechatronics system design, modelling and control, industrial automation, internet-of-things, human machine interaction and agriculture mechanisation.

KEYNOTE SPEAKERS

Assoc. Prof. Ts. Dr. Mohd Ibrahim Shapiai @ Abd. Razak

Director of CAIRO, Universiti Teknologi Malaysia (UTM)

ADVANCEMENT IN AI REVOLUTIONIZES INDUSTRY AND ACCELERATES RESEARCH

The presentation titled "Advancement in AI Revolutionizes Industry and Accelerates Research" offers a comprehensive and forward-looking exploration of how artificial intelligence is transforming sectors and accelerating innovation. Beginning with a historical lens — from the early promises of AI to the setbacks of the "AI winters" — the talk highlights how breakthroughs in deep learning have reignited progress, leading to the rise of Generative AI and Large Language Models (LLMs) like ChatGPT. These models, capable of not just predicting but generating human like content, are demystified through an explanation of embeddings, fine-tuning, and how they can be adapted for real-world applications. The presentation introduces the concept of AI Agents — intelligent systems powered by LLMs and Large Vision Models (LVMs) — that are not only reactive but also able to reason, plan, and act autonomously in complex environments. These agents, when deployed on the cloud, are revolutionizing operations such as livestock monitoring, asset tracking on tall structures, semiconductor defect detection, and AI-driven conversational interfaces. Central to enabling this intelligence is the Model Context Protocol (MCP), a robust framework for grounding and governing model behavior in multi-agent systems, ensuring that agents remain context-aware, goal-driven, and aligned with operational rules and ethical considerations. Whether in industrial automation, education, customer service, or healthcare, this synergy between LLMs, LVMs, MCP, and cloud infrastructure marks a paradigm shift — one that not only boosts productivity but redefines human-AI collaboration through context rich, multimodal, and dynamic interaction.

Assoc. Prof. Ts. Dr. Mohd Ibrahim Bin Shapiai @ Abd. Razak is a distinguished expert in Artificial Intelligence, specializing in Generative AI, Deep Learning, Machine Learning, Brain-Computer Interface, and Computer Vision. He is currently the Director of the Centre for Artificial Intelligence and Robotics (CAIRO) and an Associate Professor in the Department of Electronic Systems at the Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia (UTM). He holds an MEng from the University of York, UK (2007), and a PhD in Machine Learning from UTM (2013). His contributions to AI research have earned him multiple accolades, including the York Probe Prize and various awards in AI and machine learning. He has been a Certified NVIDIA Deep Learning Instructor since 2018 and is a member of the Academy of Sciences Malaysia's Special Interest Group on Machine Learning. Internationally, he has collaborated as a visiting researcher at Keio University and Kyushu University in Japan, and currently serves as a visiting scholar at Nanjing University, China, focusing on AI-related collaborative research initiatives.

KEYNOTE SPEAKERS

Prof. Dr. Porkumaran Karantharaj

IEEE TEMS India Chair

Sri Krishna Collegeof Engineering and Technology, India;

AI REVOLUTIONIZING HEALTHCARE TECHNOLOGY

Artificial Intelligence is no longer a frontier technology—it is the catalyst driving a fundamental transformation in healthcare delivery, diagnostics, and decision-making. This keynote will delve into how AI is revolutionising healthcare technology across the continuum of care, from early detection and precision diagnostics to personalised treatment and intelligent workflow automation. Anchored by real-time case studies from leading hospitals, health-tech innovators, and research institutions, the session will showcase how AI is already delivering measurable outcomes: reducing diagnostic errors, accelerating drug discovery, optimising clinical operations, and expanding access to quality care. Attendees will gain strategic insights into the evolving role of AI in shaping a more responsive, predictive, and equitable healthcare system. This keynote challenges leaders to not just adapt to change—but to lead it—by embracing AI as a tool for meaningful, sustainable impact.

Dr. K. Porkumaran is a distinguished academician and pioneering researcher, currently serving as Principal and Senior Professor at Sri Krishna College of Engineering and Technology, Coimbatore. Also serving as Chair IEEE TEMS INDIA, member in IEEE R10 Asia Pacific Professional Activities and Industry Relations Committee. He has significantly advanced the fields of Control Systems, Artificial Intelligence, Signal Processing, and Defense Innovation. He holds a Ph.D. in Electrical and Electronics Engineering and has published over 175 research papers, authored 22 book chapters, and filed 12 patents (3 granted). Under his mentorship, 14 Ph.D. scholars have earned their doctorates. His research has attracted good funding from premier agencies such as DRDO, ISRO, DST, AICTE, ICMR, and corporate partners. Dr. Porkumaran is a Fellow of IEI and IETE, Senior Member of IEEE, ISA, and a Chartered and Professional Engineer. He has held several leadership roles including Chairman of IEEE Madras Section and has represented India in global IEEE initiatives. His visionary leadership has elevated institutional excellence and fostered innovation ecosystems across academia and industry. His exceptional contributions have earned him numerous accolades including the ISTE Best Engineering College Principal Award, FICCI Startup Leader of the Year, IEEE USA Outstanding Counselor Award, and international recognitions from IBC, UK and Marquis Who's Who, USA. A trailblazer in defense innovation, he is a two-time winner of the IDEX Defence India Startup Challenge (DISC 7 & 10), developing advanced autonomous systems for the Indian Navy and Army With experience in academics, technological foresight, and national service, Dr. K. Porkumaran continues to inspire the next generation of engineers, researchers, and innovators

SPECIAL INVITED GUEST

Dr. Sazali Yaacob

Founder of ICAIET Conference
Former Dean of School of Engineering and Technology (now Faculty of Engineering), Universiti Malaysia Sabah

Sazali Yaacob was born in 1960. He received his Bachelor of Engineering degree in Electrical Engineering in from Universiti Malaya. Upon graduation, he worked in oil palm estate before joining Universiti Malaya as an academic staff in 1986. He pursued his Master of Science degree in System Engineering at University of Surrey, 1987 and later his Doctor of Philosophy in Control Engineering from University of Sheffield, United Kingdom, 1995.

He was promoted to Associate Professor in 1998 by Universiti Malaysia Sabah and later appointed as the first dean of the School of Engineering and Information Technology from August 1998 till 2004. From 2004 till 2015, he served at University Malaysia Perlis as Professor in School of Mechatronic Engineering and was the Dean of the School from 2005 till 2007 and as Deputy Vice Chancellor (Academic) from 2009 till 2010. He recently retired from University Kuala Lumpur Malaysian Spanish Institute at Kulim, Kedah as Professor in School of Mechatronic Engineering and was the Dean and Head of Campus from 2020 till 2022.

He had published more than 300 papers in National and International Journals and Conference Proceedings. He has supervised more than 40 of postgraduate students in either Master or Doctor of Philosophy levels. His research interests are in Artificial Intelligence applications in the fields of acoustics, vision and robotics. He was conferred a Charted Engineer status by the Engineering Council, United Kingdom in 2005 and Member to the Institute of Engineering and Technology, United Kingdom.

CONFERENCE PROGRAM
IICAIET 2025

DAY 1: 26 AUGUST 2025

Time (MYT)	Programme	
8:00 – 9:00	Registration	
9:00 – 9:45	IICAIET 2025 Opening Ceremony	
9:45 – 10:30	Keynote 1: Ir. Dr. Bernard Lim (Chief Operating Officer, Appscard Group AS; IEEE Malaysia Chair) Title: Inventive Minds Utilize IEEE Intellectual Resources Like Artificial Intelligence to Improve What Matters Most in Our Lives *Moderator: Dr. Aroland Kiring*	
10:30 – 10:45	Morning Tea Break	
10:45 – 12:30	Technical Session A1: Intelligent Systems for Agriculture and Aquaculture *Session Chair: Assoc. Prof. Dr. Jamal Ahmad Dargham*	Technical Session A2: AI for Medical Imaging and Health Diagnostics *Session Chair: Dr. Rosalyn R Porle*
12:30 – 14:00	Lunch Break	
14:00 – 15:30	Technical Session B1: Smart Aquaculture and Environmental Monitoring *Session Chair: Dr. Aroland Kiring*	Technical Session B2: Intelligent Image Processing and Classification *Session Chair: Ts. Dr. Lim Kit Guan*
15:30 – 15:45	Afternoon Tea Break	
15:45 – 17:30	Technical Session C1: AI-Driven Optimization and Security in Critical Infrastructures *Session Chair: Dr. Tan Soo Fun*	Technical Session C2: IoT-Driven Intelligent Sensing and Smart Devices *Session Chair: Ir. Dr. Chua Bih Lii*
End of Conference Day 1		

CONFERENCE PROGRAM
IICAIET 2025

DAY 2: 27 AUGUST 2025

Time (MYT)	Programme	
9:00 – 9:45	Keynote Address 2 Speaker: Assoc. Prof. Ir. Dr. Hudyjaya Siswoyo Jo (Swinburne University of Technology, Sarawak Campus) Title: Practical Applications of AI in Robotics and Automation: Bridging Theory and Deployment *Moderator: Assoc. Prof. Dr. Renee Chin Ka Yin*	
9:45 – 10:30	Keynote Address 3 Speaker: Assoc. Prof. Ts. Dr. Mohd Ibrahim Shapiai @ Abd. Razak (Director of CAIRO, Universiti Teknologi Malaysia (UTM)) Title: Advancement in AI Revolutionizes Industry and Accelerates Research *Moderator: Assoc. Prof. Dr. Renee Chin Ka Yin*	
10:30 – 10:45	Morning Tea Break	
10:45 – 12:30	Technical Session D1: AI for Emotion, Action, and Experiential Insights *Session Chair: Dr. Lai Po Hung*	Technical Session D2: Reliability and Predictive Approaches in Power Systems *Session Chair: Dr. Nurfatihah Syalwiah binti Rosli*
12:30 – 14:00	Lunch Break	
14:00 – 15:30	Technical Session E1: Predictive and Optimization Techniques *Session Chair: Assoc. Prof. Dr. Tham Heng Jin*	Technical Session E2: Intelligent Modeling and Data-Driven Analysis *Session Chair: Ir. Dr. Mazlina Mamat*
15:30 – 15:45	Afternoon Tea Break	
15:45 – 17:30	Technical Session F1: AI Solutions for Industry Operations *Session Chair: Dr. Siti Nurfadilah Binti Jaini*	
End of Conference Day 2		

CONFERENCE PROGRAM
IICAIET 2025

DAY 3: 28 AUGUST 2025

Time (MYT)	Programme		
8:30 - 10:30	Technical Session G1: AI Applications in Healthcare and Public Safety *Session Chair: Ts. Dr. Tan Min Keng*	Technical Session G2: Advances in AI for Automation Control and Network *Session Chair: Ir. Dr. Yew Hoe Tung*	
10:45 - 11:00	Short Break		
11:00 - 13:15	Technical Session H1: AI for Human Interaction, Services, and Language *Session Chair: Dr. Helen Chuo Sin Ee*	Technical Session H2: AI for Visual Inspection, Materials, and Robotics *Session Chair: Assoc. Prof. Dr. Mohd. Suffian bin Misaran @ Misran*	
13:15 - 14:00	Lunch Break		
14:00 - 14:45	Keynote Address 4 (Online) Speaker: Prof. Dr. Porkumaran Karantharaj (Sri Krishna Collegeof Engineering and Technology, India; IEEE TEMS India Chair) Title: AI Revolutionizing Healthcare Technology Moderator: Dr. Aroland Kiring		
14:45 - 15:00	Short Break		
15:00– 17:30	Technical Session I1: AI for Security and Trust in Digital Systems *Session Chair: Dr. Lorita Angeline*	Technical Session I2: AI-Driven Detection and Monitoring Systems *Session Chair: Dr. Muhammad Nur Afnan bin Uda*	Technical Session I3: AI and Optimization for Sustainable Systems *Session Chair: Assoc. Prof. Ts. Dr. Leau Yu Beng*
End of IICAIET 2025			

PAPER TRACKS AND SCHEDULE

IICAIET 2025

Day 1: 26 August 2025

A1: INTELLIGENT SYSTEMS FOR AGRICULTURE AND AQUACULTURE		
SESSION CHAIR: ASSOC. PROF. DR. JAMAL AHMAD DARGHAM		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
10:45	310	Efficient Swarm Consensus: Comparative Evaluation of RLR vs Raft, RaBFT and VSSB-Raft *Sathishkumar Ranganathan,* ***Muralindran Mariappan*** *and Karthigayan Muthukaruppan*
11:00	136	Yellowfin Tuna Meat Grading Using Computer Vision and k-Nearest Neighbors Algorithm ***Jamie Eduardo Rosal****, May Demabildo, Daryl Ivan Hisola, Alan Alejandrino, Rommel Recla and Archangelo Alegado*
11:15	132	Deep Learning-Based Detection and Classification of Copra Cooking Levels Using Faster R-CNN and MobileNet SSD V2 ***Juvy Amor Galindo****, Jamie Eduardo Rosal, Apple Joy Tamayo, Cesar Tecson, Crister Canitan and Kaycee Kaye Villanueva*
11:30	1	Improving Soft-shell Mud-Crab Production using Image Processing Techniques on Crab Shell Colour Change Detection for Automation ***Joyce Kuan Yee Lu*** *and Hou Pin Yoong*
11:45	183	Real-Time Detection of Northern Corn Leaf Blight in Maize Using a Lightweight YOLOv8n Model *Jamie Eduardo Rosal, Juvy Amor Galindo, Daryl Ivan Hisola, Michael Ryan Arreglo,* ***Arnel Valdueza*** *and Amie Lou Cisneros*
12:00	107	A Comparative Study of Supervised Learning with ResNet18 and GLCM Features for Enhanced Accuracy of Cocoa Bean Classification ***Rahmat Siswanto****, Hasyiya Karimah Binti Adli and Hadi Santoso*
12:15	244	Detection and Classification of Sugarcane Leaf Diseases Using Faster R-CNN Inception V2 Architecture *Jamie Eduardo Rosal,* ***Apple Joy Tamayo****, Daryl Ivan Hisola, Juvy Amor Galindo, Jared Gamutin and Lemuel Sayao*

SESSION A2: AI FOR MEDICAL IMAGING AND HEALTH DIAGNOSTICS		
SESSION CHAIR: DR. ROSALYN R PORLE		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
10:45	321	Evaluation of a Deep Learning System for Pulmonary Tuberculosis Detection via Chest Radiographs: A Quasi-Experimental Study in Sabah ***Che Wan Ilmiyah Che Wan Ahmad***, *Khamisah Awang Lukman, Mohammad Saffree Jeffree, Raja Muhammad Raja Omar, Richard Avoi, Mohd Hanafi Ahmad Hijazi, Muhammad Zahid Abdul Muein, Hwa Kieu Stefanus Tao and Mohd Yusof Ibrahim*
11:00	292	A Collaborative Framework for Disease Prediction Using Machine Learning *Oras Baker, Kasthuri Subaramaniam, Abdul Samad Shibghatullah,* ***Zatul Alwani Shaffiei*** *and Amir Syafiq Syamin Syah Amir Hamzah*
11:15	234	Evaluation of Region-Level Loss Functions in Convolutional Neural Network for Stroke Lesion Image Segmentation ***Nurul Mazwani Marsam*** *and* ***See Pheng Hang***
11:30	97	Deep Learning Approach to EEG-Based Attention Deficit Hyperactivity Disorder (ADHD) Detection: An Empirical Comparison of Ensemble Classifiers ***Lilian Lee Yen Wei***, *Ag Asri Ag Ibrahim and Rayner Alfred*
11:45	265	A Modular Framework for Gradual LDCT Denoising Using Noisy Data Only ***Kousik Sarkar*** *and Soumen Bag*
12:00	127	A Computational Model for Stress Intervention Using Affective Brain-Computer Interfaces ***Ain Shaheada Abdul Rahim Dapit***, *Marini Othman, Muna Azuddin, Asmarani Ahmad Puzi and Untung Rahardja*
12:15	119	Magnetic Resonance Image Segmentation for Myocardial Scar Detection using Multi-stage DeepLabV3+ Framework with Comparative Backbone Analysis *Nur Ulya Nasuha Zakaria,* ***Muhammad Khusairi Osman***, *Siti Noraini Sulaiman, Dayang Suhaida Awang Damit, Nor Ashidi Mat Isa, Noor Khairiah A. Karim, Zakaria Hussain and Nor Afnan Zharif Nor Kamal*

SESSION B1: SMART AQUACULTURE AND ENVIRONMENTAL MONITORING		
SESSION CHAIR: DR. AROLAND M'CONIE JILUI KIRING		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
14:00	318	Machine Learning Based Hunger Behaviour Classification for Hybrid Grouper ***Zi Kai Tan**, Kit Guan Lim, Rossita Shapawi, Leong Seng Lim, Hui Hwang Goh and Kenneth Tze Kin Teo*
14:15	314	Integrated Real-Time Decision Support for Precision Aquaculture Using 3D Vision and Dynamic Coefficient Swarm Optimization ***Nyiak Tien Tang**, Kit Guan Lim, Fui Fui Ching, Ismail Saad, Baojian Yang and Kenneth Tze Kin Teo*
14:30	309	Design and Development of a Volumetric Smart Feeder for Fish Meal Production Line *Jamal Dargham, Renee Chin, Ervin Gubin Moung, **Mohd Rafiezul Fikri Hassan**, Bih Lii Chua and Hoe Tung Yew*
14:45	209	A Comparative Study of Segmentation Techniques for Automated Fish Counting ***Mohd Hanafi Ahmad Hijazi**, Aiesha Zahratul Jannah Jaiman, Puteri Nor Ellyza Nohuddin and Ervin Gubin Moung*
15:00	290	A State-of-the-Art Review of Deep Learning-Based Computer Vision Waste Detection: R-CNN, YOLO, Transformers, and Hybrid Models *Ervin Gubin Moung, **Owen Tamin**, Samsul Ariffin Abdul Karim, Jumat Sulaiman and Ali Farzamnia*
15:15	293	Contois Model Related to Constructed Wetland System *Irwan Iqbal Ihsanuddin, **Amir Syafiq Syamin Syah Amir Hamzah** and Zatul Alwani Shaffiei*

SESSION B2: INTELLIGENT IMAGE PROCESSING AND CLASSIFICATION		
SESSION CHAIR: TS. DR. LIM KIT GUAN		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
14:00	275	Impact of Image Quality on YOLOv7-Based Face Detection Accuracy ***Hakimmie Zainal**, Min Keng Tan, Chung Fan Liau, Soo Siang Yang, Min Yang and Kenneth Tze Kin Teo*
14:15	304	Enhancing Suspicious Behaviour Detection in Low-Light Surveillance Using a Hybrid Deep Learning Model *Lorita Angeline, **Ernes Jane Radin**, Muhammad Nur Afnan Bin Uda, Ervin Moung and Kenneth Teo*
14:30	307	Face Recognition with Mask Using Generative Adversarial Networks and Variational Autoencoders ***Khalifa Chekima**, Rayner Alfred, Mohammed Ahmed Mohammed Saleh, Rayner Pailus and Ashraf Osman Ibrahim Elsayed*
14:45	303	Exploring Chaotic Image Characteristics for Age Classification Enhancement ***Nurfarahin Jemali** and Renee Chin*
15:00	139	Remote Sensing Image Classification Using Deep Residual Networks *Melati Idayu Abdul Kahar, **Hariyanti Mohd Saleh** and Cascarldini Chrisson Nelson*

SESSION C1: AI-DRIVEN OPTIMIZATION AND SECURITY IN CRITICAL INFRASTRUCTURES		
SESSION CHAIR: DR. TAN SOO FUN		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
15:45	257	Adaptive Automatic Generation Control for Interconnected Power Systems with Q-Learning ***Shun Quan Chai***, *Min Sian Ng, Wan Zaizarenah Zaman, Wei Yeang Kow, Min Keng Tan and Kenneth Tze Kin Teo*
16:00	196	Evaluation of Various Sequential Constructive Approaches for Optimizing Vehicle Routing Problem with Time Windows ***Hongyi Du*** *and Yoshitaka Tanimizu*
16:15	284	Deep Q-Learning-Based Route Optimization for Traffic Network ***Siti Nor Atiqah Moharam***, *Matthew Laurentius Bansing, Kit Guan Lim, Min Keng Tan, Helen Sin Ee Chuo and Kenneth Tze Kin Teo*
16:30	89	Strengthening Trust and Security through ISO 27001 Compliance: A Conceptual Framework for Information Management ***Azlin Ramli***, *Mohamad Yusof Darus, Fakariah Hani Mohd Ali, Mohd Rashid Abu Bakar, Nor Shamshillah Kamarzaman and Zolidah Kasiran*
16:45	80	Enhancing 5G/6G Network Efficiency and Security via Artificial Intelligent-Driven Real-Time Analytics and Resource Optimization *Sharmin Sharmin,* ***Ismail Ahmedy*** *and Habibah Ismail*
17:00	306	Adaptive Parameters Configuration of LoRa for Multi-Hop Networks Transmission ***Muhd Kahfi Jumali***, *Kit Guan Lim, Lorita Angeline, Ervin Gubin Moung, Tianlei Wang and Kenneth Tze Kin Teo*
17:15	261	Comparative Analysis of Lightweight Stream Ciphers for Constrained IoT Resources ***Soo Fun Tan***, *Zi Xuan Wan, Po Hung Lai, Florence Sia and Yu Beng Leau*

SESSION C2: IOT-DRIVEN INTELLIGENT SENSING AND SMART DEVICES		
SESSION CHAIR: IR. DR. CHUA BIH LII		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
15:45	100	Performance Evaluation of Blockchain-Based AIoT Inspection Device ***Zi Yi Lim***, *Chien-Chia Huang and Yi-Da Chiang*
16:00	301	Design And Implementation of an ESP32-CAM 4WD Remote Monitoring with EEPROM Calibration & PythonAnywhere Cloud *Muhammad Nur Afnan Bin Uda,* ***Randy Chong****, Uda Hashim, Muhammad Nur Aiman Bin Uda, Chai Chang Yii, Aroland Kiring and Saroja Rijal*
16:15	175	Smart Cane for the Visually Impaired: Enhancing Navigation, Safety, and Emergency Response ***Kah Meng Leong****, Irene Cheh Lin Kong, Khai Le Ng, Bun Seng Chan, Tian Swee Tan, Matthias Foh Thye Tiong, Jahanzeb Sheikh and Kun Ma*
16:30	251	UAV-Based Visual Contamination Detection and Intelligent Cleaning Strategy Optimization for Photovoltaic Panels ***Haijiang Tian****, Ismail Saad, Tianshu Chen, Xiwei Yu, Bih Lii Chua and Houpin Yoong*
16:45	302	IoT-Based System for Nanoampere to Milivolt Amplification in Amperometric Biosensors *Muhammd Nur Afnan Bin Uda,* ***George Wong Teck Siang****, Uda Hashim, Muhammad Nur Aiman Bin Uda, Lorita Angeline, Min Keng Tan and Kit Guan Lim*
17:00	279	Design and Performance Evaluation of a Touchless IR-Based IoT Smart Lock for Hygienic Access Control *Ismail Bin Saad,* ***Lim Kit Guan****, Nurmin Binti Bolong, Mohammad Saffree Jeffree, Kenneth Teo Tze Kin, Fatimah Binti Ahmedy and Kukjin Chun*

Day 2: 27 August 2025

SESSION D1: AI FOR EMOTION, ACTION, AND EXPERIENTIAL INSIGHTS		
SESSION CHAIR: DR. LAI PO HUNG		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
10:45	315	Evaluation of Noise Filtering Techniques for Speech Emotion Recognition in Educational Environment ***Fatmawati Sunaryo*** *and Rosalyn R Porle*
11:00	316	Real-Time Speech Emotion Recognition Using Deep Learning for Emotion Based Music Recommendation ***Grace Evelyn Wong*** *and Rosalyn R Porle*
11:15	102	Measuring Neck Squeezing Angles in Validating the Creative Trauma Cleansing Therapy Effectiveness *Azeem Fitri Mohamad,* ***Ummi Noor Nazahiah Abdullah*** *and Jumala Multazam*
11:30	260	A Comparative Analysis of Skeleton-Based Human Action Recognition on DOOH Advertising ***Jen Li Chung****, Lee Yeng Ong and Meng Chew Leow*
11:45	181	Classification of Song Genre Based on Textual Lyrics and Song Profile Information ***Po Hung Lai****, Jerrald Juan Pinso, Florence Sia and Soo Fun Tan*
12:00	308	Comparative Analysis of Feature Extraction and Noise Reduction Methods for Distress Keyword Detection *Lorita Angeline,* ***Wan Nur Afrina Wan Azli****, Min Keng Tan, Kit Guan Lim and Kenneth Teo*
12:15	262	ExplainNet: A Hybrid Visual-Linguistic Model for Human-Centered Autism Diagnosis ***S.M. Sefat****, Muhamad Hariz Bin Muhamad Adnan and Md Mahmudul Hasan*

SESSION D2: RELIABILITY AND PREDICTIVE APPROACHES IN POWER SYSTEMS		
SESSION CHAIR: DR. NURFATIHAH SYALWIAH BINTI ROSLI		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
10:45	224	Reliability Analysis Based on Fault Tree Analysis for SSCB Snubber Circuit Employing Inverse Current Injection Method ***Jae-seong Jo***, *Jae-Hun Cha, Guangxu Zhou and Feel-Soon Kang*
11:00	222	Reliability Analysis of SSCB Snubber Circuit Based on Markov Model and LSTM ***Seong Jin Lim***, *Jae-seong Jo, Sung Yong Joo and Feel-Soon Kang*
11:15	300	Correlation Between Surface Morphology and Conductivity of Nanostructured Electrodes: A FESEM and I–V Characterization Study *Uda Hashim,* ***Saroja Rijal****, Muhammad Nur Afnan Bin Uda, Muhammad Nur Aiman Bin Uda, Yuri Pamungkas and Nurul Hulwani Ibrahim*
11:30	221	Reliability Assessment of DC Solid-State Circuit Breaker with Snubber Circuit Based on Part Stress Analysis Using LSTM ***Jae-Hun Cha***, *Yun-Sik Jang, Sang-Hyeok Lee and Feel-Soon Kang*
11:45	223	Relationship Between Charging Time and Converter Reliability According to the Current Magnitude of the CC Section in the CCCV Charging Method ***Yun-Sik Jang***, *Sung-Geun Song, Seong-Jin Lim and Feel-Soon Kang*
12:00	227	Predictive Modelling of Air Booster Compressor Motor for Health Monitoring Using Optimized Feedforward Neural Network ***Rosli Nurfatihah Syalwiah***, *Ibrahim Rosdiazli, Ismail Idris and Omar Madiah*
12:15	258	Common-Mode Voltage Suppression Strategy for Odd-Phase Motor Based on Pulse Shifting and Dead-Time Compensation ***Chengjiang Shangguan***, *Yiying Wu, Ye Lin, Lixia Chen and Yafei Ma*

SESSION E1: PREDICTIVE AND OPTIMIZATION TECHNIQUES		
SESSION CHAIR: ASSOC. PROF. DR. THAM HENG JIN		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
14:00	259	Multi-Level Support Thresholds for Association Mining ***Pakorn Leesutthipornchai***
14:15	317	Reinforcement Learning-Based Control for Fed-Batch Penicillin Fermentation ***Rosmawati Rumi***, *Min Keng Tan, Kenneth Tze Kin Teo, Sivakumar Kumaresan and Heng Jin Tham*
14:30	278	Dyna Q-Learning Algorithm in Temperature Control for Exothermic Process ***Yan Yi Vun***, *Huiyi Xu, Min Keng Tan, Helen Sin Ee Chuo, Heng Jin Tham and Kenneth Tze Kin Teo*
14:45	174	An Enhanced EWMA Chart with Variable Sampling Interval Based on Expected Average Run Length ***Peh Sang Ng***, *Zhi Lin Chong, Huai Tein Lim, Wai Chung Yeong and Poh Choo Song*
15:00	233	An Effective Binary Equilibrium Optimizer Based on Fitness-Distance Balance for the Minimum k-Dominating Set Problem *Saad Adnan Abed, Mustafa Tareq, Ali A. Mahmood and* ***Farrukh Hassan***
15:15	81	Adaptive Model Retraining via Intelligent Data Extraction for Distribution Shifts ***Hoo Meng Wong***, *Ling Ling Chan, Siti Farah Norbaini Binti Mohamad and Sundresan Perumal*

SESSION E2: INTELLIGENT MODELING AND DATA-DRIVEN ANALYSIS		
SESSION CHAIR: IR. DR. MAZLINA MAMAT		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
14:00	291	Integrated Renewable Energy Performance in Tropical Climates: A Review ***Rickson Dutis***, *Mohd Azlan Bin Ismail and Mohd. Kamel Wan Ibrahim*
14:15	238	Predicting Wind Speed Using Historical Averages: An Extra Trees Regressor Approach ***Izhar Hussain***, *Boon Ching Kok, Chessda Uttraphan, Kim Gaik Tay, Adil Noor and Safdar Ali Abro*
14:30	228	Vibration Measurement Using L-K Optical Flow LSTM Regression Model ***Harold Harrison***, *Mazlina Mamat, Farrah Wong, Yew Hoe Tung, Racheal Lim and Mohd Amran Madlan*
14:45	176	Channel Estimation for mmWave Massive MIMO Systems Using Deep Convolutional Neural Network ***Shahryar Akbar***, *Farhan Khalid, Abdullah Hasan and Muhammad Shahzad Younis*
15:00	184	Hybrid Quantum Convolutional Neural Networks with Structured Quantum Layers and Expressivity Analysis ***Kai Ping Hoo*** *and Tan Chye Cheah*
15:15	283	Exploring the Synergy of Augmented Reality and Smart Tourism in the Digital Era: Integrating IoT, 5G, and Big Data for Enhanced Travel Experiences *Angeline Lee Ling Sing and* ***Ng Giap Weng***

SESSION F1: AI SOLUTIONS FOR INDUSTRY OPERATIONS		
SESSION CHAIR: DR. SITI NURFADILAH BINTI JAINI		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
15:45	56	LLM-Based Hybrid Framework for Industrial Anomaly Detection for Smart Manufacturing ***Swee Tee Fu***, *Bee Theng Lau, Mark Kit Tsun Tee and Deron Yijia Foo*
16:00	68	Semantic Feature Selection via LLMs for Palm Oil Price Forecasting in Low-Resource Markets ***Mutian Ouyang***, *Maobo Guo, Biqin Li, Baiyi Chen, Maria Anu V and Joshua Thomas*
16:15	155	Optimized Tree-Based Mining Contrast Subspace for Categorical Data ***Nadia Mukti***, *Florence Sia, Lai Po Hung, Tan Soo Fun, Rayner Alfred and Ayman Al-Ani*
16:30	255	Ensemble Learning with N-Gram Features for Enhanced Fault Diagnosis Through Maintenance Reports ***Nik Ahmad Danial Mohd Kamarolzaman***, *Nurul Adilla Mohd Subha, Nurul Hannah Mohd Yusof, Norikhwan Hamzah, Anita Ahmad and Noorhazirah Sunar*
16:45	312	Deep Learning Approaches for Sentiment Analysis in Customer Reviews ***Po Hung Lai***, *Geraldine Keng-Cheng Yew, Florence Sia and Soo Fun Tan*
17:00	286	Influence of Data Pre-Processing on CNN-LSTM Model for Regression-Based Analysis *Mohd Hafizie Hamdie James,* ***Siti Nurfadilah Binti Jaini***, *Mohd Azlan Bin Ismail and Choong Wai Heng*

Day 3: 28 August 2025

SESSION G1: AI APPLICATIONS IN HEALTHCARE AND PUBLIC SAFETY		
SESSION CHAIR: TS. DR. TAN MIN KENG		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
8:30	289	Hyperparameter-Tuned LSTM for High-Performance Malay Sentiment Classification ***Rayner Alfred***, *Shahdatul Syahirah Shahdatul Syahirah Binti Faid, Rayner Pailus, Khalifa Chekima, Zaidatol Haslinda Abdullah Sani and Yuto Lim*
8:45	294	Optimizing Hyperparameters in Machine Learning for Enhanced Fake News Detection on Social Media ***Rayner Alfred***, *Anis Aqilah Binti Zazali, Florence Sia Fui Sze, Po Hung Lai, Rayner Pailus, Khalifa Chekima, Ashraf Osman Ibrahim Elsayed, Yuto Lim and Haviluddin Haviluddin*
9:00	144	Retail Transformation in Healthcare: A Comprehensive Framework for Intelligent Eye Care Services Integration ***Ajit Kumar Sahu*** *and* ***Kapil Kumar Reddy Poreddy***
9:15	263	AI-Powered Health Insurance Fraud Detection Using QEM-FusionNet Based SmartGridRand ***Indirakumar Rajendiran*** *and Dhivyabharathi Ramanathan*
9:30	194	Application of Machine Learning Algorithms for Early Prediction of Diabetes Using Lifestyle and Physiological Data ***Meena Ravikumar***, *Sudikshya Shrestha and Mohammad Dabbagh*
9:45	133	Predictive Modeling of Type 2 Diabetes via Glucose-Insulin Interactions Using Machine Learning Techniques ***Nor Azlan Othman***, *Muhammad Zuhair Muqris Mohd Zamri, Mohd Hussaini Abbas, Sarah Addyani Shamsuddin, Nor Salwa Damanhuri, Belinda Chong Chiew Meng, Samsul Setumin and James Geoffrey Chase*
10:00	131	Classification of Cleft Lip Among Children Using Convolutional Neural Network Architectures ***Nor Salwa Damanhuri***, *Nur Zulaika Izzati Abdul Rahman, Nor Azlan Othman, Belinda Chong Chiew Meng, Nur Najiha Kamarulzaman and Pauline Yap*
10:15	250	Philippine-Based Anti-Scam SMS Relay System Using Few-Shot LaBSE ***Simon Carl De Leon***, *Ryan Ray Limbo and Rosemarie Pellegrino*
10:30	103	Why Dark Nuns Split Audiences: A Sentiment Analysis of Hype vs Disappointment Using BERT NLP ***Bryan Yang***, *Kevin Gunawan and Christian*

SESSION G2: ADVANCES IN AI FOR AUTOMATION CONTROL AND NETWORK		
SESSION CHAIR: IR. DR. YEW HOE TUNG		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
8:30	151	Optimizing Data Stream Partitioning to Improve RealTime Performance in Distributed Messaging ***Sibaram Prasad Panda***
8:45	159	Optimizing LLM-Based Recommendation Systems with Distillation and Quantization ***Yuanjing Zhu*** *and Yunan Liu*
9:00	225	Enhancing Retail System Resilience Through Integrated Cloudless AI and AIOps: A Framework for Real-Time Market Adaptation and Consumer Behavior Response ***Milankumar Rana****, Monika Malik and Twinkle Joshi*
9:15	276	Optimization of Multi-Area Automatic Generation Control Using Temporal Difference Algorithm ***Jared Riong****, Shun Quan Chai, Nordin Aminuddin, Min Keng Tan, Ahmad Razani Haron and Kenneth Tze Kin Teo*
9:30	211	Transformative AI Technologies in High-Voltage Systems: A Review of Advances in Predictive Maintenance, Fault Detection, and Grid Optimization ***Ian Benitez*** *and Melodia Pahati*
9:45	313	Robust Adaptive Kalman Filtering with Dynamic Learning for UAV Altitude Estimation ***Longxin Wei****, Jin Shi, Kit Guan Lim, Min Keng Tan, Hou Pin Yoong and Kenneth Tze Kin Teo*
10:00	169	Optimized RSS-Based Handover Algorithm for IoMT System in HETNET *Hoe Tung Yew,* ***Benson Foo Zen Kong****, Chung Seng Kheau, Aroland Kiring, Mazlina Mamat and Farrah Wong*
10:15	287	Development of a Sensor-Driven Autonomous Vehicle for Real-Time Obstacle Avoidance on a Microcontroller-Based Platform ***Alvin Wong****, Aroland Kiring, Mohamed Aizad Mohamed Ghazali, Muhammad Nur Afnan Uda, Liawas Barukang and Lyudmila Mihaylova*
10:30	236	Study of Path Plotting for Unmanned Rice Harvester Based on Improved A* Algorithm *Qingqing Qiao, Baojian Yang, Kenneth Tze Kin Teo, Liwen Liang, Zhuoying Xie and* ***Qinyuan Wang***

SESSION H1: AI FOR HUMAN INTERACTION, SERVICES, AND LANGUAGE		
SESSION CHAIR: DR. HELEN CHUO SIN EE		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
11:00	115	Gesture-Controlled Device for Speakers using Machine Learning ***Josh Mickylle Amonoy*** *and Meo Vincent Caya*
11:15	285	PoliBERT: Dynamic Computation Allocation via Policy Networks ***Vishnunand Pillai****, Darsh Tibrewal, Mubashir Farooqui and Gokul Raj Rajasekaran*
11:30	116	Advancing Sentiment Analysis in Malayalam: A Resource-Constrained Study on Sports News ***V R Girija*** *and T Sudha*
11:45	252	Hybrid Deep Learning Model for Sentiment Analysis on Japanese Amazon Product Reviews ***Ramanna T****, Gayathri Hegde and P Deepa Shenoy*
12:00	254	Performance and Efficiency Trade-Offs in Transformer Models for Kannada Sentiment Analysis ***Meghana D K****, Kiran K, Sahar Mariam Baig, P Deepa Shenoy and Venugopal K R*
12:15	156	WORDEX: Early Dyslexia Detection and Support ***Sasindu Hansamal****, Oshan Dissanayake, Sandunika Samarakoon, Namal Jayawardana, Samantha Thelijjagoda and Poojani Gunathilake*
12:30	185	TripHomie: A Machine Learning-Driven Web Platform for Smart Tourism in Kandy, Sri Lanka ***Wathsala Priyankara*** *and Asanka Dinesh*
12:45	253	Filipino Sign Language Recognizer Using Hand Pose Estimation and SqueezeNet ***Jeremy Espera****, Jarl Kayne Jon Centeno and John Paul Cruz*
13:00	280	Machine Learning Techniques for Predictive Analytics of Academic Outcomes and Behavior of Pupils ***Samuel-Soma M. Ajibade****, Nanet A. Goles, Mersin C. Villagonzalo, Rosie Fe B. Legaspino, Charmaine P. Antecristo, Johnry P. Dayupay, Catherine P. Tapales, Feliciana G. Cababat, Anthonia Oluwatosin Adediran and Kayode A. Akintoye*

SESSION H2: AI FOR VISUAL INSPECTION, MATERIALS, AND ROBOTICS		
SESSION CHAIR: ASSOC. PROF. DR. MOHD SUFFIAN BIN MISARAN @ MISRAN		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
11:00	214	SVM-LSTM Model for Real-Time Detection of Punching Errors and Classification Using Kinectv2 and BNO055 Sensor ***Keenan Kyle Malonzo*** *and Joseph Bryan Ibarra*
11:15	166	Review of Artificial Intelligence Applications in Performance Prediction of Advanced Energy Materials ***Paula Marielle Ababao*** *and Ian Benitez*
11:30	167	AI-Driven Computational Materials Science for Advanced Energy Materials Development ***Paula Marielle Ababao*** *and Ian Benitez*
11:45	171	Fitness Assessment of Philippine Bill Using YOLOv8 *Ameer Allen Abinuman,* ***Marc Hendri Soquiat*** *and Noel Linsangan*
12:00	217	Harris Performance as Activation Function for Image Classification in Convolutional Neural Network and Transfer Learning Models ***Luther Villacruz****, Maria Lyn Bernadette Mendoza and Robetson Laban*
12:15	134	DiffuseNet: A Hybrid cGAN and Diffusion Model Framework for Enhanced SAR Image Colorization ***Pranav Rao Pernankil****, Rohan Anantapur, Sripriya Addanki,* ***Manav Madhusudhan Nayak*** *and Prema R*
12:30	138	Wafer Defect Image Classification Optimization Using CNN with Cyclical Learning Rate ***Cascarldini Chrisson Nelson****, Hariyanti Mohd Saleh and Nor Hidayah Saad*
12:45	249	Enhancing Recruitment Selection Process in Human Resource with Artificial Intelligence Powered Resume Parser *Yik Junn Kuan,* ***Pei Yi Voon****, Li June Tan, Mahdiyeh Sadat Moosavi and Kar Yee Chong*
13:00	248	Analyzing Machine Learning Models for Demand Forecasting in Fast-Moving Consumer Goods on Responsible Consumption and Production ***Jing Yao Yap****, Yik Junn Kuan, Preethi Subramanian, Li June Tan and Mahdiyeh Sadat Moosavi*

SESSION I1: AI FOR SECURITY AND TRUST IN DIGITAL SYSTEMS		
SESSION CHAIR: DR. LORITA ANGELINE		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
15:00	118	Gait-Based User Authentication System Using Machine Learning on Mobile Devices ***Vyshak R*** *and Dushyanth Gopal*
15:15	142	Detecting Impersonation in Social Media: An NLP and Machine Learning Perspective *Ihab Agha,* ***Nancy Bou Ghannam****, Mahmoud El Samad and Kamil Badereldine*
15:30	215	Deepfake Video Detection Based on Scatter Wavelet Transform and Deep Learning ***Baneen Musa Mahdi*** *and Ali Mohammad Sahan*
15:45	178	AI-Driven Network Intrusion Detection Systems: A Survey of Techniques, Datasets, and Deployment Challenges ***Sedat Çimen***
16:00	106	Integration of Quantum-Based Approaches into Visual Question Answering Systems ***Merve Güllü*** *and Necaattin Barışçı*
16:15	92	Toward Semantic Communication in 6G: A Multimodal Perspective Based on Visual Question Answering Systems ***Merve Güllü*** *and Necaattin Barışçı*
16:30	157	Analyzing the Efficacy of Open-Source Forensic Features in Image Tampering Detection ***Norkhushaini Awang****, Mohamad Darus and Nur Amirah Balqis Noor Azli*
16:45	192	A Meta-Classified Hybrid Fusion Model for Interference-Resilient Modulation Recognition ***Muhammad Muneeb Tahir****, Arbab Latif, M Shahzad Younis, Rao Naveed Bin Rais and Khalid Ammar*
17:00	243	An Enhanced Hybrid Deep Learning Architecture for Android Malware Detection Using CFG and DeepWalk Embeddings ***Mohammad Sarwar Hossain Mollah****, Mohd Fadzli Bin Marhusin and Syaril Nizam Omar*
17:15	272	Detecting IPv6 SEND Flooding Attacks Using a Machine Learning Framework *Ayman Al-Ani, Ahmed K. Al-Ani, Francis Syms, Shams A. Laghari and* ***Ashraf Osman Ibrahim***

SESSION I2: AI-DRIVEN DETECTION AND MONITORING SYSTEMS		
SESSION CHAIR: DR. MUHAMMAD NUR AFNAN BIN UDA		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
15:00	189	Deep Learning for Brain Tumor Detection: U-Net Segmentation and Xception Classification with LoRA-Driven Synthetic Data Augmentation ***Md. Muhaimenul Haque Prottoy***, *Rifat Bin Reza, Shahriar Islam, Md. Mahfujul Haque and Nafiz Ahmed Rhythm*
15:15	86	Lightweight Deep Learning for Fish Disease Detection: An EfficientNet Approach *Abdul Kadar Muhammad Masum,* ***Md Fokrul Islam Khan****, Md. Maruf Hassan and Touhid Bhuiyan*
15:30	129	Explainable AI Approach for Classifying Fruit and Vegetable Health Condition Status Using CNN and Grad-CAM ***Redha Yousif*** *and Khamael Al-Dulaimi*
15:45	240	AI-Based Chilli Leaf Disease Detection and Remedy Recommendation System ***Waruni Hettiarachchi*** *and Daminda Herath*
16:00	160	Eggplant Size Acquisition Using Mask R-CNN ***Martin Julian C. Aniceto****, John Cedrick A. Montilla and Meo Vincent C. Caya*
16:15	170	Chili Peppers Inspection Based on Philippine National Standard Specification and Grading Using Integrated Image Processing Algorithms and Support Vector Machine ***Richard Rodrigo****, Mykell Paulines and Jessie Balbin*
16:30	161	Real-time Vision Based Diseases Identification for Oil Palm Trees Using Edge Device *William Kwong Fook Chen,* ***Vasanthan Maruthapillai****, Leong Kah Meng and Teh Zhong Kiat*
16:45	147	Hygienic Design of Autonomous Mobile Robot for Seafood Industry ***Supachai Vongbunyong****, Kitti Thamrongaphichartkul, Natkamon Khantee, Jitphisuit Thanajinda, Suvaluk Asavasanti and Chatchai Pholmool*
17:00	177	State-of-the-Art Smart Technology for Real-Time Monitoring and Analysis of Palm Oil Mill Effluent (POME) Wastewater ***Thamil Vaani****, Yap Chiew Lin and Joshua Yap Lip Vun*

SESSION I3 AI AND OPTIMIZATION FOR SUSTAINABLE SYSTEMS		
SESSION CHAIR: ASSOC. PROF. TS. DR. LEAU YU BENG		
TIME (MYT)	**PAPER ID**	**PAPER TITLE & AUTHORS**
15:00	271	Spatio-Temporal Q-Learning for Optimal Sealed-Bid Generation in Consortium Blockchain-Based Double Auctions for Multi-Microgrid Energy Markets ***Zubin J. B.**, Sunitha R. and Gopakumar Pathirikkat*
15:15	305	A Comparative Study of BP and GA-BP Models for Predicting the Dual-Fuel Engine Performance *Hui Chen, **Xianglei Meng**, Kit Guan Lim, Min Keng Tan, Mohd Suffian Misaran and Kenneth Teo*
15:30	187	Energy-Optimal Routing Optimization for Connected and Autonomous Vehicles in Urban Networks: A Numerical Modeling Approach ***Mahbub Hassan**, Md. Emtiaz Kabir, Touhid Bhuiyan and Md Maruf Hassan*
15:45	188	Bilevel Optimization Framework for Urban Toll Pricing Under Stochastic User Equilibrium: A Metaheuristic Approach ***Mahbub Hassan**, Md. Emtiaz Kabir, Touhid Bhuiyan and Md Maruf Hassan*
16:00	208	Microscopic Debris Classification of Pasig River Philippines Using Unsupervised Learning Clustering Algorithms ***Amelie Claire Festin**, Jianette Mari Go, Antonio Santino Chan, Aidan Radley Sy and Melchizedek Alipio*
16:15	96	Agriculture Decision Support Systems Review to Analyse and Limit Problems Inside Greenhouses ***Hanan Hussein Al-Asadi**, Nicolae Goga and Ali M Muslim*
16:30	112	Designing Effective LSTM Models for Household Energy Forecasting: An Empirical Study on the Effects of Architectural Choices and Regularization ***Muhammad Mukmin Muwahid Ahmad Aidil**, Norzaidah Md Noh and Zaid Mujaiyid Putra Ahmad Baidowi*
16:45	190	Explainable Machine Learning for Understanding Trip Mode Choice: Evidence from the 2022 U.S. National Household Travel Survey ***Mahbub Hassan**, Syeda Tamzida Akter, Sayed Shahriar Islam Lamun, Touhid Bhuiyan and Md Maruf Hassan*
17:00	191	Sociodemographic Determinants of Gasoline Vehicle Ownership in the United States: A Machine Learning Approach ***Saikat Sarkar Shraban**, Mahbub Hassan, Touhid Bhuiyan and Md Maruf Hassan*
17:15	195	Visions of Cleanliness: Accelerating Waste Management with Deep Learning ***Yu Beng Leau**, Yong Zhen Goh, Kun Li, Ying Han, Adi Wibowo and Ervin Gubin Moung*

ABSTRACTS

Session A1:
Intelligent Systems for Agriculture & Aquaculture

310 Efficient Swarm Consensus: Comparative Evaluation of RLR vs Raft, RaBFT and VSSB-Raft

Sathishkumar Ranganathan, **Muralindran Mariappan** and Karthigayan Muthukaruppan

Consensus algorithms have been integrated with swarm robotics for decades to maintain a consistent global state among swarm agents in the distributed environment. Common consensus approaches in swarm robotics includes majority voting, average consensus, leader election, and more recently, blockchain-inspired protocols like PoW, PoS, PBFT, and Raft algorithms. However, deploying consensus in swarm robotics has several challenges like computing resource and energy storage constraints, scalability limitations due to message complexity and high latency, and inadequate security to handle byzantine robots in the swarm. Consequently, our research is aimed to design and develop a suitable consensus mechanism that overcomes these limitations and enables effective coordination among swarm robots. This paper primarily focuses on significance of our solution, details on simulator based experiment and the experiment results discussion.

136 Yellowfin Tuna Meat Grading Using Computer Vision and k-Nearest Neighbors Algorithm

Jamie Eduardo Rosal, *May Demabildo, Daryl Ivan Hisola, Alan Alejandrino, Rommel Recla and Archangelo Alegado*

This study presents a computer vision system for grading yellowfin tuna meat using the k-nearest neighbors (k-NN) algorithm. The system utilizes a studio-type light box and a high-definition camera connected to a computer, capturing images under consistent lighting conditions. Image processing techniques were applied to extract color and texture features, which were then used to train the k-NN classifier. The system was evaluated using classification metrics derived from the confusion matrix, achieving an overall accuracy of 80.77%. The developed setup demonstrates effective classification performance while maintaining low computational resource usage, making it suitable for real-time deployment in resource-constrained environments.

132 Deep Learning-Based Detection and Classification of Copra Cooking Levels Using Faster R-CNN and MobileNet SSD V2

***Juvy Amor Galindo**, Jamie Eduardo Rosal, Apple Joy Tamayo, Cesar Tecson, Crister Canitan and Kaycee Kaye Villanueva*

This paper explores the performance of two deep learning object detection architectures—Faster R-CNN with Inception V2 and MobileNet SSD V2—for detection and classification of the degree of cooking in copra meat based on its visual characteristics. A total of 1,932 annotated images were collected and categorized into three classes: under-cooked, perfectly-cooked, and over-cooked. Both models were trained and tested using the same dataset, with performance evaluated using standard COCO metrics, including Average Precision (mAP), Average Recall (AR), and overall classification accuracy. Faster R-CNN with Inception V2 achieved an overall accuracy of 98.47%, with an mAP of 83.6% and AR of 87.4%, while MobileNet SSD V2 achieved 81.3% accuracy, 75.6% mAP, and 79.5% AR. These results suggest that Faster R-CNN offers higher precision for industrial settings, while MobileNet SSD may be suitable for mobile or edge deployment where computational efficiency is critical. The study presents a baseline evaluation and identifies opportunities for future improvements in copra quality assessment through deep learning.

1 Improving Soft-shell Mud-Crab Production using Image Processing Techniques on Crab Shell Colour Change Detection for Automation

***Joyce Kuan Yee Lu** and Hou Pin Yoong*

In order to improve the efficiency of soft-shell crab production of the mud crab Scylla spp., the study investigated whether there are viable macroscopic moult signs that are distinct and can be extracted as feature for artificial neural network for automation in aquaculture. The study first built the enclosure to house the crabs for a prolonged period where camera system was built to obtain new data on a high interval basis. Months after, the data of two thousand two hundred images were analysed categorically by individual crabs where methods of object detection tasks and image processing tasks were chosen. Two methods were used which were hue, saturation, value with heatmap threshold to calculate the light-to-dark pixels ratio, and average brightness of pixel value. The subjects in this study consist of 13 crabs where 3 moulted and are separated as different crabs due to colour difference post-moulting. There are Scylla tranquebarica and Scylla paramamosain, where both species show a similar pattern of shell colour lightening with time until moult day. It was found that average pixel brightness evaluation can extract consistent a pattern of changing crab shell colouration as long as isolation of crab from background is accurate.

183 Real-Time Detection of Northern Corn Leaf Blight in Maize Using a Lightweight YOLOv8n Model

Jamie Eduardo Rosal, Juvy Amor Galindo, Daryl Ivan Hisola, Michael Ryan Arreglo, ***Arnel Valdueza*** *and Amie Lou Cisneros*

Maize production faces a significant threat from Northern Corn Leaf Blight (NCLB), a devastating fungal disease. This study developed and evaluated a YOLOv8n-based system for the automated detection and localization of NCLB in maize leaves. A comprehensive dataset for model training and validation was constructed from 984 original diseased corn leaf images, which were subsequently augmented to create a diverse set of 5,682 annotated images. The model's performance was rigorously assessed on an independent local test dataset comprising 263 images, demonstrating strong detection capabilities. It achieved an accuracy of 85.55%, a precision of 97.78%, a recall of 79.04%, and an F1-score of 87.42%. These results confirm that the lightweight YOLOv8n architecture is a viable and effective tool for automated plant disease detection, offering a practical and efficient solution to support farmers in early NCLB identification and management.

107 A Comparative Study of Supervised Learning with ResNet18 and GLCM Features for Enhanced Accuracy of Cocoa Bean Classification

Rahmat Siswanto*, Hasyiya Karimah Binti Adli and Hadi Santoso*

Artificial Intelligence (AI) has revolutionized agriculture by enabling automated quality assessment, particularly in cocoa production. This study explores supervised learning approaches for classifying cocoa bean quality, leveraging AI's ability to process complex image data. A hybrid model combining ResNet-18 with Gray-Level Co-occurrence Matrix (GLCM) features was developed, alongside transfer learning (TL) using pre-trained ResNet-18 and a custom Convolutional Neural Network (CNN) with Support Vector Machine (SVM) or XGBoost classifiers. These approaches were evaluated on the Cocoa Beans Image Dataset (614 images) across six categories: Bean Fraction, Broken, Fermented, Moldy, Unfermented, and Whole Beans Cocoa. Enhanced pre-processing, including Contrast Limited Adaptive Histogram Equalization (CLAHE), Gaussian Blur, HSV conversion, and Canny edge detection, improved feature extraction. The ResNet-GLCM Classifier achieved the highest accuracy of 91.87% on Fold 2, with a mean accuracy of 88.77% ± 3.46% across 5-fold cross-validation, outperforming TL (82.26%) and Custom CNN with SVM/XGBoost (77.42%). These results highlight the potential of integrating deep learning with texture features for automated cocoa bean quality assessment, supporting IoT-enabled smart farming and cocoa traceability systems to enhance precision agriculture and ensure transparency in the cocoa supply chain.

244 Detection and Classification of Sugarcane Leaf Diseases Using Faster R-CNN Inception V2 Architecture

Jamie Eduardo Rosal, ***Apple Joy Tamayo,*** *Daryl Ivan Hisola, Juvy Amor Galindo, Jared Gamutin and Lemuel Sayao*

This paper presents a deep learning-based approach for the detection and classification of sugarcane leaf diseases using the Faster Region-Based Convolutional Neural Network (Faster R-CNN) with an Inception V2 backbone. The study targets four economically significant diseases—Smut, Red Rot, Leaf Scald, and Brown Rust—that commonly affect sugarcane crops in Guihing, Hagonoy, Davao del Sur, Philippines. A balanced and expert-annotated dataset of 800 high-resolution images was used to train and evaluate the model under controlled laboratory conditions. The proposed system achieved an overall classification accuracy of 80.83% and a mean Average Precision at IoU 0.50 (mAP@0.50) of 85.2%. Notable performance was observed for Smut (F1-score: 0.97) and Leaf Scald (recall: 1.00), while Red Rot and Brown Rust posed greater challenges due to visual symptom overlap. These results demonstrate the model's potential for real-time, AI-assisted disease identification in sugarcane, establishing a foundation for future deployment in precision agriculture systems.

Session A2:
AI for Medical Imaging & Health Diagnostics

321 Evaluation of a Deep Learning System for Pulmonary Tuberculosis Detection via Chest Radiographs: A Quasi-Experimental Study in Sabah

***Che Wan Ilmiyah Che Wan Ahmad**, Khamisah Awang Lukman, Mohammad Saffree Jeffree, Raja Muhammad Raja Omar, Richard Avoi, Mohd Hanafi Ahmad Hijazi, Muhammad Zahid Abdul Muein, Hwa Kieu Stefanus Tao and Mohd Yusof Ibrahim*

Tuberculosis (TB) remains a major public health challenge in Sabah, Malaysia. Chest radiographs (CXR) are commonly used for pulmonary TB (PTB) screening, and deep learning (DL) systems show potential in enhancing diagnostic accuracy. This study evaluated the SAT4TB, a locally developed DL system, for detecting PTB in CXR images. This quasi-experimental study was divided into three parts. Part I assessed SAT4TB's diagnostic performance, including sensitivity, specificity, and area under the receiver operating characteristics curve (AUC). Part II evaluated the inter-reader agreement between SAT4TB and experienced radiologists using Cohen's kappa. Part III compared PTB detection rates between two clinics: one utilizing SAT4TB for CXR interpretation (intervention) and the other following standard clinical practices (control). SAT4TB demonstrated a sensitivity of 82% and specificity of 84.9%, with an AUC of 0.91 (95% CI: 0.86–0.96). The inter-reader agreement between SAT4TB and radiologists was moderate (Cohen's kappa = 0.49). In clinical practice, SAT4TB detected a higher proportion of PTB cases (42%) compared to the control group (36%). SAT4TB exhibited good diagnostic performance for PTB detection in CXR and could be a valuable tool in resource-limited settings, particularly in areas without radiological expertise. Further research is needed to validate these findings across broader populations and settings.

292 A Collaborative Framework for Disease Prediction Using Machine Learning

*Oras Baker, Kasthuri Subaramaniam, Abdul Samad Shibghatullah, **Zatul Alwani Shaffiei** and Amir Syafiq Syamin Syah Amir Hamzah*

Machine learning has become an important tool in modern healthcare, especially for predicting diseases early and improving patient outcomes. However, most current machine learning models are developed using isolated data from individual hospitals, which limits their ability to generalize to wider populations. These models also face challenges such as data bias, limited accuracy, and strict data privacy laws that prevent institutions from sharing patient information. To address these issues, this paper proposes a Collaborative Framework for Disease Prediction Using Machine Learning (CFMLDP). The framework uses federated learning, differential privacy, and secure multiparty computation to allow multiple healthcare institutions to train shared models while keeping patient data private. The framework includes stages such as data preprocessing, privacy-preserving local training, secure model aggregation, bias detection, and fairness auditing. It was tested using various disease categories and achieved high performance with both overall accuracy and average F1-score recorded at 93%. These results show that collaborative machine learning can produce reliable, accurate, and privacy-conscious disease prediction models.

234 Evaluation of Region-Level Loss Functions in Convolutional Neural Network for Stroke Lesion Image Segmentation

Nurul Mazwani Marsam *and* ***See Pheng Hang***

Ischemic stroke is one of the leading causes of mortality, where early detection is crucial for early treatment. Manual lesion tracing, although accurate, it can be time consuming and traditional image processing techniques are limited in precision and generalizability. Deep learning, such Convolutional Neural Networks (CNNs), have shown a significant advancement in ischemic stroke lesion image segmentation. However, using the networks alone may reduce the accuracy as class imbalance typically happens in biomedical dataset. Region-level loss functions have shown promising results compared to other levels, but choosing the right type and weight values in fixed-weighted loss functions can be challenging. Therefore, this study evaluates the effectiveness of implementing adaptive weighting strategies in region-level loss function at improving segmentation accuracy for ischemic stroke lesion using CNN. A 2D U-Net with ResNet34-based encoder, incorporating fixed, fixed-weighted, and adaptive weighted loss functions, was trained on Ischemic Stroke Lesion Segmentation 2022 (ISLES'2022) dataset. The adaptive weighted loss function outperformed fixed and fixed-weighted region-level loss functions, achieving 0.8677 in DSC score. The qualitative result also showed improvement in boundary lesion detection, illustrating lower false predictions. These findings suggest that adaptive weighting strategies in loss function is effective for overall segmentation accuracy of ischemic stroke lesion.

97 Deep Learning Approach to EEG-Based Attention Deficit Hyperactivity Disorder (ADHD) Detection: An Empirical Comparison of Ensemble Classifiers

Lilian Lee Yen Wei*, Ag Asri Ag Ibrahim and Rayner Alfred*

Machine learning has shown significant potential in enhancing the understanding and treatment of neurodevelopmental disorders. This study explores various deep learning approaches applied to attention-deficit/hyperactivity disorder (ADHD) detection and diagnosis, with a focus on classification techniques. The paper reviews multiple deep learning methods, particularly the ensemble models incorporating Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Gated Recurrent unit (GRU), and Transformer classifiers. The datasets used in these approaches are publicly available Electroencephalogram (EEG) dataset from DataPort IEEE, recorded during cognitive activities involving both ADHD and neurotypical subjects. Performance was analysed from various perspectives, including optimal feature selection and hyperparameter tuning. Additionally, the models were evaluated based on accuracy, F1-score, precision, recall and 5-fold cross validation. Finding indicates a significant improvement in accuracy over time, influenced by different settings. While the performance of most ensemble classifiers varies depending on different datasets, optimal features selections and parameter setting. CNN+RNN demonstrated consistent performance across different conditions.

265 A Modular Framework for Gradual LDCT Denoising Using Noisy Data Only

Kousik Sarkar *and Soumen Bag*

Low-dose computed tomography (LDCT) reduces radiation exposure but introduces significant noise that can impair diagnostic accuracy. Although supervised deep learning methods are effective at removing this noise, they typically require paired LDCT and standard dose computed tomography (SDCT) scans, which are often unavailable in clinical practice. To enable training without paired data, we introduce a self-supervised denoising framework inspired by the Noise2Noise paradigm. Our method leverages the similarity between adjacent axial slices within LDCT volumes, enabling training directly on unpaired LDCT data. To accommodate varying noise levels present in multi-dose LDCT scans, we design a cascaded modular architecture in which the same denoising unit is applied sequentially. Each stage further reduces noise, allowing radiologists to select the image quality that best suits their diagnostic needs. Experiments on the publicly available AAPM Mayo Clinic LDCT dataset demonstrate that our approach achieves strong noise suppression while preserving anatomical structures, with a peak signal-to-noise ratio (PSNR) of 31.58 and a structural similarity index (SSIM) of 0.9004. These results indicate strong potential for clinical adoption.

127 A Computational Model for Stress Intervention Using Affective Brain-Computer Interfaces

Ain Shaheada Abdul Rahim Dapit*, Marini Othman, Muna Azuddin, Asmarani Ahmad Puzi and Untung Rahardja*

Stress is a growing public health concern that negatively impacts individual well-being, making accurate detection of stress emotions essential yet challenging due to the limitations of self-reporting and the complexity of emotional states. Electroencephalography (EEG) offers an objective means to monitor brain activity related to stress emotions, but effective interpretation requires advanced analytical methods. This research aims to develop a reliable EEG-based model for stress emotion detection by collecting EEG data from participants exposed to stress-inducing stimuli and applying machine learning techniques for classification. The expected outcome is an improved stress detection model that augments traditional subjective measures. By advancing EEG-based stress emotion detection, this study seeks to contribute to better mental health interventions and more effective management of stress-related conditions.

119 Magnetic Resonance Image Segmentation for Myocardial Scar Detection using Multi-stage DeepLabV3+ Framework with Comparative Backbone Analysis

*Nur Ulya Nasuha Zakaria, **Muhammad Khusairi Osman**, Siti Noraini Sulaiman, Dayang Suhaida Awang Damit, Nor Ashidi Mat Isa, Noor Khairiah A. Karim, Zakaria Hussain and Nor Afnan Zharif Nor Kamal*

Myocardial infarction (MI) remains a leading cause of morbidity and mortality globally. Accurate segmentation of infarcted myocardial regions from cardiac magnetic resonance images (MRI) is crucial for diagnosis and treatment planning. Manual segmentation, though precise, is time-consuming and subject to inter-observer variability. This study introduces a novel multi-stage deep learning framework based on DeepLabV3+ model for automatic myocardial scars detection. The framework employs three DeepLabV3+ models arranged in a multistage configuration, with each network independently segmenting the left ventricle (LV), cavity, myocardium and scar from MRI images. Two different DeepLabV3+'s backbones were investigated which are ResNet50 and MobileNetV2. A dataset of late gadolinium-enhanced cardiac MRI (LGE-CMR) images was obtained from Advanced Medical and Dental Institute (AMDI), Universiti Sains Malaysia (USM), and used with expert-annotated ground truths for training and validation of the proposed framework. The proposed framework was also compared to a single-stage deep learning model that simultaneously segments MRI images into LV, cavity, myocardium and scar to benchmark its performance. Experimental results show that the framework demonstrated promising performance in segmenting infarct regions, measured by Dice Similarity Coefficient (DSC), IoU and accuracy of each. The proposed framework achieved the dice similarity of 0.68486, IoU of 0.4849 and the accuracy 0.6133 respectively. The results support the potential of the proposed method in clinical workflows, offering fast, reliable, and reproducible segmentation.

Session B1:
Smart Aquaculture & Environmental Monitoring

318 Machine Learning Based Hunger Behaviour Classification for Hybrid Grouper

***Zi Kai Tan**, Kit Guan Lim, Rossita Shapawi, Leong Seng Lim, Hui Hwang Goh and Kenneth Tze Kin Teo*

This research aims to propose an automated demand-feeding system for groupers that responds to hunger symptoms. It leverages computer vision for information capture and uses machine learning models to process the data, at the same time classify the state of groupers, and determine whether to feed them. Traditional feeding methods, such as scheduled feeding and manual observation-based feeding have limitations in terms of effectiveness and efficiency. Current automated feeder research includes timer-based systems, weight-based feeders, vision-based feeding systems, sensor-based feeders, and hybrid systems. However, these methods have drawbacks such as lack of adaptability, accuracy issues, complexity in setup, sensitivity to environmental conditions, and high maintenance requirements. Thus, the proposed system aims to address these limitations by accurately capturing real-time data on grouper behavior, including hunger symptoms, and use machine learning algorithms to classify the state of the fish. By automating the feeding process, this system offers greater adaptability and responsiveness, reduces labor and time, and improves efficiency and cost savings in aquaculture operations. Both the Random Forest and SVM classifiers showed outstanding performance in classifying the fish states as "hungry" or "full." Each model achieved an overall accuracy of 98% on the test dataset, reflecting their strong predictive capabilities. Results showed that group fish states in an aquarium setting can be robustly and accurately classified using features derived from movement and spatial occupation.

314 Integrated Real-Time Decision Support for Precision Aquaculture Using 3D Vision and Dynamic Coefficient Swarm Optimization

***Nyiak Tien Tang**, Kit Guan Lim, Fui Fui Ching, Ismail Saad, Baojian Yang and Kenneth Tze Kin Teo*

This paper presents a novel real-time Decision Support System (DSS) for precision fish farming, integrating non-intrusive biomass estimation via Structure-from-Motion (SfM) and adaptive feed management using Dynamic Coefficient Particle Swarm Optimization (DCPSO). The system architecture leverages multi-source data fusion from IoT sensors and underwater cameras to capture high-fidelity, real-time measurements of water quality and fish biomass. An empirically calibrated regression model translates dense 3D reconstructions into accurate biomass estimates, enabling automated, closed-loop optimization of feeding regimes. Over a one-month nursery tank trial with n=10 groupers, the DSS achieved a mean biomass estimation error of 3.2% and reduced average feed conversion ratio (FCR) from 1.28 (manual control) to 1.19, while minimizing operator intervention. The proposed system demonstrates robust performance under environmental disturbances and provides a user-centric interface for actionable insights and control. This study establishes the feasibility and efficacy of combining SfM-based vision and advanced optimization within a unified DSS, offering a scalable blueprint for next-generation, sustainable aquaculture management.

309 Design and Development of a Volumetric Smart Feeder for Fish Meal Production Line

Jamal Ahmad Dargham, Renee Ka Yin Chin, Ervin Gubin Moung, ***Mohd Rafiezul Fikri Hassan****, Bih Lii Chua and Hoe Tung Yew*

Feeders are essential components in many production lines as they control the amount of each ingredient fed to the mixer. The exact proportions of each ingredient according to recipe for the produced product has a significant role in the quality of the finished product. Feeders are generally divided into two groups volumetric and gravimetric. The choice of the type of feeder depends heavily on the properties of the ingredients being fed and the processing mode such as batch processing or continuous processing. In this paper, the design, development and evaluation of volumetric feeder for a fish meal production line is presented. The fish meal is made from 4 ingredients, three of them are powder-like dry ingredients and the fourth one is vegetable oil. The feeder was designed to operate in batch mode whereby ingredients are fed one at a time. The weight for each ingredient depends on the fish meal type being produced. A 1-inch solenoid valve was used to control the flow of the oil and electrically operated butterfly valves were used to control the flow of the dry ingredients. It was found that flow of the powder-like dry ingredients in the butterfly valves and that of the flow of oil in the solenoid valve are linear. Thus, a linear line equation between the weight of the dispensed ingredient and the time the valve was open was developed. The developed equations are used to obtain the required time to open the valve to dispense a given weight of a given ingredient. The developed system performance was good with a maximum mean relative error of 0.012818Kg with a standard deviation of 0.020115.

209 A Comparative Study of Segmentation Techniques for Automated Fish Counting

Mohd Hanafi Ahmad Hijazi*, Aiesha Zahratul Jannah Jaiman, Puteri Nor Ellyza Nohuddin and Ervin Gubin Moung*

Automated fish counting have significantly improved due to the advancements of convolutional neural networks. However, current deep learning models struggle with precise segmentation in visually complex underwater environments. This paper presents a comparative study of multiple segmentation approaches; the Edge-based Segmentation, the Segment Anything Model, U-Net, and an ensemble of these methods to determine their impact on segmentation quality and subsequent counting accuracy. The YOLOv11 model is employed for fish detection and counting using a standard dataset of zebrafish larvae. Experimental results show that ensemble segmentation improves accuracy and better differentiation between fish and non-fish objects. The U-Net-based model delivers the most accurate fish counts (92.73%). The analysis highlights the relationship between segmentation precision and object detection performance, providing insights into the strengths and limitations of each technique. Some future work is suggested to improve the segmentation and counting further.

290 A State-of-the-Art Review of Deep Learning-Based Computer Vision Waste Detection: R-CNN, YOLO, Transformers, and Hybrid Models

*Ervin Gubin Moung, **Owen Tamin**, Samsul Ariffin Abdul Karim, Jumat Sulaiman and Ali Farzamnia*

Effective waste detection remains a pressing challenge due to the variability, clutter, and inconsistent visual characteristics of waste environments. This state-of-the-art review rigorously examines recent advancements in object detection models for waste detection and classification, covering the evolution from two-stage architectures (e.g., Faster R-CNN, Mask R-CNN) to single-shot detectors (YOLO family), recent Transformer-based models (e.g., ViT-WM, AL-DETR) and recent hybrid approaches. A structured literature review was conducted across major databases (2019–2025), guided by clearly defined inclusion and exclusion criteria. The review synthesizes reported results across studies to identify emerging trends, model capabilities, and deployment-readiness, while acknowledging the variations in datasets and evaluation conditions. Instead of ranking models, this review focuses on observed performance patterns and trade-offs. It also assesses the maturity of current techniques, analyzes limitations that hinder large-scale adoption, and highlights recent hybrid approaches and deployment requirements. Finally, it outlines future research directions toward building scalable, energy-efficient, and interpretable waste detection systems integrated with edge computing and smart infrastructure.

293 Contois Model Related to Constructed Wetland System

*Irwan Iqbal Ihsanuddin, **Amir Syafiq Syamin Syah Amir Hamzah** and Zatul Alwani Shaffiei*

Constructed wetlands are widely recognized as sustainable, cost-effective solutions for wastewater treatment, offering efficient pollutant removal through natural processes. This study develops a biokinetic model describing microbial growth, pollutant concentration (COD) and dissolved oxygen (DO) in a planted constructed wetland. Monod and Contois kinetics are applied, producing two models with different microbial growth formulations. These models are tested against an experimental data set, and their fit and dynamics are compared. The Contois-based model provides a slightly better fit with the experimental data. The results are expected to be useful for the computational applications in other fields involving decomposition processes in wastewater.

Session B2:
Intelligent Image Processing & Classification

275 Impact of Image Quality on YOLOv7-Based Face Detection Accuracy

***Hakimmie Zainal**, Min Keng Tan, Chung Fan Liau, Soo Siang Yang, Min Yang and Kenneth Tze Kin Teo*

This paper studies the impact of image quality of You Only Look Once Version 7 (YOLOv7) on face detection accuracy. It evaluates how various conditions of an image affect the performance of YOLOv7 in accurately detecting and recognizing faces. While YOLOv7 has shown strong performance in object detection, the algorithm accuracy under various image quality and conditions such as change in resolution, brightness and partial occlusions remains underexamined. The main aim is to quantitatively assess the accuracy of YOLOv7 in face detection under controlled variations in image resolution, brightness and partial occlusion. Datasets of face images subjected to controlled variations in resolutions, brightness and partial occlusion are prepared. YOLOv7 is trained and tested on the prepared images to evaluate the algorithm detection performance. Performance metrics such as precision, recall and F1-score are computed for each variation scenario. Comparative analysis is then conducted to identify which image quality factors have the most significant impact on the algorithm's accuracy. YOLOv7-tiny maintained robust performance with only 4.38% F1-score reduction when resolution was halved from 320×320 to 160×160 pixels. However, combined lighting and occlusion conditions significantly degraded precision by 48.2% while recall decreased by only 5.5%. The findings guide the development of more resilient face detection systems by identifying resolution resilience versus lighting/occlusion vulnerabilities.

304 Enhancing Suspicious Behaviour Detection in Low-Light Surveillance Using a Hybrid Deep Learning Model

*Lorita Angeline, **Ernes Jane Radin**, Muhammad Nur Afnan Bin Uda, Ervin Moung and Kenneth Teo*

Surveillance under low-light conditions presents a persistent challenge, as poor illumination reduces the visibility of critical features needed to detect suspicious behaviour. This study proposes a deep learning-based approach that enhances low-light video clarity and improves behavioural classification accuracy. A custom image enhancement pipeline is developed, combining Multi-Scale Retinex, gamma correction, CLAHE, and sharpening techniques to improve frame quality. The enhanced frames are then processed using a hybrid architecture that integrates 3D Convolutional Neural Networks (3D CNN) for spatial-temporal features, ResNet50 for spatial feature extraction, and Gated Recurrent Units (GRU) for temporal modelling. The model is trained and evaluated on a selected subset of the UCF-Crime dataset, augmented to simulate low-light scenarios. Results show that the hybrid model with enhancement achieves 90% accuracy, with an F1-score of 0.93 for suspicious class detection and 0.80 for normal class. Without enhancement, performance drops drastically to 20% accuracy. These findings highlight the crucial role of pre-processing and hybrid feature learning in improving surveillance accuracy under poor lighting conditions.

307 Face Recognition with Mask Using Generative Adversarial Networks and Variational Autoencoders

***Khalifa Chekima**, Rayner Alfred, Mohammed Ahmed Mohammed Saleh, Rayner Pailus and Ashraf Osman Ibrahim Elsayed*

Face recognition technology has become important for security and identification purposes. However, the widespread use of face masks during the COVID-19 pandemic has posed significant challenges. According to the National Institute of Standards and Technology, masks can obscure up to 70% of the facial area critical for recognition, causing error rates as high as 50%. This research proposes a deep learning model that uses generative adversarial networks (GANs) and variational autoencoders (VAEs) to detect and identify masks with high accuracy. GANs create realistic face characteristics by training a generator against a discriminator, whereas VAEs extract relevant facial features from partially occluded pictures. By integrating these techniques, the model aims to improve face recognition performance. The model will be trained and tested on a dataset of masked and unmasked facial images. Successful development of this masked face recognition system can help maintain effective security, access control, and identification in environments where mask wearing has become the norm.

303 Exploring Chaotic Image Characteristics for Age Classification Enhancement

***Nurfarahin Jemali** and Renee Ka Yin Chin*

Age classification using deep learning has gained significant attention due to its application in various fields. However, image classification models face challenges with noise and chaotic inputs, leading to a lack of robustness needed for consistent real-world performance. Various types of noise present in real-world images introduce confusion among classifiers. Therefore, this study focuses on establishing baseline accuracy for MobileNetV2 before introducing noise augmentation. In addition to testing noisy datasets, mixed datasets with both clean and noisy images are used to assess model robustness. To solve class imbalance, balanced datasets are generated with both uniform and unequal noise distributions. The results revealed that the model's accuracy decreased as noise levels increased, although balancing measures helped reduce the performance degradation and improve fairness across ages. While the clean dataset is normally the most accurate, in this experiment, the 50% noisy dataset had a slightly better accuracy (85.17%) than the clean dataset (84.94%). This minor improvement is most likely due to the regularization effect of moderate noise, which allowed the model to generalize more effectively to previously unseen data. Mixed datasets produced more robust findings where the uniform noise enhanced fairness across classes but reduced overall accuracy, whereas uneven noise increased accuracy for certain age groups but introduced classification bias.

Remote sensing image classification is essential for land cover analysis and environmental monitoring. The study explores the effectiveness of ResNet models and evaluates their performance with and without Transfer Learning (TL). Three models were assessed: ResNet-50 that trained from scratch, pre-trained ResNet-50, and pre-trained Res2Net-50. Experiments were conducted on the EuroSAT and UC Merced Land (UCM) datasets. ResNet-50 achieved the highest accuracy of 96.15% on EuroSAT. while pre-trained ResNet-50 outperformed other models on UCM with 92.86% accuracy. Performance was evaluated using accuracy, precision, recall, and F1-score, derived from confusion matrices. Results show that model performance depends on dataset characteristics, and that training from scratch can outperform transfer learning in specific remote sensing tasks.

Session C1:
AI-Driven Optimization & Security in Critical Infrastructures

257 Adaptive Automatic Generation Control for Interconnected Power Systems with Q-Learning

***Shun Quan Chai**, Min Sian Ng, Wan Zaizarenah Zaman, Wei Yeang Kow, Min Keng Tan and Kenneth Tze Kin Teo*

This paper proposes a model-free reinforcement learning approach for optimizing Automatic Generation Control (AGC) in a multi-area interconnected power system. The Q-learning algorithm is employed as a secondary controller to regulate system frequency and manage tie-line power exchanges in the presence of dynamic load disturbances. Unlike conventional proportional-integral-derivative (PID) controllers, which require precise tuning and are limited to specific operating conditions, Q-learning adapts its policy by learning from real-time interactions with the power system environment. A two-area power system model is developed in MATLAB/Simulink, where Q-learning agents operate based on the Area Control Error (ACE). The Q-learning AGC is compared against a PID controller tuned using the Non-Dominated Sorting Genetic Algorithm II (NSGA-II) algorithm across two test scenarios: a single-area disturbance and a multi-area disturbance. Simulation results show that the Q-learning-based AGC consistently outperforms the PID-based approach, especially under complex, multi-area disturbances. In the multi-area scenario, Q-learning reduced the Integral of Absolute Error (IAE) for ACE by 28.43% (0.794 p.u.) and for frequency by 27.52% (1.040 Hz). These results demonstrate Q-learning's superior adaptability and robustness, making it a promising alternative for AGC in modern, dynamic power systems.

196 Evaluation of Various Sequential Constructive Approaches for Optimizing Vehicle Routing Problem with Time Windows

***Hongyi Du** and Yoshitaka Tanimizu*

Evolutionary algorithms and genetic algorithms have been widely applied to routing optimization problems due to their outstanding performance. Among them, Sequential Constructive Crossover (SCX) is regarded as one of the most effective crossover operators. Although SCX was originally designed to solve the Traveling Salesman Problem (TSP), it has also been successfully applied to the Capacitated Vehicle Routing Problem (CVRP) in recent years. However, currently, there is no literature reporting the application of SCX to the Vehicle Routing Problem with Time Windows (VRPTW). This paper adapts and implements several variants of the SCX operator within a genetic algorithm framework tailored for VRPTW, systematically comparing their performance in benchmark instances. Furthermore, several other commonly used crossover operators are compared. The experimental results demonstrate that the proposed method exhibits both high efficiency and effectiveness in solving VRPTW.

284 Deep Q-Learning-Based Route Optimization for Traffic Network

***Siti Nor Atiqah Moharam**, Matthew Laurentius Bansing, Kit Guan Lim, Min Keng Tan, Helen Sin Ee Chuo and Kenneth Tze Kin Teo*

This paper presents a Deep Q-Learning (DQL) approach to enhance traffic rerouting in urban vehicular networks. The objective is to develop a dynamic route planning system that adapts to real-time traffic conditions using AI-based decision-making. Traffic congestion in Malaysia cities highlights the limitations of static route planning that lacks of responsiveness to fluctuating travel demand and localized congestion. This study addresses the need for intelligent rerouting by manipulating learning-based models while controlling key traffic variables such as speed, acceleration, vehicle position, and travel time. The aim is to develop and evaluate an intelligent rerouting system that is capable of minimizing traffic delays and improving vehicular flow efficiency. This is achieved by integrating Simulation of Urban Mobility (SUMO) with MATLAB via Python TraCI and UDP sockets that enable real-time monitoring and data exchange. A deep Q-Learning agent was trained to make rerouting decisions based on live vehicle state inputs and traffic conditions which then the agent's reward function was designed to reduce congestion. Quantitative evaluations show that DQL-based rerouting achieves 22% reduction in average travel time compared to conventional shortest-path routing. The proposed method demonstrates the potential of Deep Reinforcement Learning to solve complex travel problems. This work contributes toward intelligent transportation systems in smart cities which enable adaptive and scalable traffic control framework.

89 Strengthening Trust and Security through ISO 27001 Compliance: A Conceptual Framework for Information Management

***Azlin Ramli**, Mohamad Yusof Darus, Fakariah Hani Mohd Ali, Mohd Rashid Abu Bakar, Nor Shamshillah Kamarzaman and Zolidah Kasiran*

This study conceptualises how ISO/IEC 27001 compliance enhances stakeholder trust and strengthens information security performance. Against the backdrop of escalating cyber threats and data breaches, organisations encounter significant challenges in sustaining trust while safeguarding critical information assets. Anchored in Institutional Theory and Stakeholder Theory, the paper underscores the strategic significance of transparency, accountability, and resilience in trust-building. Employing a theory-driven framework development approach, the study synthesises literature and normative guidance, integrating the Plan–Do–Check–Act (PDCA) model to propose a structured, risk-based, and continuous improvement framework. The model explicates how ISO/IEC 27001 implementation fosters stakeholder confidence and organisational resilience, particularly within resource-constrained SMEs. The framework advances three mechanisms through which compliance promotes trust and security: standardising risk assessment and treatment processes, embedding continuous improvement to proactively address emerging threats, and signalling accountability through third-party certification. A persistent gap in empirical evidence on quantifying trust outcomes is identified, prompting suggested pathways for empirical validation. As a conceptual contribution, the study is limited by its reliance on secondary data and absence of empirical testing. Future research should rigorously examine the proposed linkages, develop trust measurement metrics, and explore organisational contingencies. The originality of the study lies in its synthesis of institutional, stakeholder, and process perspectives to elucidate how ISO/IEC 27001 compliance can deliver measurable trust and security outcomes. The proposed framework offers theoretical and practical value by providing actionable insights for practitioners seeking to align internal controls with external stakeholder expectations while addressing systemic vulnerabilities.

80 Enhancing 5G/6G Network Efficiency and Security via Artificial Intelligent-Driven Real-Time Analytics and Resource Optimization

*Sharmin Sharmin, **Ismail Ahmedy** and Habibah Ismail*

The evolution of 5G and emerging 6G wireless networks is poised to revolutionize global connectivity, powering applications such as the Internet of Things (IoT), autonomous systems, and smart cities. However, the increasing complexity and scale of these networks present significant challenges in maintaining high performance, particularly regarding throughput, latency, and efficient resource allocation. Conventional network management approaches often fall short in addressing the dynamic and heterogeneous nature of 5G/6G environments. This paper proposes an artificial intelligence (AI)-driven framework aimed at optimizing network performance by leveraging real-time data analytics, anomaly detection, and adaptive resource management. The framework integrates AI techniques to dynamically allocate resources and mitigate performance bottlenecks, thereby enhancing network efficiency and reliability. Simulation results demonstrate that the AI-based approach significantly improves throughput and reduces latency while maintaining scalability and adaptability. This research contributes to the development of intelligent, resilient 5G/6G networks capable of meeting the stringent requirements of future wireless communication ecosystems.

306 Adaptive Parameters Configuration of LoRa for Multi-Hop Networks Transmission

***Muhd Kahfi Jumali**, Kit Guan Lim, Lorita Angeline, Ervin Gubin Moung, Tianlei Wang and Kenneth Tze Kin Teo*

This study evaluates the performance of a node-autonomous Adaptive Data Rate (ADR)-like algorithm in optimizing Packet Delivery Ratio (PDR) within a LoRa multi-hop network, simulated in a forestry-like environment using Python with Visualize and matplotlib. Operating at 915 MHz with a log-distance path loss model. The simulation models a three-node topology (transmitter, relay, gateway) across 200–1000 meters, dynamically adjusting Spreading Factor (SF10 to SF12), transmission power (14–20 dBm), and bandwidth (125–250 kHz). After 300 packet transmissions, multi-metric analyses revealed PDR maintaining 100% up to 400 meters, dropping sharply to 40% at 500 meters, and nearing 0% by 1000 meters, driven by RSSI declining from -90 dBm to -125 dBm and SNR falling from 30 dB to 0 dB. Energy consumption escalated from 0–2000 mJ to over 8000 mJ at 1000 meters due to retransmissions and higher power. The 500-meter threshold highlights a critical range limit, suggesting optimal relay placement. While effective at shorter distances, the algorithm's limitations at longer ranges underscore the need for enhanced strategies like coding rate adjustments or additional relays. This work provides insights for energy-efficient LoRaWAN deployments in challenging terrains, with recommendations for real-world validation.

261 Comparative Analysis of Lightweight Stream Ciphers for Constrained IoT Resources

***Soo Fun Tan**, Zi Xuan Wan, Po Hung Lai, Florence Sia and Yu Beng Leau*

The rapid expansion of smart devices has made the Internet of Things (IoT) a critical security concern, with Statista reporting over 1.5 billion IoT security breaches. Resource-constrained IoT devices, often limited in processing power and storage, face heightened security and privacy risks. Traditional cryptographic algorithms impose significant processing, memory, and power demands, making them unsuitable for such devices. While lightweight cryptographic solutions have been explored, selecting the most appropriate algorithms remains challenging due to the diversity of IoT environments and device limitations. This study addresses the lack of comparative evaluations of lightweight stream ciphers by analyzing their performance on resource-constrained platforms. Specifically, it evaluates five stream ciphers—SNOW 3G, ZUC-128, Mickey-128 2.0, KCipher-2, and Sosemanuk—based on computational efficiency, memory usage, energy consumption, and resilience against cryptographic attacks. KCipher-2 demonstrated superior efficiency on the Arduino Mega, while ZUC-128 outperformed others on the more constrained Arduino UNO, highlighting the importance of aligning cryptographic choices with specific hardware constraints and performance requirements in IoT applications. Through controlled experiments, the study identifies stream ciphers optimized for resource-constrained IoT environments, offering insights into balancing security, efficiency, and practicality for real-world deployments. The findings provide valuable guidance for implementing secure, lightweight cryptographic solutions tailored to the unique constraints of IoT devices.

Session C2:
IoT-Driven Intelligent Sensing & Smart Devices

100 Performance Evaluation of Blockchain-Based AIoT Inspection Device

***Zi Yi Lim**, Chien-Chia Huang and Yi-Da Chiang*

The research proposes and evaluates a blockchain-based AIoT inspection system implemented on an NVIDIA Jetson Xavier NX edge computing device. The system integrates AI-powered inspection capabilities with Hyperledger Fabric blockchain technology to ensure tamper-proof recordkeeping and data integrity. Performance analysis demonstrates the feasibility of running distributed ledger technology in conjunction with AI processing on edge computing devices. The implementation achieves reliable verification of inspection data while maintaining acceptable computational resource usage and energy consumption. Results indicate that blockchain integration prevents unauthorized data manipulation without significantly compromising system performance.

301 Design And Implementation of an ESP32-CAM 4WD Remote Monitoring with EEPROM Calibration & PythonAnywhere Cloud

*Muhammad Nur Afnan Bin Uda, **Randy Chong**, Uda Hashim, Muhammad Nur Aiman Bin Uda, Chai Chang Yii, Aroland Kiring and Saroja Rijal*

This paper presents an ESP32-CAM based environmental monitoring system with persistent sensor calibration and multi-mode operation. The system implements EEPROM-based calibration storage, eliminating manual sensor recalibration after power cycles. EEPROM calibration achieved 87.56% overall pH accuracy with 49-day retention without degradation. The platform integrates a 4WD mobile vehicle with camera streaming, pH and soil moisture sensing, and soil sampling through a linear actuator. The system operates in three modes including vehicle navigation, environmental monitoring, and actuator deployment, all controlled through a web-based interface. Integration with PythonAnywhere cloud platform enables data storage and visualisation. Field testing across different soil environments validated system functionality and measurement capabilities. The system provides environmental monitoring capabilities at educational pricing levels, suitable for precision agriculture and research applications.

175 Smart Cane for the Visually Impaired: Enhancing Navigation, Safety, and Emergency Response

***Kah Meng Leong**, Irene Cheh Lin Kong, Khai Le Ng, Bun Seng Chan, Tian Swee Tan, Matthias Foh Thye Tiong, Jahanzeb Sheikh and Kun Ma*

In Malaysia, blindness and visual impairment are still severe problems, with 180,000 blind persons and more than half a million are suffering from moderate to severe visual impairments. In response to these challenges, an innovative smart cane has been proposed, developed, and tested. The cane has built-in obstacle detection, and a fall detection system with auto-emergency notification alert and GPS for navigational assistance. A user-friendly mobile application is designed and it is connected to the cane via Bluetooth. The mobile application is created with Kodular and it allows simple interaction using swipe and tap gestures and includes text-to-speech option. It also supports customizable fonts and high contrast visual themes. Users are able to find facilities such as toilet or bus stops on their own at their fingertips, which greatly improves independence, equality, and sense of secure. The cane consists of a fall detector that employs Inertial Measurement Unit (IMU) sensors, which trigger GPS navigation and WhatsApp based emergency notifications through Bluetooth to emergency contacts. The emergency button on the cane can be manually pressed and it produces an alarming sound and grabs attention of the surrounding people to the users. Therefore, the proposed cane and app can gain independency, support security, and achieve SDG Goal 3 to enhance good health, well-being and SDG Goal 10 to reduce inequalities.

251 UAV-Based Visual Contamination Detection and Intelligent Cleaning Strategy Optimization for Photovoltaic Panels

***Haijiang Tian**, Ismail Saad, Tianshu Chen, Xiwei Yu, Bih Lii Chua and Houpin Yoong*

An industrial park in China has adopted Building Integrated photovoltaic (BIPV) technology, integrating solar power generation products into steel structure workshops. The resulting pollution from photovoltaic panels has significantly reduced the power generation efficiency. Therefore, effective detection and cleaning strategies are imperative. In recent years, breakthroughs in unmanned aerial vehicles (UAVs) and artificial intelligence technologies have enabled UAVs to achieve precise pollution monitoring and formulate optimized cleaning strategies, providing new solutions for the cleaning of photovoltaic panels. This study explores the optimization of visual pollution detection and intelligent cleaning strategies based on unmanned aerial vehicles. Use UAVs to enter the photovoltaic panel array at a specific height and path to collect infrared video streams for color space conversion. Artificial intelligence is used to detect images to identify common defects in photovoltaic panels and guide cleaning robots to formulate effective cleaning strategies. In 2025, experimental flights were conducted using UAVs under various weather conditions, and the following conclusions were drawn. Firstly, the strategies of UAVs and cleaning robots depend on the weather, and the detection effect is best in clear and cloudy conditions. Secondly, a dynamic cleaning strategy must be adopted, that is, the degree of cleaning varies in different weather conditions. Thirdly, in future applications, all-weather sensor fusion and multi-robot collaboration must be employed to achieve a cleaning efficiency higher than 95%.

302 IoT-Based System for Nanoampere to Milivolt Amplification in Amperometric Biosensors

*Muhammd Nur Afnan Bin Uda, **George Wong Teck Siang**, Uda Hashim, Muhammad Nur Aiman Bin Uda, Lorita Angeline, Min Keng Tan and Kit Guan Lim*

This paper presents an IoT-based system developed for amperometric biosensors, focusing on the amplification of nanoampere-level signals into measurable millivolt outputs. The system is capable of detecting extremely low current signals, ranging from 0 to 230 nA, through a precision amplification circuit utilizing the MAX4238 operational amplifier, known for its ultra-low input bias current and high gain accuracy. Circuit performance was first validated via simulations in LTSpice, followed by PCB design and layout using Proteus 8 Professional to realize the hardware implementation. The complete setup comprises five main modules, a display for real-time output, a microcontroller for signal processing, a voltage converter for power stabilization, a high-gain amplifier for current-to-voltage conversion, and a dedicated power supply circuit. The IoT feature, enabled by the HC-05 Bluetooth module, facilitates wireless data transmission to smartphones or cloud platforms, enabling remote monitoring. Experimental results confirmed that the system successfully amplifies ultra-low biosensor currents with stable and low-noise output, making it suitable for portable biosensing applications.

279 Design and Performance Evaluation of a Touchless IR-Based IoT Smart Lock for Hygienic Access Control

*Ismail Bin Saad, **Lim Kit Guan**, Nurmin Binti Bolong, Mohammad Saffree Jeffree, Kenneth Teo Tze Kin, Fatimah Binti Ahmedy and Kukjin Chun*

Conventional door locks using physical keys pose risks such as loss, theft, and unauthorized duplication. Recent advancements have introduced electronic smart locks leveraging biometric, RFID, and wireless technologies. In the post-COVID-19 era, there is increasing demand for contactless systems to reduce surface transmission of pathogens. This paper presents the development of a keyless, touchless smart door lock system based on Internet of Things (IoT) architecture using infrared (IR) technology for password input. The system replaces physical keypads with IR transmitter-receiver pairs, enabling users to enter passcodes without direct contact. The prototype was developed with custom hardware schematics and a control program, supporting hygienic and convenient access. Performance evaluations include repeatability and robustness tests under varying lighting conditions. Results show high reliability and low standard deviation in input registration times, though minor delays were observed under direct sunlight due to IR signal interference. This system offers strong commercial potential for residential, healthcare, and public access applications, particularly for hygiene-sensitive users.

Session D1:
AI for Emotion, Action, & Experiential Insights

315 Evaluation of Noise Filtering Techniques for Speech Emotion Recognition in Educational Environment

Fatmawati Sunaryo *and Rosalyn R Porle*

The growing demand for intelligent systems in education, coupled with the need to understand students' emotional states, has highlighted the importance of efficient and scalable emotion recognition solutions. Traditional approaches, such as facial expression analysis and paper-based questionnaires, are often time-consuming and prone to inaccuracies. This study presents a speech emotion recognition (SER) system that classifies emotions from speech signals, with a focus on addressing the impact of noise on classification performance. To enhance audio quality prior to classification, three filtering techniques, namely Butterworth bandpass, FIR, and adaptive LMS filtering were applied. Mel Frequency Cepstral Coefficients (MFCCs) were extracted as input features for deep learning-based classifiers. Performance was evaluated using accuracy, precision, recall, and F1-score. The proposed approach aims to improve the robustness of SER systems in noisy, real-world educational environments.

316 Real-Time Speech Emotion Recognition Using Deep Learning for Emotion Based Music Recommendation

Grace Evelyn Wong *and Rosalyn R Porle*

Affective state is a key factor affecting the music preference and the user experience. Traditional music recommendation systems do not have the capability of emotional sense, and the recommendations may then be contradictory to the user who wants to listen to music in a certain mood. This paper introduces a real-time Speech Emotion Recognition (SER) system, which employs a hybrid model of a CNN and a BiLSTM to recognize the user's emotions from speech input. The model is trained on public available databases--CREMA-D, and RAVDESS--and Mel-Frequency Cepstral Coefficients (MFCC) features with 50 dimensions are used. The system is tailored for mobile implementation with TensorFlow Lite and packaged in a native Android app. Emotion recognition outcome play emotion-based music according to a pre-stored play-list. The performance of the system is tested under different real-world scenarios ranging from noisy to silent conditions. User testing has shown that users can discern between positive, neutral and negative emotions. In addition, the mobile app possessed good usability and learned user satisfaction, which further implied that it had the possibility to be used to facilitate emotion efficiently using personalized music experiences.

102 Measuring Neck Squeezing Angles in Validating the Creative Trauma Cleansing Therapy Effectiveness

Azeem Fitri Mohamad, ***Ummi Noor Nazahiah Abdullah*** *and Jumala Multazam*

Creative Trauma Cleansing (CTC) therapy is an alternative intervention that involves cervical manipulation through neck squeezing. This study is an exploratory biomechanical investigation into the kinematic patterns of neck squeezing during CTC therapy. The findings provide foundational biomechanical data that support further exploration of CTC therapy and highlight the need for continued empirical validation of its physiological and therapeutic outcomes. This study investigates the kinematic patterns of neck squeezing during CTC therapy. A total of 30 Malaysian adults aged 20–30 years participated in a controlled experimental protocol comprising mental load induction followed by standardized CTC therapy sessions. Neck squeezing angles were recorded across nine therapy cycles using an Arduino-based measurement system, while electromyography (EMG) and electrocardiogram (ECG) data were collected to assess muscle activity and heart rate. Results revealed significant angular variability, with alternating forward and backward motions observed across cycles, notably a peak extension (mean: 79.70) in Cycle 3 and a marked backward tilt (mean: 12.70) in Cycle 4. These patterns suggest a deliberate, rhythmic pressure application inherent in the CTC technique. The findings provide foundational biomechanical data that support further exploration of CTC therapy within the Biopsychosocial Model and highlight the need for continued empirical validation of its physiological and therapeutic outcomes.

260 A Comparative Analysis of Skeleton-Based Human Action Recognition on DOOH Advertising

Jen Li Chung*, Lee Yeng Ong and Meng Chew Leow*

Digital Out-of-Home (DOOH) advertising is increasingly deployed in public places, offering dynamic and customizable content to attract diverse audiences. It is important to understand the audience response to help advertisers optimize their advertising strategies. However, the questionnaires and facial analysis used in existing studies are time-consuming, subjective, and prone to errors from occlusion or tracking failure. Skeleton-based human action recognition (HAR) provides a promising alternative by modelling human actions through posture and movement, thereby enabling analysis of audience response based on physical actions and dwell time. Despite its potential, skeleton-based HAR has not yet been applied in DOOH advertising. This study presents a comparative analysis of three skeleton-based HAR models, including single-stream convolutional neural network (1SCNN), three-stream CNN (3S-CNN), and spatial temporal graph convolutional network (ST-GCN). The analysis employed a subset of actions from the NTU RGB+D dataset, specifically selected for relevance to DOOH advertising. This subset comprises six actions commonly observed in public advertising scenarios. The experimental results show the STGCN achieved the highest recognition accuracy in cross-subject and cross-view evaluation protocols, whereas the 3SCNN demonstrated the fastest computational performance.

181 Classification of Song Genre Based on Textual Lyrics and Song Profile Information

***Po Hung Lai**, Jerrald Juan Pinso, Florence Sia and Soo Fun Tan*

This study proposes a machine learning-based approach for the classification of song genre using textual lyrics and song profile information. Song genre classification is an important task in the field of music information retrieval, as it enables music industry professionals to analyze and understand music trends and to make informed decisions about music production and marketing. This paper will perform pre-processing of lyrical data from songs and perform machine learning tasks to classify the genre by using machine learning algorithms such as Support Vector Machine, Recurrent Neural Networks and Attention architecture. To enhance the outcomes, hyperparameter tuning will be performed. Finally, the output from each model is compared by using suitable performance assessment measures and the best machine learning algorithm to classify song genre can be obtained.

308 Comparative Analysis of Feature Extraction and Noise Reduction Methods for Distress Keyword Detection

*Lorita Angeline, **Wan Nur Afrina Wan Azli**, Min Keng Tan, Kit Guan Lim and Kenneth Teo*

This paper presents a distress keyword detection system designed for noisy environments, aimed at enhancing safety through sound-based surveillance. Traditional audio detection often fails in real-world conditions, highlighting the need to evaluate pre-processing methods. This study investigates the impact of noise reduction and feature extraction techniques on the performance of a Convolutional Neural Network (CNN) classifier. Two feature types were used, namely Mel Frequency Cepstral Coefficients (MFCC) and Mel spectrograms. These were tested under three input conditions including raw noisy audio, Spectral Subtraction and Wiener Filtering. An ablation study was conducted with a fixed CNN architecture to isolate the effects of each technique. Results show that models trained directly on noisy MFCC features achieved the highest accuracy (88.27%) and distress-class F1-score (0.88). Spectral Subtraction improved recall but lowered precision, while Wiener Filtering generally degraded performance. These findings suggest that training on realistic noisy data using MFCCs yields more robust distress keyword detection, supporting the development of practical audio surveillance systems for safety-critical applications.

262 ExplainNet: A Hybrid Visual-Linguistic Model for Human-Centered Autism Diagnosis

***S.M. Sefat**, Muhamad Hariz Bin Muhamad Adnan and Md Mahmudul Hasan*

Autism Spectrum Disorder is a complex neurodevelopmental condition that requires early diagnosis for effective treatment. Deep learning-based facial image classification models have demonstrated significant potential for automated autism diagnosis. Nevertheless, the black box nature of the model limits its application for clinical adoption. This paper presents a novel approach to a hybrid model framework that enhances the interpretability of deep learning models by combining visual interpretability with natural language processing. The model utilizes Grad-CAM-based heatmaps with facial landmarks-based region segmentation to indicate salient areas such as the eyes, nose, and mouth that influence classification. In this pilot study, the identified regions are mapped to predefined linguistic templates using a rule-based explanation module, while the full framework proposes a transformer-based natural language generation model for future implementation. This heatmap-to-text pipeline bridges the gap between AI decision-making and clinical reasoning, achieving 80 percent accuracy on a small dataset. Interpreting heatmaps requires technical expertise, and a human-readable explanation improves clinical decision-making. The proposed approach enhances user understanding, clinician trust, and early autism screening accessibility in real-world healthcare environments.

Session D2:
Reliability & Predictive Approaches in Power Systems

224 Reliability Analysis Based on Fault Tree Analysis for SSCB Snubber Circuit Employing Inverse Current Injection Method

***Jae-seong Jo**, Jae-Hun Cha, Guangxu Zhou and Feel-Soon Kang*

Using the inverse current injection method, zero current switching can effectively suppress the surge voltage during SSCB's switch turn-off. However, it requires additional auxiliary components such as resonant circuits and thyristors, which increase circuit complexity and may increase the failure rate. In this paper, Fault Tree Analysis (FTA) is conducted to identify the failure modes of the snubber circuit and to analyze its reliability by reflecting its operational characteristics. It was confirmed that the SSCB's switch exhibits a long lifespan because it does not perform frequent operations, unlike general power electronic systems.

222 Reliability Analysis of SSCB Snubber Circuit Based on Markov Model and LSTM

***Seong Jin Lim**, Jae-seong Jo, Sung Yong Joo and Feel-Soon Kang*

The dc solid-state circuit breaker (SSCB) uses MOVs or MOV with resistor-capacitor-diode (RCD) snubber circuit combinations to reduce the surge voltage that occurs when breaking a fault current. The more MOV and RCD circuit components are added, the greater the surge voltage reduction effect. However, as the number of components increases, the failure rate of the snubber circuit increases. This paper analyzes the reliability of the surge voltage reduction circuit. The component failure rate is calculated by mission profile according to the circuit breaker operation based on the FIDES 2022 fault library. Also, the long short-term memory (LSTM) model is used to predict the ambient temperature to calculate the failure rate by reflecting the actual operating temperature of the component. The reliability analysis uses the Markov model to consider the surge voltage fluctuation due to the component's partial failure.

300 Correlation Between Surface Morphology and Conductivity of Nanostructured Electrodes: A FESEM and I–V Characterization Study

*Uda Hashim, **Saroja Rijal**, Muhammad Nur Afnan Bin Uda, Muhammad Nur Aiman Bin Uda, Yuri Pamungkas and Nurul Hulwani Ibrahim*

This study discusses the fabrication and characterization of aluminum interdigitated electrodes (Al-IDEs) designed for cost-effective electrochemical sensing. The IDEs were created on silicon substrates using UV photolithography with a 5 μm finger width and optimized spacing. Morphological analysis via field emission scanning electron microscopy (FESEM) showed high precision in the electrode structure. Electrical testing through current-voltage (I-V) measurements revealed a stable and linear response across multiple cycles, producing an average current output of 0.12964 nA at 1.0 V, with a relative standard deviation below 3%. These findings demonstrate the reliability of the Al-IDEs for future surface modifications in bio-sensing applications.

221 Reliability Assessment of DC Solid-State Circuit Breaker with Snubber Circuit Based on Part Stress Analysis Using LSTM

***Jae-Hun Cha**, Yun-Sik Jang, Sang-Hyeok Lee and Feel-Soon Kang*

This paper presents a reliability evaluation of a dc Solid-State Circuit Breaker (dc-SSCB) equipped with a snubber circuit, based on the FIDES 2022 failure library and the Parts Stress Analysis (PSA) methodology, utilizing a Long Short-Term Memory (LSTM) neural network. To validate the performance, actual temperature data from Seoul, South Korea, was used. The system failure rates and reliability were analyzed using both the conventional failure rate method and LSTM-based predictions of operating temperature. Furthermore, the predicted temperatures were compared with actual measured values to assess the accuracy of the prediction model. The analysis results show that the LSTM-based approach predicts the system reliability to reach 0.5 after approximately 14 years of operation, which is about 12.5% lower than the result obtained using the conventional static method based on average failure rates. Moreover, when compared with the reliability evaluated using actual measured temperature data, the prediction error of the LSTM-based approach was found to be less than 1%, demonstrating high accuracy. These findings indicate that incorporating time-varying thermal stress information enables more precise and realistic reliability assessments that closely reflect actual operating conditions.

223 Relationship Between Charging Time and Converter Reliability According to the Current Magnitude of the CC Section in the CCCV Charging Method

***Yun-Sik Jang**, Sung-Geun Song, Seong-Jin Lim and Feel-Soon Kang*

This paper analyzes the effect of current variation in the CC (Constant Current) section in the CCCV (Constant Current and Constant Voltage) charging method on the reliability of the battery charging circuit. First, a charging simulation is performed with three current conditions of 1C, 0.75C, and 0.5C to analyze the time variation in the CC and CV sections. Next, the effect of the change in current amount and operating time on the failure rate and reliability of the charging circuit is analyzed. As a result, the smaller the charging current in the CC section, the longer the CC section, and the longer the total charging time. In particular, the points at which the reliability decreases below 0.35 are 9.1 years (1C), 7.6 years (0.75C), and 18.5 years (0.5C), respectively, confirming that the low charging current in the CC section does not always guarantee high reliability. In other words, to secure the charging circuit's reliability, the charging current in the CC section and the interaction of the duration of the CC section should be considered together.

227 Predictive Modelling of Air Booster Compressor Motor for Health Monitoring Using Optimized Feedforward Neural Network

***Rosli Nurfatihah Syalwiah**, Ibrahim Rosdiazli, Ismail Idris and Omar Madiah*

Accurate prediction of Air Booster Compressor (ABC) Motor failure is crucial for effective Operation & Maintenance (O&M) of rotating equipment. This paper investigates robust predictive maintenance strategies for ABC Motors. While Feedforward Neural Networks (FNNs) have good performance for such predictions, they often suffer from limitations like susceptibility to local minima, leading to suboptimal prediction accuracy. To address this, the training of FNN weights and biases using the Spiral Dynamics Algorithm (SDA) is proposed. The performance of SDA-FNN is evaluated and compared against a standard FNN model, using Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) between predicted and actual values. The results demonstrate that the SDA-based approach significantly outperforms the conventional FNN model in terms of prediction accuracy.

258 Common-Mode Voltage Suppression Strategy for Odd-Phase Motor Based on Pulse Shifting and Dead-Time Compensation

***Chengjiang Shangguan**, Yiying Wu, Ye Lin, Lixia Chen and Yafei Ma*

For multiphase motor system driven by two-level multiphase voltage source inverter (VSI), the application of pulse width modulation (PWM) inevitably generates common-mode voltage (CMV), which induces electromagnetic interference (EMI) and causes bearing damage in the motor. In the case of odd-phase motor, CMV is mathematically impossible to eliminate. This paper proposes a generalized CMV suppression algorithm for odd-phase motor, based on carrier-based modulation (CBM) and pulse phase-shifting. The algorithm comprehensively addresses both the amplitude and switching frequency components of CMV, while incorporating a compensation method for dead-time effects in driving pulses to achieve common-mode voltage reduction (CMVR). The proposed CBM-CMVR algorithm suppresses the CMV amplitude to the minimum positive and negative peak values. Within one switching cycle, the CMV pulsates only twice or remains constant. Simulation results on a five-phase motor validate the effectiveness of the algorithm.

Session E1:
Predictive & Optimization Techniques

259 Multi-Level Support Thresholds for Association Mining

Pakorn Leesutthipornchai

Over the past few decades, association mining has been proposed for discovering co-occurrence patterns among sets of products in transactional data from supermarkets. The knowledge derived in the form of association rules is often extensive and difficult to filter or prioritize. This paper proposes a multi-level support thresholds approach with three distinct objectives: human-friendliness, insight discovery, and recommendation. In addition, novelty-based association rules are emphasized to uncover unfamiliar or less obvious relationships. A simplified groceries dataset containing 10,000 transactions and 167 items is used to demonstrate the approach. The results show that the proposed multi-level support thresholds method can reduce the number of association rules from 959,346 to 8 representative rules based on popularity and novelty.

317 Reinforcement Learning-Based Control for Fed-Batch Penicillin Fermentation

***Rosmawati Rumi**, Min Keng Tan, Kenneth Tze Kin Teo, Sivakumar Kumaresan and Heng Jin Tham*

The fed-batch penicillin fermentation process is inherently complex and nonlinear due to the sensitivity of microbial growth and product synthesis to environmental and operational conditions. Conventional control methods like Exponential Feeding (EF) or fixed strategies, lack adaptability when faced with dynamic process changes. Reinforcement Learning (RL), a branch of Artificial Intelligence (AI), offers a model-free approach that enables an agent to learn optimal actions through environmental interaction using rewards and penalties. This study employs a reinforcement learning-based adaptive control technique to dynamically adjust the feed rate in penicillin fermentation, with the objective of maximizing productivity while minimizing substrate inhibition. A streamlined kinetic model incorporating substrate inhibition and product synthesis was written in MATLAB. The RL controller employs a Dynamic Programming (DP) framework to determine the ideal feed rate, with the reward function structured to promote penicillin production while penalizing high substrate concentration. The feed rate action space had increments of 1 L/h and covered 0 to 50 L/h over a 400-h batch time. According to the simulation findings conducted under both nominal and variable initial conditions, the RL controller maintained the residual substrate concentration below 0.003 g/L while achieving a total batch penicillin product ranging from 141,858 g to 148,523 g. This adaptive approach shows potential for intelligent, reward-driven process control that optimizes fed-batch penicillin production.

278 Dyna Q-Learning Algorithm in Temperature Control for Exothermic Process

***Yan Yi Vun**, Huiyi Xu, Min Keng Tan, Helen Sin Ee Chuo, Heng Jin Tham and Kenneth Tze Kin Teo*

This paper explores the application of Dyna Q-learning algorithm in temperature process control, especially in the chemical batch reactor. Since the precise control of temperature in batch is the most important aspect to ensure stability, safety and yield. The application of Dyna Q-learning algorithm is rare especially in chemical processes. This might be due to Dyna Q complexity when it is used to control continuous process which is full of uncertainty especially in the chemical batch process. In most of the existing studies, Dyna Q is used for discrete process control. There is still study gap in Dyna Q-learning on the continuous process control such as chemical batch process. In this paper, the algorithm will implement with discretized version of temperature error as the state of the system and the increment and decrement of the fluid temperature as the action of the system. Both Dyna Q-learning and the conventional controller will be tested under both nominal and robustness cases to evaluate the controller's performance. The Dyna Q-learning controller performs equally as the conventional controller in nominal case but improves by 86% in terms of temperature overshoot in robustness case. This project shows Dyna Q-learning is capable of continuous process control. This result further supports the future integration of reinforcement learning type of control in continuous processes, especially in chemical processes.

174 An Enhanced EWMA Chart with Variable Sampling Interval Based on Expected Average Run Length

***Peh Sang Ng**, Zhi Lin Chong, Huai Tein Lim, Wai Chung Yeong and Poh Choo Song*

The auxiliary information based variable sampling interval Exponentially Weighted Moving Average (VSI EWMA AI) chart, which combines the EWMA AI chart with the variable sampling interval (VSI) scheme has been shown to outperform the EWMA AI chart in detecting the mean shifts. However, the performance on the VSI EWMA AI chart was investigated by assuming the exact shift size is known in advance. Practically, this assumption is often unrealistic because the exact shift size is usually unknown. If the actual shift size deviates from the one assumed during the design of the control chart, the chart's run length properties could be significantly affected, making the interpretation on the chart's performance inaccurate. To address this limitation, the expected average time to signal (EATS) performance metric which accounts for shift sizes within a specified interval is adopted, that is, the optimal design of the VSI EWMA AI chart in minimizing the out-of-control EATS is proposed. The results generally demonstrate the superiority of the proposed VSI EWMA AI chart over the EWMA AI chart for the shift interval (0.2, 0.6) across different values of the correlation coefficient between the study and auxiliary variables (ρ), and for the shift interval (0.5, 1.0) when ρ is small to moderate.

233 An Effective Binary Equilibrium Optimizer Based on Fitness-Distance Balance for the Minimum k-Dominating Set Problem

Saad Adnan Abed, Mustafa Tareq, Ali A. Mahmood and ***Farrukh Hassan***

A k-dominating set of a graph G = (V,E) is a subset D ⊆ V such that every vertex not in D is adjacent to at least k vertices in D. Finding the minimum k-DS (MKDS) is not solvable in polynomial time as it belongs to the class of NP-hard problems. Hence, we present a meta-heuristic method to find near-optimal solutions for the MKDS in a reasonable amount of time. A binary solution representation is used to solve the tackled problem; where, ones refer to the k-DS nodes and zeros are the other nodes. This paper presents a Binary Equilibrium Optimizer (BiEO) for the MKDS problem. The standard binary equilibrium optimizer tends to converge prematurely when applied to dominating set problems. To address this limitation, we propose a Fitness-Distance Balance (FDB) mechanism aimed at promoting exploration and helping the algorithm to avoid getting trapped in low-quality local optima. The proposed BiEO-FDB is evaluated on benchmark datasets. The experiments show that BiEO-FDB performs better than the original BiEO and competes favorably with other related approaches for the tested instances. Based on the evaluation, we can conclude that the proposed method provides an effective solution to the MKDS problem.

81 Adaptive Model Retraining via Intelligent Data Extraction for Distribution Shifts

Hoo Meng Wong*, Ling Ling Chan, Siti Farah Norbaini Binti Mohamad and Sundresan Perumal*

Efficient model retraining is critical for sustaining machine learning model accuracy in dynamic environments facing distribution shifts. Conventional retraining on evolving datasets is computationally intensive, limiting scalability. This paper proposes a novel framework for adaptive model retraining that intelligently extracts high-impact data to address concept drift, feature drift, and class imbalance. The current proposed framework integrates advanced drift detection, error-based data selection, and uncertainty sampling within a unified pipeline, optimizing data relevance to streamline retraining and enhance model performance. Experiments on benchmark datasets and a real-world financial fraud detection use case demonstrate significant reductions in retraining time and improved accuracy compared to traditional methods. This scalable solution enables continuous model adaptation, offering substantial advancements for real-world applications under distribution shifts.

Session E2:
Intelligent Modeling & Data-Driven Analysis

291 Integrated Renewable Energy Performance in Tropical Climates: A Review

***Rickson Dutis**, Mohd Azlan Bin Ismail and Mohd. Kamel Wan Ibrahim*

Traditional renewable energy modelling frameworks designed for temperate climates inadequately predict system performance in tropical regions, limiting deployment accuracy in areas with unique environmental challenges. This systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to assess the performance of integrated renewable energy systems across tropical climate zones. A comprehensive search of IEEE Xplore, ScienceDirect, Scopus, and Web of Science databases identified relevant studies that record key parameters, including Köppen-Geiger climate zone classification, system configurations and capacity ranges, performance metrics and efficiency data, economic parameters (CAPEX, OPEX, LCOE), and the duration of the validation methodology. Analysis reveals significant performance variations across all renewable technologies in tropical conditions, with integrated photovoltaic-wind-battery systems demonstrating superior performance compared to standalone configurations. Economic analysis indicates that an optimized levelized cost of electricity can be achieved through proper system integration. The review identifies promising research areas, including long-term validation datasets, enhanced modelling approaches, and comprehensive environmental impact assessment. These findings lay the groundwork for developing tropical-specific design frameworks to accelerate the deployment of renewable energy in rapidly developing tropical regions that host substantial global populations.

238 Predicting Wind Speed Using Historical Averages: An Extra Trees Regressor Approach

***Izhar Hussain**, Boon Ching Kok, Chessda Uttraphan, Kim Gaik Tay, Adil Noor and Safdar Ali Abro*

Meeting the growing demand for electric vehicles (EVs) requires reliable sources of renewable energy. Wind energy plays a crucial role in renewable energy sources and can meet these needs with precise forecasting. This research applies machine learning to wind data from Jhampir, Sindh, Pakistan. The goal is to predict average wind speeds for the current month, and the next six months forecasts' aim is to enable wind energy to consistently support energy requirements, especially for powering electric vehicles. The Extra Trees Regressor model was used to generate these forecasts, focusing on certain performance metrics. For a one-month outlook, the model showed a Mean Absolute Error (MAE) of 1.839, a Mean Absolute Percentage Error (MAPE) of 29.75%, and both a Root Mean Square Error (RMSE) and a maximum error of 1.839. Meanwhile, the six-month forecast demonstrated an MAE of 1.360, a MAPE of 24.13%, an RMSE of 1.563, and a maximum error of 2.889. This article discusses how wind speed forecasts can help manage energy demand. It also covers the prediction process and potential future research topics.

228 Vibration Measurement Using L-K Optical Flow LSTM Regression Model

***Harold Harrison**, Mazlina Mamat, Farrah Wong, Yew Hoe Tung, Racheal Lim and Mohd Amran Madlan*

This study presents a contactless vibration measurement system leveraging a hybrid computer vision and neural network approach. The proposed framework combines Lucas-Kanade (L-K) Optical Flow with LSTM regression to predict acceleration metrics from high-speed video sequences. Image data captured via Raspberry Pi 5 and Pi Camera are processed into spatiotemporal pixel vectors, which serve as input to the LSTM network for regression-based acceleration prediction. For ground truth validation, synchronized measurements are obtained from a direct-connect accelerometer paired with a controlled vibration motor, utilizing multiprocessing techniques to ensure efficient dataset curation. Through systematic evaluation of architectural configurations, the LSTM-64-32 model with 20-step input sequences demonstrated optimal performance, achieving a training loss of 0.425 mm2/s4 squared differences compared to physical sensor readings. While results validate the feasibility of optical flow for vibration analysis, limitations in dataset diversity were identified as a contributor to model overfitting. This work advances non-contact vibration sensing by integrating low-cost hardware with deep learning, offering a scalable alternative to traditional accelerometer-based methods in structural health monitoring and industrial applications.

176 Channel Estimation for mmWave Massive MIMO Systems Using Deep Convolutional Neural Network

***Shahryar Akbar**, Farhan Khalid, Abdullah Hasan and Muhammad Shahzad Younis*

As the requirements for ultra-reliable and high-throughput communication intensify in fifth generation (5G) and future wireless networks, accurate and scalable channel estimation remains crucial for optimal system performance. This paper proposes a deep learning-based approach for channel estimation in millimeter-wave (mmWave) massive multiple-input multiple-output (MIMO) systems, utilizing a custom-designed convolutional neural network (CNN) trained on diverse synthetic datasets spanning a broad range of signal-to-noise ratio (SNR) conditions. Instead of relying on traditional handcrafted models and statistical assumptions, the proposed framework learns the underlying channel characteristics directly from data, enabling more adaptive and robust estimation. Experimental results demonstrate that our method achieves substantial reductions in normalized mean-square error (NMSE) compared to conventional estimators such as least squares (LS), and further exhibits improved performance over advanced methods, particularly across both low and high SNR regimes. Comprehensive evaluation and visualization underscore the robustness, adaptability, and practical potential of the proposed solution, highlighting the promise of deep learning to enhance or replace conventional channel estimation techniques in next-generation mobile communication systems.

184 Hybrid Quantum Convolutional Neural Networks with Structured Quantum Layers and Expressivity Analysis

Kai Ping Hoo *and Tan Chye Cheah*

This paper proposes and evaluate Hybrid Quantum Convolutional Neural Networks (HQCNNs) that integrate Structured Variational Quantum Circuits (SVQCs) into classical convolutional networks for image classification. Prior quanvolutional architectures often rely on unstructured variational circuits, leading to barren-plateau training landscapes, unpredictable convergence, and poor scaling of expressivity as qubit count grows. Moreover, simplistic data-encoding schemes can either fail to capture spatial correlations or demand impractically deep circuits, while arbitrary entanglement patterns obscure the relationship between circuit design and learning capacity. To address these challenges, we design four HQCNN architectures with progressively increased quantum encoding precision, entanglement topology, and classical post-processing depth. Each HQCNN replaces the convolutional layer with a quanvolutional layer: local image patches are encoded into small qubit registers via an Enhanced Novel Enhanced Quantum Representation (ENEQR), then processed by the SVQCs, and then measured to produce quantum feature maps. The four versions vary in quantum structure: Version 1 uses a simple linear 5-qubit chain (q=2), Version 2 adds wrap-around entanglement (closed-loop topology), Version 3 augments the classical head with a deeper batch-normalized multilayer perceptron, and Version 4 increases encoding fidelity to q=4 (7 qubits per patch). All models end-to-end using the Adam optimizer and cross-entropy loss on the MNIST dataset for 10 epochs using a PennyLane simulator. Version 4 achieves the best test accuracy (96% on MNIST). Fourier spectrum analysis reveals that richer entanglement and higher-fidelity encoding broaden the circuits' harmonic spectrum, correlating with enhanced representational capacity and improved classification performance. These results confirm that carefully structured quantum layers and enhanced encoding can enrich feature representations and boost accuracy, albeit with increased simulation overhead and training complexity.

283 Exploring the Synergy of Augmented Reality and Smart Tourism in the Digital Era: Integrating IoT, 5G, and Big Data for Enhanced Travel Experiences

Angeline Lee Ling Sing and ***Ng Giap Weng***

The tourism industry is experiencing a digital transformation, driven by the convergence of emerging technologies like Augmented Reality (AR), the Internet of Things (IoT), 5G, and Big Data. These technologies are reshaping the sector by enhancing user experiences, optimizing operations, and promoting sustainability. AR enables immersive experiences such as virtual tours and interactive storytelling, fostering cultural appreciation and engagement. IoT provides real-time, context-aware systems that personalize services and improve safety and operational efficiency. The rollout of 5G networks ensures high-speed, low-latency connectivity, facilitating seamless AR experiences, even in crowded or remote locations. Big Data supports personalized recommendations and resource optimization by analyzing tourist behavior and forecasting demand. The integration of these technologies addresses key challenges in tourism, including overcrowding, resource management, and environmental sustainability. AR and IoT work together to enhance personalized navigation and dynamic content, while 5G enables real-time applications like interactive 3D projections and virtual time travel. However, challenges such as high implementation costs, privacy concerns, and system interoperability remain. To fully capitalize on these technologies, tourism operators must make strategic investments and overcome these obstacles. By doing so, they can create sustainable, innovative tourism experiences that meet evolving consumer expectations, ensuring long-term growth and success in the industry.

Session F1:
AI Solutions for Industry Operations

56 LLM-Based Hybrid Framework for Industrial Anomaly Detection for Smart Manufacturing

***Swee Tee Fu**, Bee Theng Lau, Mark Kit Tsun Tee and Deron Yijia Foo*

Industrial Anomaly Detection (IAD) is increasingly critical in advanced manufacturing due to the high cost and operational disruptions caused by machine faults and process deviations. IAD supports early issue detection across the entire manufacturing lifecycle, from raw material handling to final assembly, thereby ensuring efficiency and minimizing unplanned downtime. However, the scarcity of labelled industrial anomaly data poses a major challenge, limiting the effectiveness and generalizability of traditional AI and machine learning models, which also tend to lack interpretability and delay critical decision-making. Recent advancements in Conversational AI, particularly Large Language Models (LLMs), offer promising opportunities to enhance explainability and operate under limited data conditions through their generative and reasoning capabilities. Despite this, LLMs still face notable challenges in object hallucination and limited comprehension of physical and temporal dynamics in complex industrial settings. This research explores the current landscape of IAD and proposes a conceptual hybrid anomaly detection architecture that integrates discriminative visual analysis models with LLMs. The proposed framework leverages scene understanding, anomaly feature detection, and motion abnormality analysis to produce enriched contextual embeddings, enhancing the interpretive capacity of the LLM for more human-readable explanations. While this paper focuses on reviewing existing methods and conceptualizing the proposed framework, future work will involve its implementation, experimentation, and validation to assess performance, interpretability, and practical applicability in real-world smart manufacturing environments.

68 Semantic Feature Selection via LLMs for Palm Oil Price Forecasting in Low-Resource Markets

***Mutian Ouyang**, Maobo Guo, Biqin Li, Baiyi Chen, Maria Anu V and Joshua Thomas*

Accurate commodity price forecasting is critical in low-resource markets where data scarcity limits the effectiveness of traditional machine learning pipelines. This study proposes a zero-shot semantic feature selection framework using GPT-4 for forecasting Malaysian crude palm oil (CPO) prices. Unlike correlation-based filters, our method leverages the pretrained knowledge of large language models (LLMs) to rank features based on their conceptual relevance via natural language prompts. We construct a structured dataset of exogenous variables covering commodity prices, macroeconomic indicators, and financial indices from 2020 to 2024. A dual-branch experiment compares traditional selection methods (Mutual Information, Lasso, RFE) with the proposed LLM-guided strategy, using XGBoost as the downstream prediction model. Experimental results show that LLM-selected features consistently outperform baselines across all metrics, achieving the lowest RMSE of 0.1477 and MAE of 0.1240. Visual analyses further confirm the model's ability to track actual price movements with semantic features alone. This work demonstrates the viability of LLMs in structured data tasks, offering a scalable and interpretable solution for economic forecasting under data-scarce conditions.

155 Optimized Tree-Based Mining Contrast Subspace for Categorical Data

***Nadia Mukti**, Florence Sia, Lai Po Hung, Tan Soo Fun, Rayner Alfred and Ayman Al-Ani*

Contrast subspace mining is the process of finding contrast subspaces in a dataset where a given query object is most similar to a target class but most different to other class. A contrast subspace typically consists of one or more features derived from the original feature set of the dataset. The obtained contrast subspace is mainly used to gain insight about the query object and thus, provide information to perform further analysis for better decision making on certain tasks. Contrast subspace mining using tree technique has shown the capability to mine contrast subspace for a query object in a categorical dataset. However, the optimization of the contrast subspace search process has not yet been explored to find contrast subspace globally. This research proposes an optimized contrast subspace search by applying genetic algorithm, called TB-CSMinerGC, to discover contrast subspace on data consisting categorical features. The likelihood contrast scoring function based on tree technique is used as a fitness function to select the contrast subspace with the most potential for a query object for evolution in order to avoid being trapped in a local optima search space. The experiment results show that the optimized method managed to determine the contrast subspaces of a query object in four real world categorical datasets and out-perform the existing method in 10 out of 16 cases.

255 Ensemble Learning with N-Gram Features for Enhanced Fault Diagnosis Through Maintenance Reports

***Nik Ahmad Danial Mohd Kamarolzaman**, Nurul Adilla Mohd Subha, Nurul Hannah Mohd Yusof, Norikhwan Hamzah, Anita Ahmad and Noorhazirah Sunar*

This paper investigates the most effective machine learning algorithm for text-based classification of manufacturing maintenance reports. The study utilizes real world maintenance data and explores NLP processing various n-gram-based TF-IDF tokenization techniques combined with ensemble machine learning (ML) approaches. Both stacking and voting ensemble methods are evaluated using base models including Logistic Regression (LR), K-Nearest Neighbors (KNN), Random Forest (RF), Naive Bayes (NB), Gradient Boosting (GB), and Support Vector Machines (SVM). Model performance is evaluated using recall, F1 score, precision, and accuracy, with a particular emphasis on recall due to the imbalanced nature of the dataset. The results demonstrate that an ensemble model combining RF-SVM with unigram features achieves the best performance, attaining 86% accuracy and recall, a 83% percent F1 score, and 84% precision. These findings offer valuable guidance for users in selecting suitable ensemble methods based on the characteristics of their textual datasets for classification tasks in the manufacturing domain.

312 Deep Learning Approaches for Sentiment Analysis in Customer Reviews

***Po Hung Lai**, Geraldine Keng-Cheng Yew, Florence Sia and Soo Fun Tan*

In today's digital landscape, analyzing consumer sentiment through reviews is crucial for businesses aiming to refine their strategies and product offerings. Traditional sentiment analysis algorithms often fall short when grappling with the intricacies of human language, limiting their effectiveness. To address these challenges, this study introduces innovative hybrid deep learning models that integrate Convolutional Neural Networks (CNNs), Long Short-Term Memory networks (LSTMs), and Recurrent Neural Networks (RNNs). The proposed models seek to enhance sentiment analysis accuracy and reliability by leveraging the spatial hierarchical features of CNNs alongside the sequential data processing strengths of LSTMs and the dynamic temporal learning capabilities of RNNs. This research emphasizes optimizing these models through extensive hyperparameter tuning and evaluating their efficacy on segmented datasets of customer reviews. The approach aims to yield more precise and actionable insights into customer sentiments, thereby enabling businesses to make informed decisions and cultivate stronger customer relationships.

286 Influence of Data Pre-Processing on CNN-LSTM Model for Regression-Based Analysis

Mohd Hafizie Hamdie James, ***Siti Nurfadilah Binti Jaini,*** *Mohd Azlan Bin Ismail and Choong Wai Heng*

Data pre-processing played a significant role in most supervised Machine Learning algorithms. Data scaling and input feature selection were among the widely utilized data pre-processing techniques. The dataset was scaled to avoid a vast difference between data points. Besides, the input feature selection technique was able to identify the correlation between the input and the output data. Nonetheless, specifying the ideal pre-processing technique remained challenging as it relied on the types of analyzed data. Hence, this study investigated the efficacy of both data scaling and input feature selection techniques for generating an accurate solar photovoltaic power generation system. Besides, the suitability of each data preprocessing technique was tested based on the CNN-LSTM algorithm's structure. Errors and correlations between predicted and actual power generation were continuously monitored to discover the optimum condition. Despite minimum error and high correlation value, the overfitting condition was assessed based on the learning curve. Therefore, the CNN-LSTM model with the SGD optimizer performed efficiently by implementing a standard scaler with all input features during data pre-processing.

Session G1:
AI Applications in Healthcare & Public Safety

289 Hyperparameter-Tuned LSTM for High-Performance Malay Sentiment Classification

***Rayner Alfred**, Shahdatul Syahirah Shahdatul Syahirah Binti Faid, Rayner Pailus, Khalifa Chekima, Zaidatol Haslinda Abdullah Sani and Yuto Lim*

Sentiment analysis is a vital task in natural language processing (NLP) that aims to determine the polarity of textual data as positive, negative, or neutral. While significant progress has been made in sentiment classification for high-resource languages, Malay language sentiment analysis remains underexplored, particularly in terms of optimizing deep learning performance. This paper addresses the performance limitations of Long Short-Term Memory (LSTM) models in Malay sentiment classification by proposing a comprehensive hyperparameter tuning strategy. The study investigates the effect of various hyperparameter combinations, namely epoch count, batch size, dropout rate, and learning rate, on LSTM performance across both domain-specific and general Malay Twitter datasets. A total of 48 hyperparameter configurations were tested using supervised datasets sourced from GitHub, covering both original and balanced (rearranged) sentiment distributions. The methodology includes data preprocessing, model implementation using TensorFlow and Keras, rigorous model evaluation using accuracy, precision, recall, and F1-score, and statistical validation through t-tests. The optimized model achieved a classification accuracy of 89.11% on domain-specific data and 72.14% on general (no-domain) data, demonstrating substantial improvement over baseline models. The novelty of this research lies in its systematic and large-scale exploration of hyperparameter settings for LSTM in a low-resource language context, combined with statistical validation to assess performance significance. The study also provides comparative insights into the impact of domain specificity and data balancing on model performance. The main contribution is a practical, fine-tuned LSTM framework tailored for Malay sentiment analysis, which can serve as a foundation for future NLP applications in the Malay language and other low-resource languages.

294 Optimizing Hyperparameters in Machine Learning for Enhanced Fake News Detection on Social Media

***Rayner Alfred**, Anis Aqilah Binti Zazali, Florence Sia Fui Sze, Po Hung Lai, Rayner Pailus, Khalifa Chekima, Ashraf Osman Ibrahim Elsayed, Yuto Lim and Haviluddin Haviluddin*

The widespread dissemination of fake news through digital media platforms presents a critical threat to public trust, democratic institutions, and social stability. While machine learning has shown great promise in automating fake news detection, a significant research gap remains in understanding how hyperparameter tuning affects the performance of these models. Many existing studies overlook this aspect, treating model configurations as fixed and underexploring their optimization potential. This study aims to fill that gap by systematically evaluating the impact of hyperparameter optimization on three widely used machine learning classifiers, Support Vector Machine (SVM), k-Nearest Neighbours (KNN), and Naïve Bayes, in the context of fake news classification. Using a publicly available dataset from Kaggle, textual features were extracted using TF-IDF vectorization, and each model was trained under optimized settings: k=5 for KNN, C=1.0 with a linear kernel for SVM, and alpha=1.0 for Naïve Bayes. Performance was assessed using accuracy, precision, recall, and F1-score, supported by statistical t-tests to validate significance. The results reveal that SVM outperforms KNN and Naïve Bayes across all metrics, achieving the highest accuracy (74.1%), recall (87.1%), and F1-score (80.4%), with statistically significant differences ($p < 0.001$). While Naïve Bayes achieved perfect recall (100%), it suffered from poor precision (61.6%), making it unsuitable for precision-sensitive applications. The findings highlight that hyperparameter tuning significantly influences model effectiveness and overlooking it may lead to misleading conclusions or suboptimal system performance. This paper contributes a replicable experimental framework and provides evidence-based guidance for selecting and configuring machine learning models in fake news detection. By addressing an underexplored but essential aspect of model development, this work strengthens the foundation for building more accurate, scalable, and robust AI-driven misinformation detection systems.

144 Retail Transformation in Healthcare: A Comprehensive Framework for Intelligent Eye Care Services Integration

Ajit Kumar Sahu *and* ***Kapil Kumar Reddy Poreddy***

The integration of artificial intelligence (AI) into healthcare within retail settings marks a transformative shift in how customers engage with services and how healthcare is delivered. This paper presents a comprehensive analysis of AI-driven transformation in retail healthcare, specifically focusing on eye care services integration. We examine the implementation of advanced AI technologies including computer vision, natural language processing, optical character recognition, and large language models to create seamless healthcare experiences within traditional retail frameworks. Our research demonstrates how AI enables real-time eye examinations, personalized eyewear recommendations, digital prescription validation, and predictive health screening through consumer devices. The proposed framework transforms routine shopping experiences into proactive healthcare interactions, achieving significant improvements in customer satisfaction, healthcare accessibility, and clinical outcomes. Performance evaluation indicates 85% improvement in customer engagement rates and 92% accuracy in AI-powered prescription validation compared to traditional methods.

263 AI-Powered Health Insurance Fraud Detection Using QEM-FusionNet Based SmartGridRand

Indirakumar Rajendiran *and Dhivyabharathi Ramanathan*

Healthcare insurance fraud presents a serious threat to medical and financial systems, causing significant economic losses and operational inefficiencies. This paper proposes a hybrid classification framework, QEM-FusionNet (Quadratic Discriminant Analysis, Extra Trees, and Multilayer Perceptron Fusion Network) based SmartGridRand, to accurately detect fraudulent healthcare claims. The model employs a stacking ensemble of MLP, Extra Trees, and QDA classifiers to enhance predictive accuracy and generalization. To optimize hyperparameters effectively, we introduce SmartGridRand Optimization, a two-phase strategy combining Randomized Search and Grid Search for improved tuning efficiency. The model is trained on a large-scale healthcare dataset comprising over 558,000 records, which undergoes preprocessing steps including missing value handling, label encoding, normalization, PCA-based dimensionality reduction, and class balancing via random undersampling. Evaluation results show that QEM-FusionNet achieves 98% across accuracy, precision, recall, and F1-score, outperforming baseline models such as Logistic Regression, Random Forest, XGBoost, and standalone MLP. The proposed framework demonstrates high robustness, efficient scalability, and practical applicability, making it suitable for real-time deployment in fraud detection systems across healthcare insurance providers.

194 Application of Machine Learning Algorithms for Early Prediction of Diabetes Using Lifestyle and Physiological Data

***Meena Ravikumar**, Sudikshya Shrestha and Mohammad Dabbagh*

Type 2 Diabetes Mellitus (T2DM) is a major global health concern, emphasizing the need for early detection to improve patient outcomes. This paper conducts a comparative study of four supervised machine learning classifiers, Two-Class Boosted Decision Tree, Decision Forest, Logistic Regression, and Neural Network, leveraging the Pima Indian Diabetes dataset within Azure ML Studio, a low-code cloud-based platform. Model performance was rigorously assessed using accuracy, precision, recall, F1 score, and AUCROC. Among the models evaluated, the Boosted Decision Tree achieved the most balanced performance with an accuracy of 0.774, recall of 0.663, and F1 score of 0.671. In contrast, Logistic Regression and Neural Networks demonstrated higher precision but lower recall, underscoring important trade-offs for clinical application. This study highlights the practical potential of low-code machine learning platforms in accelerating healthcare analytics. However, limitations include the specific demographic of the Pima dataset, lack of model interpretability methods, and no assessment of fairness. Future research will focus on model generalizability, integration of explainable AI techniques, and fairness evaluation. Overall, the results support the potential of accessible and responsible AI solutions to advance preventive healthcare.

133 Predictive Modeling of Type 2 Diabetes via Glucose-Insulin Interactions Using Machine Learning Techniques

***Nor Azlan Othman**, Muhammad Zuhair Muqris Mohd Zamri, Mohd Hussaini Abbas, Sarah Addyani Shamsuddin, Nor Salwa Damanhuri, Belinda Chong Chiew Meng, Samsul Setumin and James Geoffrey Chase*

A metabolic disorder, Type 2 Diabetes (T2D), where the human body unable to utilize and store glucose properly, results from chronically increased blood glucose (BG) levels. In particular, human body has a limited ability to generate enough insulin in order to control the BG levels and ensure homeostasis due to increased insulin resistance and/or reduced pancreatic secretion. Insulin Sensitivity (SI) is a glycaemic control biomarker indicating increased insulin resistance via lower values. This study uses a machine learning (ML) classification technique to generate insight in linking a SI with BG performance in T2D individuals. The main objective is to develop a machine learning program to make an early prediction for T2D by linking SI with BG level. An artificial neural network (ANN) is employed with a Levenberg-Marquardt (LM) training model and data from a series of Dynamics Insulin Sensitivity and Secretion Test (DISST) results. The correlation of SI as well as BG results achieved 88.89% accuracy in predicting a T2D patient compared to a non-diagnosed individual. The SI value calculated from DISST model is comparable with the HOMA model. This method and resulting ANN model can be used to help predict patient condition more accurately.

131 Classification of Cleft Lip Among Children Using Convolutional Neural Network Architectures

***Nor Salwa Damanhuri**, Nur Zulaika Izzati Abdul Rahman, Nor Azlan Othman, Belinda Chong Chiew Meng, Nur Najiha Kamarulzaman and Pauline Yap*

Cleft lip abnormalities can cause a serious oral health issue if it is not treated properly in a timely manner. Having a child with a cleft lip can be financially straining, as the child will require extra care since the cleft will not only affect their feeding and speech development but also face aesthetics and overall psychological health. However, general hospitals especially in rural areas lack dependable medical resources, which makes the diagnosis of the cleft subjective and inconsistent between medical professionals. This study aims to develop a convolutional neural network (CNN) model that is able to classify types of cleft lip among children. A total of 1976 cleft lip images, collected from various internet websites was utilized in this study. Transfer learning was used to assess the CNN's models, namely AlexNet, GoogLeNet, and ResNet-50. Classifiers like Support Vector Machine (SVM), K-Nearest Neighbors (KNN), and Random Forest (RF) was embedded in the CNN to optimize the results. With an accuracy of 94.06%, ResNet-50 with SVM classifier performed the best in classifying the type of cleft lip among children. Based on this result, it shows that the CNN with classifier is able to accurately classify cleft lips classes. Furthermore, a Graphical User Interface (GUI) was developed based one CNN-classifier model which help clinicians classifying type of cleft lip in real time mode. Hence, this study demonstrates how deep learning potentially be used to improve medical diagnosis, even in environments with limited resources.

250 Philippine-Based Anti-Scam SMS Relay System Using Few-Shot LaBSE

***Simon Carl De Leon**, Ryan Ray Limbo and Rosemarie Pellegrino*

The widespread use of the Short Message Service (SMS) plays a central role in the everyday communication of Filipinos. However, with its ubiquitous use and accessibility, the medium has become susceptible to numerous malicious activities, such as finance-related scam messages. This study implements an anti-scam SMS relay system using the Language-agnostic BERT Sentence Embedding (LaBSE) model trained via the Sentence Transformer Fine-Tuning (SetFit) few-shot learning framework. The system was deployed on a Raspberry Pi 5 with a connected Global System for Mobile Communications (GSM) module for communication via SMS. The resulting model demonstrated excellent classification performance, with an accuracy of 95.53 percent, precision of 0.94, recall of 0.98, and F1 score of 0.95. Furthermore, the training methodology consumed very few resources, using 51 samples to train for 204.29 seconds and consuming 10.7 GB of video memory on a Tesla T4 GPU, enabling faster iteration with newer data. Lastly, the model demonstrated practical real world deployment, with a model loading time of 6.64 seconds, inference time of 522.49 milliseconds, and overall memory consumption of 1.08 GB. Thus, the study proves the effectiveness, adaptability, and deployment practicality of SetFit-LaBSE in correctly classifying finance-related scam messages in the Philippine context.

103 Why Dark Nuns Split Audiences: A Sentiment Analysis of Hype vs Disappointment Using BERT NLP

***Bryan Yang**, Kevin Gunawan and Christian*

This paper analyzes shifts in audience sentiment regarding the Indonesian horror film Dark Nuns by studying user comments on TikTok before and after the film's release. A sentiment classifier based on Indonesian RoBERTa was employed to process and track shifts in 2,700 user comments. The sentiment analysis showed that premature marketing and star-centric promotions fostered predominantly positive and neutral sentiments, suggesting cautious optimism and anticipated hype. In contrast, release period comments showed a significant spike in negative sentiment, demonstrating pervasive disenchantment due to a disconnect between expectations and the film's narrative style execution. The research highlights the marketing enigma where promotional activities disconnect with reception, revealing the friction between content strategies tailored to audience expectations within the starkly horror genre, famous for its suspenseful pacing. This study develops a sentiment analysis film framework while providing admonition to filmmakers and marketers concerned with perception management given technological acceleration and paradigm shifts.

Session G2:
Advances in AI for Automation Control & Network

151 Optimizing Data Stream Partitioning to Improve RealTime Performance in Distributed Messaging

Sibaram Prasad Panda

Real-time data stream processing has become critical in distributed computing environments, especially in fog and edge deployments where low latency and high throughput are essential. This paper introduces a novel framework for optimized partitioning of Apache Kafka topics to enhance performance in such systems. By formulating the partitioning task as a constrained optimization problem, we develop two heuristic algorithms —BroMin and BroMax—that allocate topic partitions across brokers while satisfying constraints on replication latency, system unavailability, file handle limits, and application throughput. BroMin minimizes broker usage for cost- efficient deployment, whereas BroMax maximizes broker utilization for peak performance. Extensive numerical simulations and prototype experiments demonstrate the proposed heuristics outperform existing industry guidelines in terms of latency reduction, resource efficiency, and reliability. The framework also includes a fully automated evaluation toolkit, enabling reproducible testing across production, consumption, and end- to- end scenarios. Our results show that adaptive partitioning not only improves Kafka's throughput and fault tolerance but also maintains system resilience under varied consumer loads and message sizes. The findings have strong implications for designing scalable, dependable real-time messaging infrastructures in fog and cloud-edge systems.

159 Optimizing LLM-Based Recommendation Systems with Distillation and Quantization

Yuanjing Zhu *and Yunan Liu*

Large Language Models (LLMs) have shown promise in improving recommendation systems by capturing complex user preferences and contextual information. However, their large size and high computational cost make deployment challenging. This study explores ways to compress LLMs while maintaining its recommendation performance. We investigate three distillation methods to transfer knowledge from a large teacher model to a smaller student model: direct imitation, rationale-enhanced learning, and Direct Preference Optimization (DPO). Among these, DPO yields the best results, allowing the student model to outperform the teacher in key ranking metrics while significantly reducing memory requirements. To further optimize efficiency, we apply quantization techniques and found that quantization lowers model size by up to 36% with minimal impact on recommendation quality. The results demonstrate that a combination of distillation and quantization enables compact, high-performance LLM-based recommenders, which offer a practical solution for real-world applications, balancing efficiency with recommendation power.

225 Enhancing Retail System Resilience Through Integrated Cloudless AI and AIOps: A Framework for Real-Time Market Adaptation and Consumer Behavior Response

***Milankumar Rana**, Monika Malik and Twinkle Joshi*

Maintaining operational resilience against shifting consumer behavior and fast changing market conditions presents hitherto unheard-of difficulties for the retail sector. Typical problems with traditional cloud-dependent systems are latency, dependability on connectivity, and scalability restrictions that limit real-time responsiveness. In order to improve retail system resilience and enable real-time market adaptation, this work provides a fresh framework combining cloudless AI (Edge AI) and AIOps (Artificial Intelligence for IT Operations). Our method uses distributed edge computing capabilities mixed with sophisticated IT operations automation to build self-healing; adaptive retail systems competent of reacting to market variations within milliseconds. Significant increases in system availability (99.9% uptime), reaction time reduction (85% faster than conventional systems), and operational cost optimization (30% reduction in infrastructure expenditures) are shown by the suggested architecture. We demonstrate via thorough examination utilizing real-world retail scenarios that the integrated cloudless AI and AIOps methodology helps retailers to keep competitive advantage by improved customer experience, optimal inventory management, and proactive issue resolution. The capacity of the framework to handle data locally while preserving intelligent operational control marks a paradigm change toward very strong retail systems able to survive under unstable market situations.

276 Optimization of Multi-Area Automatic Generation Control Using Temporal Difference Algorithm

***Jared Riong**, Shun Quan Chai, Nordin Aminuddin, Min Keng Tan, Ahmad Razani Haron and Kenneth Tze Kin Teo*

This paper explores the use of Temporal Difference (TD) learning algorithm to optimize the Automatic Generation Control (AGC) of a multi-area thermal power system. The main challenge addressed is to manually tuning PI controller gains to ensure optimal performance under varying load conditions. The study integrates MATLAB and Simulink to model and simulate a two-area thermal power system, where TD algorithm adjusts the PI controller gains based on AGC power system feedback. The multi-area AGC system performance is evaluated in two scenarios, first with fixed loads scenario and second is with fluctuating loads scenario ± **10**% from the fixed loads scenario value. Results show that the TD algorithm improves system stability, providing smoother and more consistent power generation compared to conventional ACE-based method with fixed PI controller gains. In fluctuating load case, the TD method outperforms ACE with faster frequency recovery and reduced mechanical power generation deviations, achieving errors of 0.74% and 1.44% for areas 1 and 2, respectively, compared to ACE-based simulation with errors of 9.07% and 25.76% for areas 1 and 2 respectively. This demonstrates the potential of TD learning algorithm for optimizing AGC systems, offering an efficient and effective method for stabilizing frequency and improving power generation control in multi-area power systems.

211 Transformative AI Technologies in High-Voltage Systems: A Review of Advances in Predictive Maintenance, Fault Detection, and Grid Optimization

Ian Benitez *and Melodia Pahati*

High voltage engineering has evolved rapidly, driven by the growing need for efficient energy transmission and the integration of renewable energy into modern power grids, including urban areas. Innovations such as HVDC systems are central to this transformation, ensuring that grids can handle the increasing complexity and demand for sustainable energy. However, challenges remain, especially when it comes to coordinating insulation in hybrid AC/DC systems and maintaining the resilience of the overall infrastructure. This review looks at how Artificial Intelligence (AI) can help tackle these challenges, focusing on its role in fault detection, predictive maintenance, and improving system reliability. By comparing traditional methods with AI-driven solutions, we highlight how AI can enhance the scalability, efficiency, and adaptability of power systems. With AI, utilities can predict and prevent faults, optimize grid performance, and seamlessly integrate renewable energy sources into both rural and urban environments. Our goal is to provide insights for researchers, industry professionals, and policymakers on how AI can be harnessed to build more sustainable, resilient, and reliable energy systems. The insights shared here aim to help shape the future of power grids, positioning AI as a key player in the transition to cleaner, more efficient energy solutions.

313 Robust Adaptive Kalman Filtering with Dynamic Learning for UAV Altitude Estimation

Longxin Wei*, Jin Shi, Kit Guan Lim, Min Keng Tan, Hou Pin Yoong and Kenneth Tze Kin Teo*

This paper presents a ground altitude estimation algorithm for UAVs based on the fusion of low-cost IMU and barometric sensors. A robust adaptive filtering algorithm based on prediction residuals is proposed. By constructing a state vector containing altitude and velocity, the algorithm dynamically adjusts the noise covariance matrices according to the prediction residuals. An adaptive learning factor is introduced to regulate the weighting between predicted and observed values, improving estimation accuracy. Compared to the EKF method, the proposed algorithm does not require precise prior covariance information and achieves faster responsiveness with lower estimation latency. Under identical initial conditions, the proposed method reduces the root mean square error by 41.87% compared to EKF.

169 Optimized RSS-Based Handover Algorithm for IoMT System in HETNET

*Hoe Tung Yew, **Benson Foo Zen Kong**, Chung Seng Kheau, Aroland Kiring, Mazlina Mamat and Farrah Wong*

Existing IoMT systems typically rely on a single network, leading to disconnections and unreliable service in dynamic environments. The advancement of telehealth through the Internet of Medical Things (IoMT) has emphasized the need for seamless and efficient connectivity, especially in heterogeneous wireless network (HetNet) environments. This paper presents an optimized RSS-based vertical handover algorithm to reduce handover latency in IoMT systems. The system integrates Wi-Fi and GPRS technologies, enabling switching based on dynamic signal strength evaluation. A real-time web-based platform is also developed for data visualization and management using Node.js and Angular. Results show a reduced handover delay of 80% compared to the existing method. It improved network connection reliability for the real-time IoMT system.

287 Development of a Sensor-Driven Autonomous Vehicle for Real-Time Obstacle Avoidance on a Microcontroller-Based Platform

***Alvin Wong**, Aroland Kiring, Mohamed Aizad Mohamed Ghazali, Muhammad Nur Afnan Uda, Liawas Barukang and Lyudmila Mihaylova*

The performance of an autonomous vehicle system is significantly influenced by sensor reliability and microcontroller limitations. Challenges such as limited detection range, environmental sensitivity, constrained processing power, and slower response can lead to delays and inaccuracies in obstacle detection and navigation. Although integrating various sensors in the system can overcome the detection range constraint, its real-time decision-making will be affected due to the increased data load. In addition, dynamic environments hinder the system's path planning, as it requires robust real-time decision-making and adaptability. Therefore, the goal of this paper is to develop an autonomous vehicle system that can avoid obstacles in real time while travelling between designated points. This paper presents the design, implementation, and performance evaluation of an autonomous vehicle prototype that uses a real-time obstacle avoidance algorithm implemented on a microcontroller through integrated hardware and software. Performance evaluation in terms of efficiency, consistency, and reliability demonstrated the capability of the prototype to handle obstacles across various path types. Although the results show a decline in performance with an increasing number of obstacles, the findings serve as a basis for future enhancements of the developed system.

236 Study of Path Plotting for Unmanned Rice Harvester Based on Improved A* Algorithm

Qingqing Qiao, Baojian Yang, Kenneth Tze Kin Teo, Liwen Liang, Zhuoying Xie and ***Qinyuan Wang***

With the advancement of innovative agriculture technologies, autonomous path planning for rice harvesters has emerged as a critical challenge in agricultural mechanization. In this study, an improved A* algorithm is proposed to address the typical obstacle avoidance problems in path planning. Specifically, the traditional A* algorithm suffers from grid dependence limitations and limited dynamic adaptability. The improved A* algorithm incorporates a grid-based environmental model and integrates the Floyd algorithm to optimize path trajectories, effectively reducing redundant nodes while enhancing the smoothness of turns. Finally, the simulation experiments are conducted in the grid environment using MATLAB. Comparative results demonstrate that the improved A* algorithm significantly enhances path planning efficiency, with the generated paths exhibiting superior smoothness and feasibility compared to those produced by the traditional A* algorithm.

Session H1:
AI for Human Interaction, Services, & Language

115 Gesture-Controlled Device for Speakers using Machine Learning

Josh Mickylle Amonoy *and Meo Vincent Caya*

Hand gesture recognition is one of the recognized means of human-computer interaction (HCI). Innovation in the speaker industry is prominent with the rise of smart speakers. While smart speakers introduce voice control in addition to conventional controls, they do not have the ability to detect and use hand gestures for playback controls. This study aims to create a gesture-controlled device for any speaker with a 3.5mm audio input or Bluetooth connection. The user has the ability to control their speakers using their hands through the camera module that is connected to a Raspberry Pi 5. The study uses the MediaPipe framework for hand detection, and Keras for training the model. Two thousand five hundred one (2,501) images were used to test the model and achieved an accuracy of 93.6%. The device's performance was also measured using six hundred (600) hand gestures. The overall testing performance of the device is 96.5%.

285 PoliBERT: Dynamic Computation Allocation via Policy Networks

Vishnunand Pillai*, Darsh Tibrewal, Mubashir Farooqui and Gokul Raj Rajasekaran*

The computational burden associated with transformer architectures like BERT presents obstacles for deployment in resource-constrained environments. Contemporary compression methodologies primarily employ uniform compression strategies across diverse input instances, neglecting the inherent variability in computational requirements among different examples. In this paper, we present a distinct example-aware adaptive layer pruning framework that dynamically orchestrates transformer layer selection contingent upon input complexity characteristics. Our methodology incorporates a compact policy network architecture that generates binary activation masks for individual layers, allowing for personalized computational resource allocation per input instance. Through the implementation of differentiable Gumbel-Sigmoid relaxation mechanisms, we enable end-to-end optimization protocols while preserving classification accuracy. Comprehensive empirical evaluation on the Stanford Sentiment Treebank (SST-2) corpus demonstrates our approach achieving 93.0% classification accuracy while utilizing just 3.81 layers on average from the complete 12-layer architecture, yielding a substantial 3.15× compression ratio. This methodology outperforms established compression techniques including DistilBERT, TinyBERT, and conventional static pruning approaches, establishing a superior equilibrium between accuracy preservation and computational efficiency in BERT compression paradigms.

116 Advancing Sentiment Analysis in Malayalam: A Resource-Constrained Study on Sports News

V R Girija *and T Sudha*

This study proposes a sentiment classification approach for a moderately sized, class-imbalanced Malayalam sports news dataset in a resource-constrained setting. A novel, domain-specific dataset labeled with positive, negative, and neutral sentiments was developed. By assessing the performance of traditional machine learning algorithms, deep neural networks, transformer-based architecture, and hybrid architecture, the dataset can be considered as a key resource for Malayalam. Model performance is evaluated using AUC, recall, precision, F1-score and accuracy. This study emphasizes the importance of data normalization in handling the linguistic challenges of Malayalam, a low-resource and morphologically rich language. The findings underscore that the hybrid transformer-based model serves as a practical and adaptable solution for small to moderate datasets in resource-limited settings. The comparative evaluation further demonstrates that contextual models consistently outperform traditional methods, especially in capturing semantic nuances and handling the morphological complexity of low-resource languages.

252 Hybrid Deep Learning Model for Sentiment Analysis on Japanese Amazon Product Reviews

Ramanna T*, Gayathri Hegde and P Deepa Shenoy*

As global connectivity increased, companies began to operate internationally. For communication and linguistic comprehension, the majority of individuals rely on translators. In addition to being a diverse language with distinct characters and grammatical structures that set it apart from other Western languages, Japan is one of the key economic players. Entrepreneurs find it difficult to understand how well their products work and to get feedback for enhancements. To facilitate contact with Japanese clients or customers, the translator helps to bridge the gap by accurately expressing the message between Japanese and other languages. Hence, this study opens the door to happier customers and better business decisions by implementing the Hybrid Deep Learning (HDL) model, Bidirectional Gated Recurrent Unit (BiGRU) and Bidirectional Long-Short Term Memory (BiLSTM) in analyzing Japanese Amazon product evaluations for sentiment. The proposed method attempts to better evoke the contextual nuances of text data through the benefit of bidirectional recurrent processing. A thorough assessment reveals that the proposed HDL achieved an accuracy of up to 97.22%. The findings highlight the model's superior ability to understand complex sentiments, making it a strong and reliable approach for real-world Sentiment Analysis (SA) applications.

254 Performance and Efficiency Trade-Offs in Transformer Models for Kannada Sentiment Analysis

***Meghana D K**, Kiran K, Sahar Mariam Baig, P Deepa Shenoy and Venugopal K R*

Sentiment analysis in resource-scarce languages like Kannada is difficult because of lack of labeled data and the complex linguistic characteristics of Dravidian languages. A machine translation tool is used to create the labeled dataset in Kannada from a high resource language English. The created dataset is analyzed by finetuning Transformer models like MuRIL, IndicBERT, mBERT, XLM-RoBERTa(XLM-R), and DistilBERT, for sentiment classification in Kannada. The sentiments are classified into three classes: positive, negative, and neutral. We analyze the performance of these models on native-script Kannada text, highlighting the advantages of language-specific pre-training in MuRIL and the efficiency of IndicBERT in resource-constrained settings. Our experiments reveal that MuRIL and XLM-R outperform other models in capturing the intricate syntactic and semantic features of Kannada. Additionally, we discuss the trade-offs between performance and computational efficiency, with DistilBERT and IndicBERT offering a viable option for real-time applications. The results demonstrate the critical role of tailored pre-training and fine-tuning strategies for low-resource sentiment analysis, paving way for improved natural language understanding in Kannada and other Dravidian languages.

156 WORDEX: Early Dyslexia Detection and Support

***Sasindu Hansamal**, Oshan Dissanayake, Sandunika Samarakoon, Namal Jayawardana, Samantha Thelijjagoda and Poojani Gunathilake*

Dyslexia is a prevalent and complex learning disability that affects approximately 5% of primary school students worldwide. It often manifests as persistent difficulties in reading, writing, spelling, and overall academic performance, which can lead to long-term educational and psychological impacts if not addressed early. To facilitate the early identification and support of dyslexic learners aged 7 to 10, this paper introduces Wordex, an innovative and adaptive educational platform. Wordex is designed to screen for multiple dyslexia subtypes and provide targeted interventions through engaging, interactive, and personalized learning activities. The platform features an integrated machine learning-based screening system that analyzes user interactions and performance metrics to assess the risk of dyslexia. Upon identification, the platform delivers tailored remedial exercises that align with national school curricula, aiming to strengthen specific cognitive and linguistic skills. Wordex is developed using a modern technology stack including Spring Boot, Flutter, Python libraries, Firebase, and MongoDB, and incorporates capabilities such as image processing, supervised learning algorithms, real-time progress tracking, and cloud-based data management. A user-centered design approach and iterative testing cycles were employed to ensure the platform is accessible, intuitive, and pedagogically effective. Wordex contributes significantly to the field of educational technology by offering a scalable, research-informed intervention tool. Future enhancements include multilingual support, broader age group coverage, and integration with classroom learning environments.

185 TripHomie: A Machine Learning-Driven Web Platform for Smart Tourism in Kandy, Sri Lanka

Wathsala Priyankara *and Asanka Dinesh*

TripHomie is a Machine Learning-Driven Web Platform for Smart Tourism in Kandy, Sri Lanka that was developed to address critical tourism challenges in Kandy, a UNESCO World Heritage City and a prominent tourist destination in Sri Lanka. Kandy was selected for this study because its frequent changes in weather conditions and the abundant of under explored tourist attractions. This research introduces a Machine Learning (ML) Driven Web Platform designed to enhance the travel experience by recommending the best travel periods, discovering hidden attraction locations, and identifying affordable accommodations. The purpose of this research is a predictive Machine Learning model trained using RandomForestClassifier (RFC) and Gradient Boosting (GB) algorithms, developed from historical weather data, past tourist behavior data, and the reasons to travel that specific for Kandy, Sri Lanka. As the result of this model achieved a high prediction accuracy of 92.3%, enabling users to generate personalized travel recommendations. As additional features, beyond weather-based planning, TripHomie offers access to lesser-known attractions (over 90%) and affordable accommodation options that align with travelers' preferences and budgets. The project was developed using Django (Python), Bootstrap and integrated with Application Programming Interface (APIs) for real time weather services. The deployed system demonstrates the potential of Artificial Intelligence (AI) in solving regional tourism challenges by promoting data informed, sustainable, and inclusive tourism development. While This was developed for Kandy, but it can be applied to any region or zone.

253 Filipino Sign Language Recognizer Using Hand Pose Estimation and SqueezeNet

Jeremy Espera, *Jarl Kayne Jon Centeno and John Paul Cruz*

Sign Language plays a crucial role for people within deaf and mute communities. Most people do not know how to use this language, let alone understand it. With the use of modern technology, Sign Language Recognition is viable for people to understand and even use it for communication. The device developed by the researchers utilizes SqueezeNet and Hand Pose Estimation to recognize and translate certain Filipino Sign Language words. The device captures a single frame from the live video feed of the Raspberry Pi 4's camera module and analyzes this key frame against the trained dataset. The model garnered an overall accuracy of 97.2%. The model successfully utilized deep learning for sign language recognition from a video input. The researchers also successfully utilized Raspberry Pi's camera module for FSL recognition, implemented SqueezeNet for training and validation, and determined the performance of the model using a confusion matrix.

Machine Learning Techniques for Predictive Analytics of Academic Outcomes and Behavior of Pupils

280 ***Samuel-Soma M. Ajibade**, Nanet A. Goles, Mersin C. Villagonzalo, Rosie Fe B. Legaspino, Charmaine P. Antecristo, Johnry P. Dayupay, Catherine P. Tapales, Feliciana G. Cababat, Anthonia Oluwatosin Adediran and Kayode A. Akintoye*

This study looks at how machine learning (ML) can be used to look at and guess how well secondary school pupils in two Portuguese schools will do in school. The study uses a dataset with 33 variables that include a lot of demographic, social, and academic elements, such as age, gender, study time, family history, and the education levels of the parents. To make it easier to sort the data, the objective variable students' final grade (G3) was changed into a binary outcome: students who scored 10 or higher were put in the "pass" (1) group, and those who scored less than 10 were put in the "fail" (0) group. We used three machine learning models which are: Random Forest, Logistic Regression, and Gradient Boosting to see how well they could predict. Random Forest had the best accuracy of the three models, at 92.4%, followed by Logistic Regression at 89.9%, and Gradient Boosting at 86.08%. The study shows that past academic performance and study habits are important indicators of how well a student will do. The results show that machine learning could be very useful in schools, which is helpful information for teachers, school administrators, and politicians. These ideas can help build focused interventions, personalized learning plans, and early warning systems that will help students do better and lower the number of students who fail in secondary school.

Session H2:
AI for Visual Inspection, Materials, & Robotics

214 SVM-LSTM Model for Real-Time Detection of Punching Errors and Classification Using Kinectv2 and BNO055 Sensor

Keenan Kyle Malonzo *and Joseph Bryan Ibarra*

This paper presents a real-time boxer form analysis system that detects errors, classifies punches, and provides feedback to users on how to correct their errors and how these errors affect the punches. This system utilized a combination of visual and wearable technologies to perform its function, using the Kinect v2 and its joint tracking for form analysis and error detection, as well as two glove-mounted BNO055 9-DOF sensors for punch classification. This system also utilized a hybrid SVM-LSTM model, leveraging the strengths of each algorithm to address the weaknesses of the other, thereby creating a robust real-time form analysis system. The system achieved an accuracy of 0.86 for beginners and 0.73 for amateur/professional fighters in error detection. Additionally, it achieved an average accuracy of 0.93 for beginners and 0.87 for amateur/professionals in punch classification.

166 Review of Artificial Intelligence Applications in Performance Prediction of Advanced Energy Materials

Paula Marielle Ababao *and Ian Benitez*

Artificial Intelligence (AI) is transforming the prediction and optimization of advanced energy materials by enabling accurate, scalable modeling beyond traditional methods. This review evaluates recent AI applications—including Graph Neural Networks (GNNs), Convolutional and Recurrent Neural Networks (CNNs, RNNs), tree-based ensembles, and Gaussian Process Regression (GPR)—for forecasting performance metrics such as overpotential, conductivity, capacity, and degradation. GNNs achieved $R^2 > 0.90$ in structure-sensitive tasks; LSTM models predicted battery degradation with <10% error; and tree-based models balanced accuracy (MAE < 0.15 V) with interpretability. GPR excelled in low-data regimes via uncertainty quantification. Hybrid and physics-informed models improved generalizability and data efficiency. While challenges remain in data quality and integration with experiments, emerging strategies like autonomous labs and generative design offer promising advances. This review provides comparative benchmarks and highlights pathways for robust AI-driven materials discovery.

167 AI-Driven Computational Materials Science for Advanced Energy Materials Development

Paula Marielle Ababao *and Ian Benitez*

The integration of artificial intelligence (AI) into computational materials science (CMS) has introduced powerful approaches for accelerating the discovery and optimization of advanced energy materials. As energy demands shift toward renewable systems, the development of efficient materials for batteries, fuel cells, and electro-catalysts becomes increasingly critical. This paper systematically reviews recent AI methodologies applied within CMS, particularly those leveraging density functional theory (DFT), molecular dynamics (MD), and kinetic Monte Carlo (KMC) simulations. Emphasis is placed on the use of machine learning (ML) models, including supervised learning, deep learning, and hybrid strategies for property prediction, structure optimization, and inverse design. The review categorizes current applications across key energy technologies and discusses how AI is reshaping material screening and development pipelines. It concludes with an outlook on future directions, highlighting the need for standardized datasets, interpretable models, and physics-informed frameworks to improve predictive accuracy and facilitate AI adoption in practical materials research.

171 Fitness Assessment of Philippine Bill Using YOLOv8

Ameer Allen Abinuman, ***Marc Hendri Soquiat*** *and Noel Linsangan*

This study classifies the fitness of bills based on the standards set by the Central Bank of the Philippines using YOLOv8, NVIDIA Jetson Nano, and Raspberry Pi Camera USB as the sensor, with a total of 1,527 images for the dataset, with classes such as soilage, charring, decay, crumples, tearing, and markings. The dataset is split into 70% for training, 15% for validation, and 15% for testing. The system's performance is measured by its accuracy, resulting in 78.33% after it made 47 out of 60 correct predictions during testing. Future work will implement a sensor capable of higher capture resolution, preferably a minimum of 1080p resolution, and computing hardware with a high-performance GPU, matched with expanding the dataset, implementing instance segmentation and edge detection, and additional functionalities such as counterfeit detection and fitness grade.

217 Harris Performance as Activation Function for Image Classification in Convolutional Neural Network and Transfer Learning Models

***Luther Villacruz**, Maria Lyn Bernadette Mendoza and Robetson Laban*

Activation functions are important parameters of a deep neural network (DNN) which introduces non-linearity, complexity, and adaptability of the model for image classification. Convolutional neural networks (CNN) is a type of DNN are well-known for addressing problems related to image classification and since DNN are data-driven transfer learning (TL) is used to address the insufficient data by training well-known CNN architectures in a generic dataset to be applied for a task-specific CNN model. In this paper, we introduce Harris as an activation function determining its capability for image classification and determine its □-values in which high accuracy is obtained using a simple convolutional neural network (SCNN) and VGG-16 model trained and tested using the CIFAR-10 dataset and comparing its performance to ReLU. The results show that Harris provides a promising performance by exceeding the target accuracies for both training and testing set by ReLU at some of the □-values and using the F1-score it exceeds ReLU in the image classification for most of the CIFAR-10 classes.

134 DiffuseNet: A Hybrid cGAN and Diffusion Model Framework for Enhanced SAR Image Colorization

*Pranav Rao Pernankil, Rohan Anantapur, Sripriya Addanki, **Manav Madhusudhan Nayak** and Prema R*

Synthetic Aperture Radar (SAR) imagery has emerged as a critical tool in remote sensing because it can be used to take images under any weather conditions and at day or night. Though SAR imagery has its benefits, it tends to have low visual interpretability due to its grayscale nature, noise, and lack of fine detail, which can cause it to be viewed as less useful for applications that need human interpretation. In order to solve these difficulties, DiffuseNet is proposed, a new two-stage deep learning model for coloring and enhancing SAR images to make it more visually interpretable. For the first stage, a conditional Generative Adversarial Network (cGAN) is employed for colorization, with grayscale SAR images being converted to their colored versions through discovering the correspondence between the input intensity patterns and valid color distributions. This provides semantic richness and contextual depth to the images. In the second phase, a self-evolving diffusion model is used to further enhance the images by removing noise, sharpening, and enhancing texture consistency, thus yielding clearer and more realistic results. The synergy of the generative ability of cGAN and the denoising ability of diffusion models allows DiffuseNet to produce high-quality, color-augmented SAR images. Experimentation indicates that improved performance is obtained by our approach in both visual and numerical comparisons, over existing methods. By offering improved clarity and colorization, DiffuseNet is introduced as a powerful tool for a wide range of remote sensing applications such as environmental monitoring, land cover classification, disaster assessment, and surveillance.

138 Wafer Defect Image Classification Optimization Using CNN with Cyclical Learning Rate

***CascarIdini Chrisson Nelson**, Hariyanti Mohd Saleh and Nor Hidayah Saad*

Wafer defect classification plays a critical role in semiconductor manufacturing, impacting industry yield and product quality. Traditional manual inspection methods are time-consuming and prone to error, highlighting the need for automated and scalable solutions. Convolutional Neural Network (CNN) has demonstrated strong performance in defect classification. However, the effective training of a model often depends on carefully tuning learning rates. This study investigates the use of Cyclical Learning Rate (CLR) as a learning rate scheduling strategy to improve training performance and generalization in the CNN model for wafer defect classification. Using the WM811K dataset, two CNN models, VGG16 and ResNet50, are evaluated with CLR and fixed learning rate settings. The results show that models trained with CLR achieve higher accuracy during validation phases, with ResNet50 with CLR reaching 98.30% testing accuracy and VGG16 with CLR reaching 95.03%. Confusion matrix analysis confirms improved classification across multiple defect classes. CLR also enables faster convergence and reduces dependence on manual hyperparameter tuning, offering practical benefits.

249 Enhancing Recruitment Selection Process in Human Resource with Artificial Intelligence Powered Resume Parser

*Yik Junn Kuan, **Pei Yi Voon**, Li June Tan, Mahdiyeh Sadat Moosavi and Kar Yee Chong*

The research addresses inefficiencies in traditional recruitment practices by leveraging advanced AI techniques such as Natural Language Processing (NLP) and Machine Learning. This aligns with Sustainable Development Goal (SDG) 8, which is to focus on promoting inclusive and sustainable economic growth and decent work for all. The proposed AI-powered Resume Processing Chatbot automates routine tasks like resume screening, enabling HR professionals to focus on strategic decision-making and candidate evaluation. By improving recruitment efficiency, reducing bias, and enabling data-driven insights, this system significantly contributes to modernizing HR practices. The research aims to revolutionize and improve the recruitment processes, promoting fairness, efficiency, and transparency, while addressing the limitations of manual recruitment methods.

248 Analyzing Machine Learning Models for Demand Forecasting in Fast-Moving Consumer Goods on Responsible Consumption and Production

***Jing Yao Yap**, Yik Junn Kuan, Preethi Subramanian, Li June Tan and Mahdiyeh Sadat Moosavi*

The fast-moving consumer goods (FMCG) industry involves products with short shelf lives, rapid consumption, and large-scale production, often relying on single-time packaging, raising environmental sustainability concerns. Accurate production planning is essential for FMCG businesses to address these issues, and demand forecasting using machine learning can play a key role. This study experiments with three algorithms —Random Forest Regression, XGBoost Regression, and LSTM. XGBoost Regression emerges as the best-performing model with the highest R-Squared, lowest Mean Absolute Error, and Weighted Absolute Percentage Error. The significance of this study lies in its comprehensive review of FMCG business practices related to demand forecasting.

Session 11:
AI for Security & Trust in Digital Systems

118 Gait-Based User Authentication System Using Machine Learning on Mobile Devices

Vyshak R *and Dushyanth Gopal*

This paper presents GaitAuth, a sophisticated gait-based user authentication system tailored for mobile platforms. It leverages the inertial measurement unit (IMU) sensors, specifically the accelerometer and gyroscope, to capture unique gait patterns. The system employs a multi-stage processing pipeline designed for real-time, on-device operation. Raw sensor data is first pre-processed using a combination of median and low-pass filters, followed by normalization to an Earth reference frame, to ensure robustness against device orientation variations and environmental noise. A hybrid deep learning architecture, combining a Convolutional Neural Network (CNN) and a Bidirectional Long Short-Term Memory (BiLSTM) network, is used for automated feature extraction and classification. The CNN extracts local discriminative features, while the BiLSTM models the temporal dependencies inherent in gait signals. This approach addresses the limitations of traditional methods by providing continuous, non-intrusive authentication with a high degree of accuracy and privacy. The proposed system achieved an authentication accuracy of 94.3%, with a False Acceptance Rate (FAR) of 2.1% and a False Rejection Rate (FRR) of 3.8%, demonstrating its potential to replace or augment traditional authentication mechanisms such as PINs and fingerprint recognition in security-conscious environments. The entire system is designed for privacy-first, on-device processing using TensorFlow Lite, ensuring no sensitive data leaves the user's device.

142 Detecting Impersonation in Social Media: An NLP and Machine Learning Perspective

Ihab Agha, ***Nancy Bou Ghannam,*** *Mahmoud El Samad and Kamil Badereldine*

As we begin to rely more on the Internet and social media, impersonation has taken off as a common and dangerous problem, for causes like seeking out attention to pulling off scams, and impersonating celebrities or other famous people. This is violating the basic rights to keep our data safe and, in essence, is highly dangerous not only for people but also for companies. In this context, we are interested in developing efficient algorithms for real-time detection and prevention of fake accounts for the privacy of users (e.g., celebrities) and to reduce impersonation risks. As a first contribution, we collected an accurate dataset of public figures from different data sources. Each record has been labeled and tagged with the appropriate attributes to ensure that the algorithm can accurately distinguish between real and fake data. This initial step allowed us to create a comprehensive dataset to train algorithms to recognize and find such data online is either not feasible or unavailable in open-source formats due to the inclusion of personal information. Our data set comprises 1,400 carefully selected personal data records, mainly from celebrities, with 80% allocated for training and 20% for testing. The second contribution is an algorithm that leverages a Natural Language Processing (NLP) framework to analyze data entered during account creation, determining whether the information is legitimate or not. Our study evaluates and compares five main algorithms: Decision Tree (DT), Support Vector Machine (SVM), Naive Bayes (NB), K-Nearest Neighbor (KNN), and Random Forest (RF). The experimental results showed that KNN and RF outperformed other algorithms in precision, recall, and F1-score. DT exhibited a precision-recall trade-off, while SVM performed poorly.

215 Deepfake Video Detection Based on Scatter Wavelet Transform and Deep Learning

Baneen Musa Mahdi *and Ali Mohammad Sahan*

Deepfake video has received more attention since it causes many problems which effected the human life in numerous domains. In this paper, we presented an effective technique for deepfake detection based on Scatter Wavelet transform (SWT) and deep learning. SWT is utilized in the preprocessing stage in order to exploit its capabilities, namely dimension reduction and preserving the most important features as well as its resistant against the noise. Dimension reduction led to increase the speed of the processing time. On the other hand using SWT convert the data to domain in multi-resolution levels led to increase the accuracy of deep fake videos detection. The efficiency of the proposed technique is evaluated by carried out many experiments on Deepfake Detection (DFD) dataset. The analysis of the experiment's results indicated that the proposed technique achieved high detection accuracy about 99.75% with highly reduction of the processing time about 54.02%.

178 AI-Driven Network Intrusion Detection Systems: A Survey of Techniques, Datasets, and Deployment Challenges

Sedat Çimen

The exponential growth in network traffic and the sophistication of cyber threats have heightened the need for intelligent and scalable security mechanisms. Artificial Intelligence (AI)-based Network Intrusion Detection Systems (NIDS) have emerged as a promising solution for identifying malicious behavior in real time by leveraging machine learning (ML) and deep learning (DL) techniques. This survey presents a comprehensive review of AI-driven NIDS models published between 2021 and 2025, offering a structured analysis of model architectures, benchmark datasets, evaluation metrics, deployment challenges, and emerging research trends. The models are categorized into classical ML, DL, hybrid approaches, Generative Adversarial Networks (GANs), and ensemble techniques. Comparative findings indicate that DL and ensemble methods achieve superior detection performance in high-dimensional traffic scenarios, while hybrid and lightweight ML models remain effective in resource-constrained environments. Key deployment challenges such as real-time latency, adversarial vulnerability, and data scarcity are critically examined. Additionally, the study highlights future directions including federated learning, LLM-assisted lightweight detection, continual learning frameworks, and synthetic dataset generation via generative AI. This work aims to inform researchers and practitioners by consolidating recent developments and identifying practical pathways for advancing robust and adaptive NIDS.

106 Integration of Quantum-Based Approaches into Visual Question Answering Systems

Merve Güllü *and Necaattin Barışçı*

Visual Question Answering (VQA) systems are artificial intelligence applications that perform multimodal inference by combining visual and linguistic information. This review surveys the current literature on integrating quantum computing, quantum machine learning (QML), and quantum natural language processing (QNLP) techniques in VQA systems. It also discusses the potential impact of quantum computing methods on VQA applications in the context of 6G networks. The paper will demonstrate how this integration can contribute to developing more robust, secure, and efficient VQA solutions.

92 Toward Semantic Communication in 6G: A Multimodal Perspective Based on Visual Question Answering Systems

Merve Güllü *and Necaattin Barışçı*

As 6G technologies emerge, the communication paradigm shifts from conventional data-centric methodologies to meaning-centric communication paradigms. This study analyzes visual question-answering (VQA) systems within multimodality, exploring their potential recontextualization in the framework of semantic communication. The paper initially examines the core ideas of semantic communication, followed by an assessment of the task-oriented framework of VQA systems. The capabilities of multimodality processing with semantic awareness in 6G networks are being underscored, and the role of VQA in offering a testing environment within this framework is emphasized. This context thoroughly examines semantic efficiency, task performance, and low-latency, AI-enhanced communication infrastructures by the semantic communication vision of 6G.

157 Analyzing the Efficacy of Open-Source Forensic Features in Image Tampering Detection

Norkhushaini Awang, *Mohamad Darus and Nur Amirah Balqis Noor Azli*

The escalating threat of digital misinformation and fabricated content necessitates robust and accessible methods for image tampering detection. The problem statement centers on the need to evaluate the efficacy of readily available, open-source forensic tools in identifying sophisticated image manipulations. The scope of this research is a comparative analysis of the forensic features of two prominent open-source tools, Forensically and Ghiro, specifically focusing on their ability to detect passive tampering techniques such as copy-move forgery, splicing, and resampling. The analysis was conducted on a curated dataset of genuine and tampered images to assess key features including Clone Detection, Error Level Analysis (ELA), Noise Analysis, Metadata Analysis, and Thumbnail Analysis. The results demonstrate that while both tools are effective in identifying digital alterations, Forensically offers a more comprehensive suite of features, including dedicated clone and noise detection, which provides a more explicit and holistic view of tampering. Conversely, Ghiro excels in its systematic metadata extraction and consistent ELA, offering a robust but more specialized set of analytical capabilities. The significant contribution of this study is its empirical validation of open-source forensic tools, highlighting their potential to serve as indispensable resources for digital forensic analysts. The findings underscore that effective image authenticity verification relies on a critical synergy between sophisticated automated tools and the discerning judgment of human expertise, ultimately strengthening the integrity of digital evidence in a world increasingly reliant on visual information.

192 A Meta-Classified Hybrid Fusion Model for Interference-Resilient Modulation Recognition

***Muhammad Muneeb Tahir**, Arbab Latif, M Shahzad Younis, Rao Naveed Bin Rais and Khalid Ammar*

Automatic Modulation Classification (AMC) is crucial for modern wireless systems in defense, IoT, and cognitive radio applications. Conventional AMC methods often fail under channel impairments like AWGN, Rayleigh fading, and hardware imperfections. We propose a novel Hybrid Fusion DNN combining VGG, LSTM-CNN, GRU-CNN, and CLDNN architectures to extract robust spatiotemporal features across SNR conditions. Evaluated on diverse modulations (ASK, PSK, AM, FSK, APSK, QAM) under CFO, phase noise, and fading, our model achieves 89.13% overall accuracy, with 30–40% accuracy gains at low SNRs (e.g., 66.72% at -20dB) and near-interference-free performance at higher SNRs (greater then 97% accuracy after -2dB SNR). This demonstrates hybrid deep learning's potential for reliable AMC in real-world wireless environments.

243 An Enhanced Hybrid Deep Learning Architecture for Android Malware Detection Using CFG and DeepWalk Embeddings

***Mohammad Sarwar Hossain Mollah**, Mohd Fadzli Bin Marhusin and Syaril Nizam Omar*

Android malware propagation poses increasing security risks to mobile ecosystems, with conventional detection techniques fighting an uphill battle against advanced evasion strategies and polymorphic variants that take advantage of static analysis limitations. Existing approaches including signature-based detection and conventional machine learning techniques have moderate performance against advanced obfuscation techniques and cannot capture complex structural relationships inherent in malicious code execution behavior. These limitations necessitate advanced techniques capable of carrying out in-depth structural analysis and dynamic pattern detection for malware detection. This paper proposes a new hybrid deep learning technique that combines Control Flow Graph (CFG) analysis with Deep Graph Convolutional Neural Networks (DeepGraphCNNs) and Temporal Convolutional Networks (TCN) to overcome current limitations. Our technique meticulously reverse-engineers APK packages, decompiles Dalvik bytecode to extract CFG representations and utilizes sophisticated graph embedding methods (DeepWalk, Node2Vec, Word2Vec) in the feature transformation process. The experiment is conducted on 2,349 samples from CICMalAnal2017 and MalwareBazar. Our DeepWalk-DeepGraphCNNs and TCN model demonstrated superior performance with 95.10% accuracy and 93.67% AUC-ROC. Our experimental results ensure the success of the technique for addressing contemporary Android security issues.

272 Detecting IPv6 SEND Flooding Attacks Using a Machine Learning Framework

Ayman Al-Ani, Ahmed K. Al-Ani, Francis Syms, Shams A. Laghari and ***Ashraf Osman Ibrahim***

The transition to IPv6 introduces new security challenges, particularly within the Neighbor Discovery Protocol (NDP). While the SEcure Neighbor Discovery (SEND) protocol was designed to protect NDP using cryptographic mechanisms, its reliance on computationally expensive signature verification creates a vulnerability to resource-exhaustion attacks. This paper addresses the sophisticated threat of the SEND flooding attack, where an adversary can induce a Denial of Service by overwhelming a target node's CPU with valid-looking, signed packets. Traditional detection methods struggle against such attacks, which do not rely on malformed packets. To counter this threat, we propose a multi-stage machine learning framework designed to distinguish between legitimate and malicious SEND traffic. We conducted a comparative analysis of five machine learning algorithms, leveraging advanced feature engineering to create a rich set of statistical and content-based features. The results demonstrate that the Gradient Boosting model achieved superior performance, with Accuracy and F1-score of 91.24% and 91.48% respectively, effectively identifying the attack with high precision and recall. This research validates that a data-driven, behavioral analysis approach can successfully defend against complex, protocol-level resource-exhaustion attacks, providing a critical security layer for modern IPv6 networks.

Session 12:
AI-Driven Detection & Monitoring Systems

189 Deep Learning for Brain Tumor Detection: U-Net Segmentation and Xception Classification with LoRA-Driven Synthetic Data Augmentation

***Md. Muhaimenul Haque Prottoy**, Rifat Bin Reza, Shahriar Islam, Md. Mahfujul Haque and Nafiz Ahmed Rhythm*

Brain tumor detection using MRI scans is critical for accurate diagnosis, and this study enhances its precision through deep learning techniques, employing Low-Rank Adaptation (LoRA)-driven synthetic data augmentation to address class imbalance. U-Net achieved a Dice Score of 88.43% and an IoU of 84.21% for tumor segmentation, while Xception was utilized for tumor classification. To address class imbalance, datasets were intentionally reduced for one class at a time, simulating real-world scenarios and causing performance drops (e.g., glioma accuracy decreased from 96.23% to 92.88%). LoRA-based synthetic data augmentation mitigated this, restoring glioma accuracy to 95.53% and improving average classification performance by 2.55% in accuracy, 2.38% in precision, 2.37% in recall, and 2.51% in F1-score across all classes compared to reduced datasets. Deployed via a Gradio interface, the integrated pipeline enables real-time tumor segmentation and classification with confidence scores, demonstrating that LoRA-driven augmentation significantly enhances the accuracy and robustness of brain tumor detection.

86 Lightweight Deep Learning for Fish Disease Detection: An EfficientNet Approach

*Abdul Kadar Muhammad Masum, **Md Fokrul Islam Khan**, Md. Maruf Hassan and Touhid Bhuiyan*

The accurate and timely detection of fish diseases is crucial for the sustainability of the aquaculture industry. While machine learning and deep learning have shown promise in this area, the high computational demands of many existing models, particularly ensemble models, hinder their practical application in real-world aquaculture settings. This study addresses this limitation by exploring the potential of lightweight EfficientNet models for efficient fish disease classification. Three EfficientNet models (B5, B6, and B7) are evaluated on a comprehensive dataset of freshwater fish diseases. EfficientNetB5's unique compound scaling method enabled it to achieve the highest accuracy of 0.95 in fish disease classification, outperforming other established models with significantly reduced computational resources. The results demonstrate that the EfficientNetB5 model offers a promising solution for real-time fish disease detection, balancing computational efficiency and diagnostic accuracy.

129 Explainable AI Approach for Classifying Fruit and Vegetable Health Condition Status Using CNN and Grad-CAM

Redha Yousif *and Khamael Al-Dulaimi*

Accurate classification and identification of healthy via rotten fruits are vital for ensuring the quality of agricultural products and optimizing food supply chains. However, traditional methods are generally manual, time-consuming, and prone to inconsistency. A key contribution in the proposed model is the integration of (Grad-CAM), which can offer visual explanations of the CNN's decision-making process for the automatic classification of fruits conditions, specifically recognizing between healthy or diseased. This proposed method improves model interpretability and also contributes to more effective training. These findings have the potential of the system as a robust tool for real-time sorting and quality control in agricultural environments. Experimental results have demonstrated high classification performance, with accuracy 95% in certain scenarios.

240 AI-Based Chilli Leaf Disease Detection and Remedy Recommendation System

Waruni Hettiarachchi *and Daminda Herath*

Chilli is one of the most important crops in Sri Lanka; however, it is very susceptible to bacterial, fungal, and viral diseases. This leads to considerable economic losses among farmers. Many of the traditional methods for disease detection are either labor-intensive, out of reach for most farmers, or prone to inaccuracies. This paper proposes a solution for overcoming these challenges by proposing an AI-based approach that fuses advanced machine learning models with mobile application technology. In this work, two datasets were applied—one with 3,000 images to categorize the leaves as healthy or unhealthy, and another with 8,320 images that involved six categories of diseases. Convolutional Neural Networks, Support Vector Machine, and KNearest Neighbors were applied for training. Of all these techniques, CNN outperformed others with 93.31 percent accuracy in the classification task of healthy versus unhealthy and 99.03 percent for disease identification. These trained models were used to develop a mobile application consisting of a FastAPI-based backend and a Flutter-based frontend that would provide farmers with real-time diagnostic capabilities, together with personalized disease management recommendations. This application can help make the solution usable and affordable for farmers. Only an AI-powered solution has great potential to bring improvement in crop health and agricultural productivity. Future research will focus on the scaling up of this system for other crops and into diverse agricultural settings, its overall scalability, and increasing scope.

160 Eggplant Size Acquisition Using Mask R-CNN

***Martin Julian C. Aniceto**, John Cedrick A. Montilla and Meo Vincent C. Caya*

Eggplant (*Solanum melongena L.*) is a widely cultivated vegetable in the Philippines, where accurate size grading plays a crucial role in determining market value. However, manual sizing methods are labor-intensive and prone to human error. This paper presents an automated system for eggplant size acquisition using Mask R-CNN for instance segmentation. A dataset of 500 annotated images was captured under controlled conditions and used to train the model via the Detectron2 framework. The system performs pixel-level segmentation and applies a pixel-to-centimeter calibration method to estimate the real-world area of each eggplant. To evaluate performance, ten samples were tested and compared with manual measurements using the grid method. A paired sample t-test generated a p-value of 0.6391, which is greater than the 0.05 significance level. This indicates that there is no statistically significant difference between the system's measurements and the manual measurements. In post-harvest processes, the suggested approach shows promise for increasing consistency, effectiveness, and scalability, especially for small-scale farmers and agricultural distributors. Future improvements include dataset refinement, sensor upgrades, and real-time optimization on AI edge devices such as the NVIDIA Jetson Nano.

170 Chili Peppers Inspection Based on Philippine National Standard Specification and Grading Using Integrated Image Processing Algorithms and Support Vector Machine

***Richard Rodrigo**, Mykell Paulines and Jessie Balbin*

In the Philippines, chili peppers are a staple ingredient valued for their flavor and versatility. The most cultivated varieties, siling labuyo and siling haba, are graded under the Philippine National Standard (PNS) into Extra Class, Class I, and Class II. However, increasing demand and time limitations make manual grading inefficient and inconsistent. This study presents a prototype that uses integrated image processing algorithms and Support Vector Machine (SVM) to automate the classification of chili peppers. The system achieved high accuracy with minimal error, effectively detecting defects and enhancing quality control. By reducing reliance on manual inspection, the proposed solution offers a reliable and consistent grading method with practical applications in agricultural production and post-harvest processing.

161 Real-time Vision Based Diseases Identification for Oil Palm Trees Using Edge Device

William Kwong Fook Chen, ***Vasanthan Maruthapillai,*** *Leong Kah Meng and Teh Zhong Kiat*

In Malaysia, the palm oil industry contributes significantly to the economy, generating RM 114 billion in exports and accounting for 2.3% of the national GDP in 2024. Smallholder farmers manage approximately 1.48 million hectares of oil palm plantations, supporting over 450,000 people [1]. However, these rural communities face challenges in rapid disease detection and yield preservation. Existing plant disease detection technologies often lack real-time capabilities and affordability, and require internet connectivity, rendering them unsuitable for remote areas with limited access. This study addresses these gaps by proposing a MobileNetV3Large-based convolutional neural network (CNN) deployed on a Raspberry Pi 4B for real-time, edge-based health monitoring of oil palm trees. The model classifies six conditions: Ganoderma Basal Stem Rot (BSR) and healthy stems, leaf diseases caused by Curvularia and Drechslera, and nutrient deficiencies in boron and potassium. Accuracy reaches 96.45% with an inference speed of 705.34ms. Operating offline, this cost-effective, portable system enables early disease identification for smallholder farmers, enhancing productivity and sustainability. This aligns with Malaysia's Sustainable Development Goals (SDGs): SDG 8 for economic growth and decent employment in rural agriculture, SDG 9 for bridging technological gaps in remote plantations, and SDG 15 for preserving healthy plantations to mitigate disease spread and deforestation.

147 Hygienic Design of Autonomous Mobile Robot for Seafood Industry

Supachai Vongbunyong, *Kitti Thamrongaphichartkul, Natkamon Khantee, Jitphisuit Thanajinda, Suvaluk Asavasanti and Chatchai Pholmool*

Autonomous Mobile Robots (AMRs) are currently implemented in many industries. They are key players in logistics management in factories, improving accuracy and safety in transportation. However, in the seafood industry, AMRs must be able to operate in harsh environments, including low temperatures, high levels of relative humidity, and high corrosion from chlorine vapor and salt. In addition to the required levels of system protection, hygienic design must be considered in accordance with regulation guidelines. Although AMRs have been widely adopted in many sectors, there has been a limited number of research studies conducted in this specific field, and no commercial products are currently available. In this article, the design of the AMR—both hardware and software—with consideration for hygienic design and the requirements of the seafood industry is presented.

177 State-of-the-Art Smart Technology for Real-Time Monitoring and Analysis of Palm Oil Mill Effluent (POME) Wastewater

Thamil Vaani, *Yap Chiew Lin and Joshua Yap Lip Vun*

The palm oil industry, a vital component of the global agricultural economy, generates substantial amounts of Palm Oil Mill Effluent (POME), which poses significant environmental hazards if not properly managed. Traditional methods of POME treatment are often labor-intensive and inadequate for real-time monitoring, leading to potential regulatory non-compliance and environmental degradation. This paper aimed to develop a novel Smart POME Wastewater Monitoring System using Internet of Things (IoT) technology, integrating real-time sampling with ammonia monitoring and mobile app or web based visualization. The primary objective was to continuously monitor critical water quality parameters, including pH, temperature, Total Dissolved Solids (TDS), and ammonia nitrogen across different treatment stages: Concrete Pond, Final Discharge Pond, and Anaerobic Pond. The methodology involved the integration of advanced sensors with IoT-enabled data acquisition and transmission systems, facilitating real-time data collection and analysis. Water samples were collected from the specified ponds to validate sensor accuracy and performance. Testing was conducted in phases, starting with system setup and calibration, followed by continuous monitoring and periodic data validation. The expected outcome was a robust monitoring system that provided accurate, real-time data on POME quality, enabling prompt corrective actions and ensuring compliance with environmental regulations. The results demonstrated significant improvements in monitoring efficiency and environmental management. The conclusion underscored the system's potential to revolutionize POME management, promoting sustainability and regulatory adherence in the palm oil industry.

Session 13:
AI & Optimization for Sustainable Systems

271 Spatio-Temporal Q-Learning for Optimal Sealed-Bid Generation in Consortium Blockchain-Based Double Auctions for Multi-Microgrid Energy Markets

Zubin J. B., *Sunitha R. and Gopakumar Pathirikkat*

This study introduces a decentralized learning framework designed to generate optimal sealed bids in sealed-bid double auctions among microgrids operating within a consortium blockchain-based multi-microgrid network. The principal innovation is a spatio-temporal Q-learning algorithm, which enables microgrid agents to learn context-sensitive bidding strategies by integrating reinforcement learning with case-based reasoning. These agents adjust their bidding prices by evaluating the similarity in energy levels and temporal recency of previous results, thereby enhancing the likelihood of bid success and profitability. Privacy is maintained through a dual-phase bid protocol, and auction clearance is executed by off-chain smart contracts, which reduces the blockchain's burden. Only cryptographic hashes of the bids and transactions are kept on-chain, ensuring both verification and security. This structure enables each autonomous microgrid to intelligently participate in decentralized energy trading, generating sealed bids that are both economically optimal and strategically sound. The method supports scalability, privacy, and adaptability, facilitating real-time participation in energy markets among interconnected microgrids.

305 A Comparative Study of BP and GA-BP Models for Predicting the Dual-Fuel Engine Performance

Hui Chen, ***Xianglei Meng,*** *Kit Guan Lim, Min Keng Tan, Mohd Suffian Misaran and Kenneth Teo*

A prediction model was developed for a diesel/natural gas dual-fuel engine using a genetic algorithm (GA) optimized back propagation neural network (BPNN). The model utilized torque engine speed, fuel injection timing and pressure, natural gas substitution rate, and excess air coefficient as inputs. Brake-specific fuel consumption (BSFC) and emissions of carbon monoxides (CO), nitrogen oxides (NOx), hydrocarbons (HC) and smoke were the predicted outputs. The results showed that the GA-BPNN model achieved superior performance compared to the BPNN. The mean absolute percentage error (MAPE) for BSFC, CO, NOx, HC and smoke predictions were all below 6%, specifically, ranging from 4.1% to 5.8%. Additionally, all the coefficient determination (R2) values surpassed 0.98, indicating high prediction accuracy and generalization ability. The GA-BPNN model offers a promising new method for optimizing operating parameters and calibrating natural gas dual-fuel engines.

187 Energy-Optimal Routing Optimization for Connected and Autonomous Vehicles in Urban Networks: A Numerical Modeling Approach

***Mahbub Hassan**, Md. Emtiaz Kabir, Touhid Bhuiyan and Md Maruf Hassan*

This study presents a numerically grounded and physically interpretable framework for energy-aware routing of Connected and Autonomous Vehicles (CAVs) in urban road networks. Conventional routing algorithms often prioritize travel time or distance, overlooking the energy implications of road geometry, vehicle dynamics, and speed profiles. In contrast, this research formulates a graph-based routing strategy that minimizes total vehicular energy consumption using a first principles physics model. The energy cost of each road segment is computed as a function of rolling resistance, aerodynamic drag, and gravitational force, parameterized by real-world attributes such as speed, road grade, and length. To validate the proposed approach, simulations were conducted on the urban road network of San Francisco using data from OpenStreetMap. A total of 150 Origin-Destination (OD) pairs were analyzed using energy optimal, shortest-distance, and fastest-time routing strategies. The results show that energy-aware routing achieves significant reductions in energy consumption compared to traditional methods, with only marginal increases in travel time and route length. The strong correlations observed between energy usage, distance, and time confirm the physical validity of the model. Additionally, distributional analysis reveals that most OD pairs benefit from the proposed strategy, while a few show minimal or negative gains, highlighting the spatial heterogeneity of eco-routing potential. The framework is implemented in Python using open-source libraries, offering reproducibility and scalability. This work contributes to the field of sustainable autonomous mobility by providing a viable tool for integrating energy efficiency into CAV navigation and intelligent transportation infrastructure.

188 Bilevel Optimization Framework for Urban Toll Pricing Under Stochastic User Equilibrium: A Metaheuristic Approach

***Mahbub Hassan**, Md. Emtiaz Kabir, Touhid Bhuiyan and Md Maruf Hassan*

This paper presents a behaviorally consistent and computationally efficient framework for optimal toll design in congested urban transportation networks. The toll-setting problem is formulated as a bilevel optimization model that captures the hierarchical interaction between a central planner and individual travelers. At the upper level, the planner aims to minimize Total System Travel Time (TSTT) by adjusting link-based tolls. At the lower level, user route choice behavior is modeled via a Stochastic User Equilibrium (SUE) using a logit-based formulation, which accounts for probabilistic decisions under bounded rationality. Due to the derivative-free, non-convex nature of the bilevel model, a hybrid solution approach is proposed by integrating a real-coded Genetic Algorithm (GA) with the embedded SUE traffic assignment. The GA evolves toll vectors using TSTT as the fitness criterion, while the SUE module computes equilibrium link flows in response to toll adjustments. The proposed method is validated on a synthetic 6-node network with fixed origin-destination demand. Numerical experiments demonstrate a 5.02% reduction in TSTT compared to the no-toll baseline. The results reveal that strategic tolling on critical links redistributes traffic effectively, mitigating congestion and enhancing system efficiency. Flow visualizations further confirm user adaptation under the influence of tolls, validating the model's behavioral realism. This research highlights the potential of metaheuristic–equilibrium hybrid models for dynamic pricing policy in Intelligent Transportation Systems (ITS). The framework is extensible to larger-scale networks, time-varying demand, and multi-objective planning, offering a robust foundation for future research and practical deployment.

208 Microscopic Debris Classification of Pasig River Philippines Using Unsupervised Learning Clustering Algorithms

***Amelie Claire Festin**, Jianette Mari Go, Antonio Santino Chan, Aidan Radley Sy and Melchizedek Alipio*

This study addresses the need for a deeper understanding of the microscopic composition of debris in freshwater bodies. This research focused on developing an image dataset to characterize microscopic debris in water samples collected from the Pasig River, Philippines, which can be used for water monitoring. The methodology involved collecting water samples from seven sampling sites, followed by physical processing and microscopic imaging. 1248 raw images were collected from the water samples. Preprocessing techniques, including noise reduction, pixel normalization, image resizing, contrast enhancement, and data enhancement, were applied to the images, where different noise reduction and contrast enhancement techniques and parameters were tested. K-means clustering, Hierarchical clustering, and Gaussian mixture models were employed to categorize the debris based on extracted features such as area, perimeter, circularity, color, and Hu Moments. The optimal preprocessing methods tested include the median filter with a kernel size of 3, CLAHE with a brightness of 120%. After preprocessing, the dataset had a total of 7488 images. Using RMSE, R^2, and MSE, it was determined that K-Means clustering had demonstrated the best clustering performance on the debris dataset.

96 Agriculture Decision Support Systems Review to Analyse and Limit Problems Inside Greenhouses

Hanan Hussein Al-Asadi, *Nicolae Goga and Ali M Muslim*

The agricultural production cycle is similar to the stages of plant life development in extremely regulated environments, which include horticulture from planting to even bearing fruits. Important factors like quantity, quality, and safety of the greenhouse plants require careful organisation and protection during this cycle. Conventional approaches including heuristic and judgemental methods, analytic models, simulation and combinations of these methods have in one way or another been appropriate for the Decision Support System (DSS) challenges in the past. This paper presented a DSS system to predict the temperature inside the greenhouse using AI, focusing on analysing validated data to avoid management mistakes in controlling and leading the greenhouse's climate. To improve plant safety, quality, and quantity in the greenhouses, this study suggests using an automated method that incorporates the analysis of the activities in the greenhouses by AI systems. Actual information from greenhouse designs proposed for different conditions of the Iraqi climate is used for this research. The main criteria in the assessment of DSS effectiveness is concerned with the ability of the system to produce accurate outputs that satisfy users' needs at the right time. This paper proposes classification and clustering techniques to demonstrate the importance of their effects on improving the control of climate and the overall practices involved. Several algorithms were applied in this research which are hierarchical clustering, k-means clustering, Random Forest, and XGBoost. For classification, Random Forest has achieved the best precision and accuracy values, which are 0. 901 and 0.945 respectively. For clustering, hierarchical clustering and K-means clustering techniques' performance was nearly similar for accuracy and F1-score (54% and 45% respectively). Specifically, these approaches demonstrate changes in the greenhouse climate to plant species and match farmers' needs.

112 Designing Effective LSTM Models for Household Energy Forecasting: An Empirical Study on the Effects of Architectural Choices and Regularization

***Muhammad Mukmin Muwahid Ahmad Aidil**, Norzaidah Md Noh and Zaid Mujaiyid Putra Ahmad Baidowi*

Accurate household energy forecasting is pivotal for efficient energy management and grid stability. This empirical study investigates the design of effective Long Short-Term Memory (LSTM) models for predicting hourly electricity consumption in residential settings. We explore the effects of key architectural choices, including network depth and input sequence design, and the critical role of regularization, specifically dropout, on model performance. Using historical electricity usage, meteorological data, and calendar features from Terrace and Semi-D residential types, two primary LSTM architectures—one with dropout and one without—were systematically trained and evaluated. Performance was assessed across 48-hour and 168-hour prediction horizons. Results demonstrate that LSTM models incorporating dropout regularization and appropriate training duration generally achieve superior generalization and lower prediction errors (Mean Absolute Percentage Error often 20-40% for Terrace houses in model testing). A prototype system integrating the optimized LSTM model further validated its practical efficacy, yielding one-hour-ahead prediction errors below 20% in user input scenarios. This study provides insights into designing robust LSTM frameworks for the complex task of residential energy forecasting.

190 Explainable Machine Learning for Understanding Trip Mode Choice: Evidence from the 2022 U.S. National Household Travel Survey

***Mahbub Hassan**, Syeda Tamzida Akter, Sayed Shahriar Islam Lamun, Touhid Bhuiyan and Md Maruf Hassan*

Travel mode choice plays a significant role in addressing urban challenges such as congestion, pollution, and accessibility. Accurate forecasting of travel behavior, especially understanding how individuals commute for various activities, is crucial for achieving sustainability goals. People have various transportation options for their daily trips, and understanding these preferences is essential for effective urban planning. This paper explores the prediction of trip mode choice, focusing on whether individuals prefer public or private transportation. We develop and evaluate prediction models using three machine learning algorithms: k-Nearest Neighbors (KNN), eXtreme Gradient Boosting (XGBoost), and Random Forest. These models were trained using datasets from the 2022 National Household Travel Survey. The performance of the models is assessed using several metrics, including average accuracy, area under the receiver operating characteristics curve, and a simple ranking system. Additionally, SHAP (Shapley Additive Explanations) is used to interpret the models and identify the most influential variables in predicting the choice between public and private transportation. This research underscores the potential of machine learning methods in understanding and predicting travel mode choices, offering valuable insights for urban planners aiming to reduce congestion and promote sustainable transportation options.

191 Sociodemographic Determinants of Gasoline Vehicle Ownership in the United States: A Machine Learning Approach

***Saikat Sarkar Shraban**, Mahbub Hassan, Touhid Bhuiyan and Md Maruf Hassan*

Understanding the factors that influence the continued ownership of gasoline-powered vehicles is essential for advancing decarbonization goals and designing equitable transportation policies. This study uses data from the 2022 National Household Travel Survey (NHTS) to examine the sociodemographic and geographic determinants of household vehicle fuel type, focusing on the binary classification of gasoline versus non-gasoline vehicles. A total of 14,112 vehicle household person observations were analyzed using five supervised machine learning models: Naive Bayes, Support Vector Machine (RBF), Decision Tree, Random Forest, and XGBoost. Class imbalance was addressed using the Synthetic Minority Over-sampling Technique (SMOTE), and model performance was evaluated through hold-out testing and five-fold cross-validation using accuracy, precision, recall, and F1 score. Random Forest achieved the highest F1 score (0.9191), followed by Decision Tree (0.8848) and XGBoost (0.8759), confirming the effectiveness of ensemble methods. SHapley Additive exPlanations (SHAP) were applied to the best-performing model to enhance interpretability, identifying vehicle type, census division, household income, education level, and respondent age as the most influential predictors. The results highlight the enduring impact of socioeconomic and regional factors on fuel-type ownership decisions and demonstrate the utility of interpretable machine learning for informing targeted, data-driven transportation policy interventions.

195 Visions of Cleanliness: Accelerating Waste Management with Deep Learning

***Yu Beng Leau**, Yong Zhen Goh, Kun Li, Ying Han, Adi Wibowo and Ervin Gubin Moung*

This study addresses the pressing issue of solid waste management by leveraging deep learning techniques, contributing to ongoing environmental and sustainability efforts. Three well-known convolutional neural network (CNN) architectures—VGG16, ResNet50, and MobileNet—were employed using transfer learning and extensive image preprocessing. Among them, ResNet50 achieved the highest classification accuracy of 95%, while MobileNet demonstrated significantly faster training time, making it more suitable for deployment in resource-constrained environments. The literature review revealed a lack of lightweight, real-time deployable models in waste classification, which this study aims to bridge. Potential real-world applications include integration into smart bins, mobile waste-sorting apps, or embedded edge devices to enhance waste categorization efficiency in practical settings.

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