Foreword

Special issue on Connected Intelligence and Green Technologies for a Sustainable Future

It is our privilege to introduce this Special Issue of the Journal of Information Science and Engineering (JISE) dedicated to "Connected Intelligence and Green Technologies for a Sustainable Future."

In the face of unprecedented global climate challenges, the transition toward clean, sustainable energy sources and environmentally responsible technological ecosystems has become one of the paramount imperatives of the twenty-first century. Addressing these multifaceted challenges requires a convergence of disciplines-uniting advanced computing architectures, intelligent systems, resilient communication networks, smart energy infrastructures, and sustainable engineering processes.

This special issue stems from the International Conference on Green Energy, Computing and Intelligent Technology (GEn-CITy 2024), held virtually from December 11-13, 2024, organized by the University of Southampton Malaysia. Following the conference, authors of top-ranked papers demonstrating high technical merit and relevance were invited to submit substantially extended and enriched versions of their research. Each submission underwent an independent, rigorous, and comprehensive peer-review process in strict accordance with the high quality and editorial standards of JISE. The accepted papers assembled in this volume reflect original, significant advancements, comprising substantial new theoretical formulations, experimental developments, and analytical insights.

We express our profound gratitude to the Editor-in-Chief and the editorial staff of the Journal of Information Science and Engineering for their steadfast support, guidance, and cooperation throughout the publication of this special issue. We extend our sincere thanks to all authors for their pioneering contributions and to the dedicated peer reviewers whose rigorous critiques, constructive feedback, and expertise ensured the high scholarly quality of this collection. Finally, we thank the GEn-CITy 2024 organizing committee and technical program members for their foundational efforts in bringing this research community together.

We trust that the research presented herein will serve as an inspiring and informative resource for researchers, engineers, academic scholars, and

practitioners striving to advance green technologies and connected intelligence for a resilient and sustainable future.

The paper, "Design and Operation of Stylus Profilometer using Image Processing based Digital Recordings", introduce an in-house developed, cost-effective stylus profilometer designed to bridge analog and digital metrology using computer vision. By coupling a 2.4-megapixel CMOS camera with an analog precision dial gauge and an automated stepper-motor stage, the system tracks pointer deflections via a lightweight Boolean-subtraction edge-detection algorithm to determine surface roughness across both flat and curved surfaces. Demonstrated on an airfoil profile, the setup delivers measurement accuracy comparable to standard industrial benchmarks while drastically reducing computational overhead—offering a practical, accessible blueprint for academic research and resource-efficient in-situ surface inspection.

The paper, "Advancing Malware Detection in Computer Systems: A Comparative Analysis of ML and DL Algorithms", addresses the limitations of traditional signature-based detection against evolving cyber threats, this work evaluates machine learning and deep learning architectures for robust malware intrusion prevention. By incorporating rigorous preprocessing, multi-dataset evaluation, and hyperparameter tuning, the authors demonstrate that standard classifiers alongside a 6-layer CNN-LSTM model achieve detection accuracies between 96% and 99%, offering a reliable framework to strengthen system security against sophisticated intrusions.

The paper, "Optimizing Academic Performance and Dropout Prediction: A Machine Learning Approach", focuses on educational data mining, this contribution tackles student retention and success by simultaneously modeling academic performance and dropout risks across multi-institutional datasets. Through systematic cross-validation and rigorous grid-search hyperparameter optimization, the authors benchmark an array of machine learning classifiers alongside deep learning architectures, achieving dropout prediction accuracies of up to 90%. The resulting predictive framework provides actionable, data-driven intelligence for educators to flag at-risk students early and deploy timely institutional interventions.

The paper, "Real-Time Epilepsy Detection in Wearable Devices: A GAN-Augmented Conv-GRU Architecture Implemented on FPGA", Addressing the growing demand for compact, high-accuracy wearable diagnostics, this article presents an edge-optimized deep learning framework for real-time epilepsy detection from EEG signals. The proposed system pairs Discrete Wavelet Transform (DWT) preprocessing with a hybrid Conv-GRU network to capture

temporal and spatial feature dynamics, employing a Generative Adversarial Network (GAN) for synthetic data augmentation to address data scarcity. Validated on a Zynq-7000 FPGA and synthesized using a 32 nm standard-cell library, the design delivers exceptional diagnostic performance – achieving 98.5% classification accuracy and an AUC of 0.99 – while maintaining a rapid 413.7 µs detection latency, an active area of 1.776 mm^2, and ultra-low power consumption of 963 µW, establishing a highly viable hardware architecture for wearable biomedical edge devices.

The paper, "Wi-Fi CSI-Based Human Activity Recognition Using a CNN-BiLSTM Model", introduces a non-wearable sensing framework utilizing Wi-Fi Channel State Information (CSI) for ambient activity monitoring. Integrating Butterworth, FIR, and Discrete Wavelet Transform filtering with an attention-boosted CNN-BiLSTM architecture, the proposed approach attains a 98.35% classification accuracy on benchmark data, offering a dependable blueprint for smart home and healthcare applications.

The paper, "Experimental Evaluation of LoRa RSSI-Based Trilateration for UAV Localisation under GPS-Denied Conditions", develops a low-cost, spoofing-resilient positioning system for UAVs using 915 MHz LoRa hardware and RSSI-based trilateration. Validated through field trials in both line-of-sight and obstructed rural conditions, the calibrated log-distance path loss model restricts localization error to 2.5 meters or less in roughly 75% of test scenarios, offering a dependable navigation framework for GPS-denied missions.

The paper, "Influence of Slanted Cavity Wall Geometry and Flow Velocity on Flow-Induced Oscillations for Energy Harvesting", Contributing to aeroacoustic control and flow-induced energy harvesting, this experimental study investigates the impact of slanted wall configurations and freestream velocity on cavity flow dynamics. Evaluating a cavity with a length-to-depth ratio of 3 across velocities from 18 to 34 m/s, the authors compare 15°, 30°, and 45° slant angles against a standard rectangular baseline. While the 45° geometry provides near-total tonal noise suppression, the 30° configuration induces robust, broadband pressure fluctuations that remain resilient to velocity shifts, providing critical design criteria for broadband aeroacoustic energy harvesting.

The paper, "Transformer DGA Analysis: Implementation Using Kolmogorov-Arnold Network (KAN)", Focusing on power grid asset reliability, this contribution investigates modern machine learning architectures for power transformer fault diagnosis using Dissolved Gas Analysis (DGA). To overcome the rigid thresholds and expert-dependence of conventional diagnostic schemes, the authors deploy a three-layer Kolmogorov–Arnold Network (KAN) to capture

complex, non-linear degradation patterns in transformer oil. Evaluated against a baseline Multilayer Perceptron and optimized via Gauss–Newton methods, the KAN model achieves near-perfect predictive accuracy on unseen test data, presenting a highly accurate, data-driven framework for transformer condition monitoring and power system stability.

The paper, "Vision Transformer-Based Approach for Explainable Steel Defect Classification", investigates automated surface defect detection in steel manufacturing. Moving beyond manual inspection and conventional multi-step feature extraction, the authors benchmark several end-to-end deep learning models, showing that a Vision Transformer (ViT) achieves a top classification accuracy of 99.17% alongside competitive inference times. To address the black-box nature of deep learning, Local Interpretable Model-agnostic Explanations (LIME) are integrated, offering visual, superpixel-level transparency into the model's decision-making process to support reliable industrial deployment.

The paper, "Spider Wasp-Inspired CNN for ECG Signal Analysis in Wearable Health Application", presents a novel hardware-efficient framework for real-time electrocardiogram (ECG) monitoring and cardiovascular disease detection. The authors introduce a Spider Wasp-based Convolutional Neural Network (SWCNN) architecture that combines adaptive noise filtering, bio-inspired PQRST wave feature extraction via Spider Wasp Optimization, and frame-difference waveform compression. Validated on the benchmark MIT-BIH Arrhythmia dataset and implemented on an FPGA platform, the design achieves 99.82% detection accuracy with a low processing latency of 995 ns. With a projected power consumption of just 235.5 μW in 16 nm ASIC technology, the work provides a compelling, energy-efficient solution for continuous mobile cardiovascular screening.

The paper, "Modified VGG16 Network for Remote Sensing Image Classification on EuroSat Dataset", investigates deep learning architectures for land use and land cover (LULC) classification using remote sensing imagery. After benchmarking multiple convolutional neural network baselines—including ResNet50, DenseNet121, and EfficientNetB0—the authors develop a modified VGG16 network tailored for the EuroSat satellite dataset. Evaluated across train-from-scratch, transfer learning, and architectural refinement paradigms, the proposed modified network achieves a peak classification accuracy of 99.19% while mitigating overfitting, demonstrating a dependable, automated computer vision solution for Earth observation and spatial resource monitoring.

The paper, "An Empirical Study of Loss Design in Deep Image Prior: From

Regularization to Fidelity", investigates the optimization dynamics and loss function design of the Deep Image Prior (DIP) framework for unsupervised denoising. To overcome DIP's inherent vulnerabilities to overfitting, slow convergence, and structural degradation, the authors systematically analyze the synergy between explicit regularizers—such as Total Variation (TV) and Regularization by Denoising (RED)—and refined data-fidelity objectives, including Stein's Unbiased Risk Estimator (SURE) and hybrid L1–L2 norms. Validated across computed tomography (CT), magnetic resonance imaging (MRI), and X-ray datasets, the study demonstrates how complementary loss combinations mitigate original DIP shortcomings, establishing practical design principles for robust, label-free clinical image restoration.

The paper, "Corrosion and Nano/Microtribological Behavior of Magnesium-Based Metallic Glass", investigates the corrosion and wear behaviour of magnesium-based metallic glass (MgMG) using a scanning Kelvin probe (SKP), atomic force microscopy (AFM), and a ball-on-disc micro-tribological test. The SKP identified the localized corrosion of the MgMG exposed to a 0.1 M NaCl solution for 40 hr. The scratch-induced wear of the MgMG generated by AFM scratching was apparently higher at a higher set-point voltage because the higher applied load resulted in the removal of more materials from its surface. The lapping of a 6 mm 100Cr6 steel ball on the MgMG gave rise to higher friction and wear than that of a ceramic ball, which clearly indicated that the MgMG had lower wear resistance during lapping contact with the metal counterpart as a result of its recrystallization.

• Introduction to Guest Editors •

Lenin Gopal is an Associate Professor at the University of Southampton Malaysia (UoSM). He earned his B.Eng. in Electrical and Electronics Engineering from Madurai Kamaraj University, India (1996), M.Eng. in Telecommunications Engineering from Multimedia University, Malaysia (2006), and Ph.D. from Curtin University, Australia (2015).

His research investigates advanced wireless communication systems, MIMO networks, signal processing, and power electronics with application to renewable energy integration and AC/DC microgrids. His recent work focuses on integrating machine learning algorithms into intelligent sensing, predictive fault diagnosis, and green technological infrastructure.

Dr. Gopal serves regularly as an organizer, keynote speaker, and technical program committee member for prominent international conferences. He is the Corresponding Guest Editor for the Journal of Information Science and Engineering (JISE) special issue dedicated to Connected Intelligence and Green Technologies for a Sustainable Future.

Jimson Mathew is currently a Professor in the Computer Science and Engineering and Dean of Student Affairs, Indian Institute of Technology Patna, India. He received the Masters in computer engineering from Nanyang Technological University, Singapore and the Ph.D. degree in computer engineering from the University of Bristol, Bristol, U.K. He was the head of the department of CSE, IIT Patna from 2017 to 2021. He has also held positions with the Centre for Wireless Communications, National University of Singapore, Bell Laboratories Research Lucent Technologies North Ryde, Australia, Royal Institute of Technology KTH, Stockholm, Sweden and Department of Computer Science, University of Bristol, UK. He is a Senior Memberof IEEE. He has previously served as a Guest Editor for ACM TECS. He also regularly serves on the program committee of top international conferences and holds multiple patents. His research interests include fault-tolerant computing, computer vision, machine learning and deep learning architecture and IoT systems.

Filbert H. Juwono received the B.Eng. degree in Electrical engineering and the M.Eng. degree in Telecommunication Engineering from Universitas Indonesia, Depok, Indonesia, in 2007 and 2009, respectively, and the Ph.D. degree in Electrical and Electronic Engineering from The University of Western Australia, Perth, WA, Australia, in 2017. He is currently with the Department of Electrical and Electronic Engineering, Xi'an Jiaotong-Liverpool University. His research interests include signal processing for communications, wireless communications, power-line communications, smart grids and battery technology, machine learning applications, and biomedical engineering. He was a recipient of the Prestigious Australian Awards Scholarship, in 2012. He serves as an Associate Editor for IEEE Access, a Review Editor for Frontiers in Signal Processing, an

Editor for Scientific Reports, and the Editor-in-Chief for a newly established journal Green Intelligent Systems and Applications.

Wei Kit Wong received his M.Eng. and Ph.D. degrees from Universiti Malaysia Sabah in 2012 and 2016, respectively. Prior to joining academia, he was with the telecommunication and building services industry in which he obtained his professional engineer (P.Eng) affiliated with Malaysian Board of Engineers in 2016. He has served as review and technical committee in various academic journals and prestigious conference programs. He is currently serving as Associate Professor with the Department of Electrical and Computer Engineering, Curtin University Malaysia. His research interests include embedded system development, machine learning applications, and image processing. He has secured and managed various grant schemes in various projects. He has particular interest and has published in areas involving sensor development and medical imaging and machine learning application/optimisation. He is currently active in both academia and serving as a director for a Building services Consultant firm.

Adrian Wei-Yee Tan is an Assistant Professor in the School of Engineering at the University of Southampton Malaysia. He received his BEng, MSc, and PhD from Nanyang Technological University, Singapore. Prior to joining UoSM, he was a Research Scientist at the Rolls-Royce@NTU Corporate Lab, where he led cold spray technology development for aerospace component repair and surface protection.

His current research is focused on wire-arc spray and plasma spray technologies, including process development, coating optimisation, and microstructural–mechanical performance for corrosion protection, wear resistance, and dimensional restoration. His work supports both applied industrial projects and fundamental research in thermal spray coatings. He has published over 60 peer-reviewed papers and serves as a reviewer for journals such as Journal of Thermal Spray Technology, Surface and Coatings Technology, Additive Manufacturing, and Materials & Design.

Suresh Merugu is an academician, researcher, and technology professional with nearly 20 years of teaching and research experience. He holds a Ph.D. from the Indian Institute of Technology Roorkee (IIT Roorkee) and is currently an Assistant Professor at the University of Southampton Malaysia. His research expertise includes artificial intelligence, machine learning, deep learning, computer vision, image processing, remote sensing, data mining, Internet of Things (IoT), and intelligent systems.

He has published more than 70 research papers in international journals and conferences, contributed to book chapters and edited volumes, and has served as Principal Investigator for several funded research projects. His research has resulted in granted patents, design patents, and registered copyrights. He has also supervised a completed Ph.D. scholar and numerous postgraduate and undergraduate research projects.

He is an IEEE Senior Member and recipient of the IEEE Hyderabad Humanitarian Technology Leadership Award (2020). His current research focuses on AI-enabled computer vision, intelligent agriculture, drone-based remote sensing, precision irrigation, Generative AI, LLMs, RAG, and IoT/edge AI, with an emphasis on developing practical, sustainable, and societal-impact-oriented intelligent systems.

Chin Vun Jack is an Assistant Professor of Electrical and Electronic Engineering and Programme Lead for the MEng Mechatronics programme at the University of Southampton Malaysia. His research focuses on artificial intelligence and machine learning applications in photovoltaic systems, power electronics, intelligent energy systems, and renewable energy technologies. He has authored numerous publications in leading international journals and actively contributes to research on photovoltaic fault diagnosis, energy analytics, and intelligent energy management.

Ahmad Syahrin Idris received the B.Eng. degree (Hons.) in electrical and electronics engineering from University Technology PETRONAS, Malaysia, in 2003, the M.Phil. degree in electronic and electrical engineering from The University of Sheffield, U.K., in 2011, and the Ph.D. degree in opto-electronics from Kyushu University, Japan, in 2018. After the B.Eng. degree, he joined Intel, as a Product Development Engineer, specializing in developing design-for-test solutions for Intel chipset products. While in U.K., he was a Researcher with The University of Sheffield, specializing in the fabrication and characterization of III-V semiconductors for APD and PIN photodetectors. After the M.Phil. degree, he joined Freescale Semiconductor, as a Senior Test Development Engineer developing test solutions for automotive and industrial microcontrollers. He is currently an Assistant Professor at the School of Electronics and Computer Science, the Civic and Global Engagement Lead and the AI@Southampton Champion at the University of Southampton Malaysia (UoSM). He is also a Professional Engineer with the Board of Engineers Malaysia and The Institute of Engineers, Malaysia. His current research interests include the fabrication and characterization of opto-electronic devices, developing design-for-test solutions for microelectronic circuits as well as AI and IoT for healthcare applications.

Ling Huo Chong received his B.Eng. (Hons), M.Eng.Sc. and Ph.D. degrees from Multimedia University, Malaysia. He is currently a Senior Lecturer in the School of Science, Engineering and Technology at RMIT University Vietnam. Prior to joining RMIT University Vietnam, he was an Associate Professor at Curtin University Malaysia from May 2015 to January 2023, and subsequently served as an Adjunct Associate Professor in the Department of Electrical and Computer Engineering, Faculty of Engineering and Science, Curtin University Malaysia, from January to December 2023. From 2001 to 2015, he was affiliated with the Faculty of Engineering, Multimedia University, Cyberjaya, Malaysia. His research interests include digital watermarking, steganography, access control system, image processing, and cyber security.

Jiann-Liang Chen is a prominent Taiwanese computer scientist and academic leader currently serving as the Executive Vice President and Dean of Research and Development at the National Taiwan University of Science and Technology (NTUST). He earned his Ph.D. in Electrical Engineering from National Taiwan University. A Distinguished Professor in NTUST's Department of Electrical Engineering since 2015, Dr. Chen previously served as the Dean of the College of Electrical Engineering and Computer Science. His extensive leadership roles in public and industrial sectors include serving as Convener of the Information Engineering Discipline for the National Science and Technology Council and President of the Mobile Security Alliance.