IEEE IEACon 2023
INDUSTRIAL ELECTRONICS AND APPLICATIONS CONFERENCE

2023 IEEE Industrial Electronics and Applications Conference

PROGRAMME BOOK

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6 to 7 November 2023

IEACon 2023

2023 IEEE Industrial Electronics and Applications Conference

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CONTENT

WELCOME MESSAGE

IEEE Malaysia Industrial Electronics (IE) and Industrial Applications (IA) Joint Chapter is honoured to host the 4th IEEE Industrial Electronics and Applications Conference (IEACon 2023) in Hard Rock Hotel Penang Malaysia from 6th to 7th November 2023. This event is technically sponsor by IEEE Industrial Applications Society. We gratefully acknowledge Penang Convention and Exhibition Bureau (PCEB) for their help and support in the preparation for this event. The main objective of this conference is to serve the purpose of sharing and disseminating the new knowledge in engineering among delegates.

The IEACon 2023 is attended by 14 countries represented by 206 authors comprise of 53 accepted papers from 83 submissions. All papers will be sent for indexing in IEEE Xplore proceedings. 20% of submitted papers will be invited to submit extended versions of their manuscripts for consideration in the IEEE Transactions on Industrial Applications and IEEE IAS Magazine. Each paper received has been going for at least two reviews. The success of IEACon 2023 depends completely on the effort and talent of researchers in the field of Industrial Electronics and Industrial Applications who have written and submitted papers on a variety of topics. Praise is also dedicated for the program committee members and external reviewers who have spent time in analysing and assessing multiple papers who hold and maintain a high standard of quality for this conference.

We are delighted to introduce a renowned speaker, Professor Dr. Amit K. Gupta from Rolls-Royce Singapore Private, Ltd., Singapore to deliver speech in the area of electrical power and propulsion. This expert carry high merit in his field to share his expertise for further scientific knowledge exploration.

Finally, we welcome you to Georgetown, Penang, Malaysia. Georgetown, being listed as a UNESCO World Heritage Site, has always be a fascinating fusion of eastern and western influences where the island manages to embrace modernity while retaining its colonial traditions due to its well-preserved heritage buildings. Nevertheless, we hope you will stay safe and God Willing we will see you all again in IEACon 2024 in Kuala Lumpur Malaysia.

Thank you

Rahimi Baharom
General Chair
2023 IEEE Industrial Electronics and Applications Conference (IEACon 2023)

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TECHNICAL PROGRAM

Monday, November 6	
08:00 - 08:45	Registration (Venue: Hall of Fame 1, level 1)
08:45 - 09:00	Welcoming Remarks (Venue: Hall of Fame 1, level 1)
09:00 - 09:10	Muti Cultural Dance Performance (Venue: Hall of Fame 1, level 1)
09:10 - 10:10	KEYNOTE SESSION: Electrical Power and Propulsion (Venue: Hall of Fame 1, level 1)
10:10 - 10:30	Announcement of the Best Paper Award & Photo Session (Venue: Hall of Fame 1, level 1)
10:30 - 10:45	Break (Venue: Courtyard, Level 1)
10:45 - 12:45	Signal and Image Processing and Computational Intelligence 1 (Venue: Hall of Fame 1, level 1)
12:45 - 14:00	Lunch & Networking Session (Venue: Hall of Fame 2, Level 1)
14:00 - 15:30	Control Systems, Robotics and Mechatronics / Electrical Machines and Drives (Venue: Hall of Fame 1, level 1)
15:30 - 15:45	Break (Venue: Courtyard, Level 1)
15:45 - 17:15	Electronic Systems on Chip and Embedded Control / Industrial Automation, Communication, Networking and Informatics / Power Systems and Smart Grids (Venue: Hall of Fame 1, level 1)
19:45 - 21:45	Dinner at The Ship Restaurant (Exclude Student Registration)

Tuesday, November 7	
08:30 - 10:30	Power Electronics 1 (Venue: Hall of Fame 1, level 1)
10:30 - 10:45	Break (Venue: Courtyard, Level 1)
10:45 - 12:45	Renewable Energy / Industrial Electronics and Education / Power Electronics 2 (Venue: Hall of Fame 1, level 1)
12:45 - 14:00	Lunch & Networking session (Venue: Hall of Fame 2, Level 1)
14:00 - 15:15	Cloud Computing, Big Data and Software Engineering (Venue: Hall of Fame 1, level 1)
15:15 - 15:30	Break (Venue: Courtyard, Level 1)
15:30 - 16:45	Signal and Image Processing and Computational Intelligence 2 (Venue: Hall of Fame 1, level 1)
16:45 - 17:00	Closing (Venue: Hall of Fame 1, level 1)

Monday, November 6, 2023

Session : **Keynote**
Title : **Electrical Power and Propulsion**
Presenter : **Professor Dr. Amit K. Gupta (Head of Rolls-Royce Electrical - Singapore)**
Time : **09:15 am - 10:15 am**
Room : **Hall of Fame 1, level 1**
Chair : **Ts. Dr. Wan Noraishah Wan Abdul Munim (Universiti Teknologi MARA, Malaysia)**

SYNOPSIS

Rolls-Royce Electrical is aiming to become the leading supplier for all-electric and hybrid-electric systems for the Advanced Air Mobility market. Our systems under design feature the latest technology, from power generation and energy storage via power electronics and control systems to electric motors and we are focused on developing our products for the Advanced Air mobility market. As the battery technology develops the range, the markets in which these aircraft can operate will open. This is why we are also developing new turbogenerator technology for the Advanced Air Mobility market. It will be designed for hybrid-electric applications and will have scalable power offerings. As an on-board power source, it will complement the Rolls-Royce electrical propulsion portfolio, enabling extended range on sustainable aviation fuels and later as it comes available through hydrogen combustion. We are also looking at the services that these aircraft will need and how we can offer the digital and services capability that will support these aircraft.

10:15 - 10:30 : Announcement of the Best Paper Award and Group Photo Session

10:30 - 10:45 : Morning break

Monday, November 6, 2023

Date : November 6, 2023 (Monday)
Time : 10:45 - 12:45
Session : A11: Signal and Image Processing and Computational Intelligence 1
Room : Hall of Fame 1, level 1
Chair : Muhammad Ammirrul Atiqi Mohd Zainuri

10:45 ***Chaotic SFS-GTO Optimizer Algorithm for Flowshop Scheduling Problems***
Tuan Ahmad Zahidi Tuan Abdul Rahman

11:00 ***Analysis of Microwave Reflectometry Data Using Empirical Mode Decomposition for Beat Frequency Estimation***
Subramaniyan N, Janmejay Umeshbhai Buch, A Amalin Prince and Surya Pathak

11:15 ***A Power and Area Efficient Approximate Matrix Vector Multiplier Using Stochastic Computing***
Mrinmay Sasmal and Bindiya TS

11:30 ***An Attention Based Video Summarization Technique for Wireless Capsule Endoscopy Data***
Nitish Kumar, Sudhish N George and Kiran B. Raja

11:45 ***Single Board Computing for Image Recognition on an Autonomous Drone***
Siu Chung Kevin Shek, Joseph Butterfield, Adrian Murphy and Ivor Spence

12:00 ***Spiking Neuron Model With Improved Plausibility Using Artificial Bee Colony Algorithm***
Sruthi P v and Bindiya TS

12:15 ***A Simple Method for Equivalent Transmit Beamforming Using the Frequency Diverse Array***
Yazan Youssef, Hasan Mir, Lutfi Albasha and Kainam T Wong

12:30 ***Multi-Fault Detection of Bearing in Water Pump Using Two-Dimensional Convolutional Neural Network***
M Hendrik, Endah Suryawati Ningrum, Ali Husein Alasiry and Zaqiatud Darojah

12:45 - 14:00: Lunch & Networking Session (Venue: Hall of Fame 2, Level 1)

Date : November 6, 2023 (Monday)
Time : 14:00 - 15:30
Session : A12: Control Systems, Robotics and Mechatronics / Electrical Machines and Drives
Room : Hall of Fame 1, level 1
Chair : Khairul Safuan Muhammad

14:00 ***An H-Infinity-Control-Based Approach to Anti-Sway Control of an Offshore Crane Without Measuring Its Sway Angle***
Masayoshi Toda and Eimi Kinjo

14:15 ***Monitoring of Electric Scooter With Intermittent Fault and Working Condition Dependent Degradation Coefficients***
Xianle Wu, Ming Yu and Rui Cheng

14:30 ***Prognosis of Steer-By-Wire System Using Degradation Model Selection***
Rui Cheng, Ming Yu and Xianle Wu

14:45 ***A Sensorless Control Method for Doubly Salient Motor Based on Variant Park Transform***
Zeqiang He and Tadahiko Shinshi

15:00 ***A Novel Constrained Latin Hypercube Sampling for Electric Machine***
Jnlong Li, Nadia Tan, Zhuang Xu and Weinong Fu

15:15 ***Investigation on Sensorless PI-IFOC Speed Control Based Flux and Speed Estimator for High Power Induction Motor for EV Drive Application***
Shamsul Zulkifli, Muhamad Syazmie Sepeeh, Sim Sy Yi and Huang-Jen Chiu

15:30 - 15:45: Break (Venue: Courtyard, Level 1)

Date : November 6, 2023 (Monday)
Time : 15:45 - 17:15
Session : A13: Electronic Systems on Chip and Embedded Control / Industrial Automation, Communication, Networking and Informatics / Power Systems and Smart Grids
Room : Hall of Fame 1, level 1
Chair : Syed Farid Syed Adnan

15:45 ***Design and Performance Benchmarking of 8T SRAM Cell Using Dynamic Feedback Control***
Somesh Kumar

16:00 ***Hardware Efficient Edge-Detection Based Color Filter Array Interpolation for Industrial Cameras***
Pranshul Goel, Midde Venkata Siva and Jayakumar E p

16:15 ***Assessing the Effectiveness of Oversampling and Undersampling Techniques for Intrusion Detection on an Imbalanced Dataset***
Fayruz Rahma, Reza Fuad Rachmadi, Baskoro Adi Pratomo and Mauridhi Hery Purnomo

16:30 ***Automation of Characterization With Data Acquisition of Reverse Recovery and Gate Charge for IGBT***
Nurul Afiqah Mohd Hasbullah, Aik Wan Chan and Muhammad Fakhrul Asyraf Abd Kadir

16:45 ***Potential Safety Hazard in Terrace Houses With Foundation Grounding Scheme***
Chuen Ling Toh, Leong Soon Toh and Kok Wah Leong

17:00 ***Equilibrium Optimizer for Community Microgrid Energy Scheduling***
Emad Alzahrani, Md Shafiullah, Waleed M. Hamanah and Mohammad A. Abido

19:45 - 21:45: Dinner

Tuesday, November 7, 2023

Date : November 7, 2023 (Tuesday)
Time : 8:30 - 10:30
Session : A21: Power Electronics 1
Room : Hall of Fame 1, level 1
Chair : Ramani Kannan

8:30 ***Development of PV Emulator for Partial Shading Condition With Processor-In-The-Loop Simulation Utilizing Real-Time Microcontoller***
Jordan Syuen Zhen Lee, Rodney H.G. Tan, Nadia Tan and Thanikanti Sudhakar Babu

8:45 ***Enhanced Intermittent Modulation With Discontinuous Current Mode of A Three-Phase Dual-Active-Bridge Converter***
Jiacheng Wen, Nadia Tan, Giampaolo Buticchi, Jiajun Yang and Sandro Guenter

9:00 ***Improved Damping Filter for Grid Connected Solar PV Microinverter***
Fouzey Aamara, Muhammad Ammirrul Atiqi Mohd Zainuri, Yushaizad Yusof, Zuhair Alaas and Mohamed Ramadan Ahmed

9:15 ***Energy Analysis Between Wire-Connected and Wireless Battery Charger System for Electric Bike***
Rahimi Baharom, Samshul Munir Muhamad, Wan Noraishah Wan Abdul Munim, Mohd Amran Mohd Radzi, Norazlan Hashim, Wan Muhamad Hakimi Wan Bunyamin, M. Zaid Zolkiffly, Ahmad Sukri Ahmad and Siti Nur Amira Shaffee

9:30 ***Wireless Battery Charger With Power Factor Correction for Electric Bike***
Wan Muhamad Hakimi Wan Bunyamin, Rahimi Baharom and Wan Noraishah Wan Abdul Munim

9:45 ***Battery Charging Strategy of Electric Vehicles***
Wan Muhamad Hakimi Wan Bunyamin, Muhammad Zaim Azizi Bin Zahari, Wan Noraishah Wan Abdul Munim, Rahimi Baharom and Khairul Safuan Muhammad

10:00 ***Dynamic Modeling of Multi-Phase Induction Machine With Indirect Rotor-Flux Field-Oriented Control***
Nooradzianie Muhammad Zin, Wan Noraishah Wan Abdul Munim, Ahmad Farid Abidin, Hang Seng Che and Rahimi Baharom

10:15 ***Simulation Model of Uninterruptible Wireless Power Supply Based on Single-Phase Matrix Converter With Active Power Filter Functionality***
Muhammad Shawwal Mohamad Rawi, Rahimi Baharom and Mohd Amran Mohd Radzi

10:30 - 10:45: Break (Venue: Courtyard, Level 1)

Date : November 7, 2023 (Tuesday)
Time : 10:45 - 12:45
Session : A22: Renewable Energy / Industrial Electronics and Education / Power Electronics 2
Room : Hall of Fame 1, level 1
Chair : Wan Noraishah Wan Abdul Munim

10:45 ***Fault Identification Technique for Fault-Tolerant Boost Rectifier Based on SPMC Using Simulink/MATLAB***
Muhammad Hakiem Hayroman, Khairul Safuan Muhammad, Rahimi Baharom and Wan Noraishah Wan Abdul Munim

11:00 ***Minimizing the Partial Shading Effect by Connecting a Multi-Input Converter to Three PV Submodule Strings***
Zaid Al Otaibi, Abdulmalik actionAlmutairi, Badr Alali, Mohammed Almoiqli and Khalid Alharbi

11:15 ***Optimizing PV Array Performance: Comparative Study of Shading Mitigation Techniques and Row-Constrained Swapping***
Lawrence Sii Ying Ting, Yi Lung Then, Hazrul M Basri and Abadi Chanik Azhar

11:30 ***Fault Detection and Classification in the Photovoltaic Arrays Using Machine Learning***
Khaled Baradieh, Muhammad Ammirrul Atiqi Mohd Zainuri, Nor Azwan Mohamed Kamari, Yushaizad Yusof, Huda Abdullah and Mohd Hairi Mohd Zaman

11:45 ***Modeling and Simulation of Graphene-Based Working Electrodes for Highly Capacitive Energy Storage Devices***
Mohammad Obaidur Rahman, Nursyarizal Bin Mohd Nor, Ramani Kannan, Muhammad Fadhlullah Shukur, Md. Mahmudul Hasan and Mohammad Golam Mostafa

12:00 ***Grid Connected PV System for an Academic Building of KFUPM Campus in Saudi Arabia***
Waleed M. Hamanah, Md Shafiullah and Mohammad A. Abido

12:15 ***Comparative Study of Designing Compensators Using Auto Tuning and Manual Pole Placement Techniques for Switch Mode Power Converters***
Sumukh Surya, Ramani Kannan, Ahilya Chhetri, Paavana Raj and Arjun Mudlapur

12:30 ***A Usability Study of Mobile Augmented Reality-Based Learning Media for Heavy Equipment Safety in Indonesian Vocational School***
Shofiyul Anam Al Mubarok, Ketut Ima Ismara, Ika Ruyanah, Surya Sumpeno and Mauridhi Hery Purnomo

12:45 - 14:00: Lunch & Networking Session (Venue: Hall of Fame 2, Level 1)

Date : November 7, 2023 (Tuesday)
Time : 14:00 - 15:15
Session : A23: Cloud Computing, Big Data and Software Engineering
Room : Hall of Fame 1, level 1
Chair : Shamsul Zulkifli

14:00 ***Using Structure-Behavior Coalescence Method for Systems Definition 2.0***
Hsien-Tzu Wang, Wei-ming Ma and William S. Chao

14:15 ***Efficient IoT Data Processing Framework for High Velocity Data to Non-Intrusively Track Machine Operation Status***
Ken Why Goh, Boon Yaik Ooi and Xin Yi Kh'ng

14:30 ***A Sampling-Based Sentiment Analysis of Imbalanced Streamed Movie Reviews***
Ary Mazharuddin Shiddiqi, Reza Wahyu Ramadhan, Gehad Adel Ali Dahman, Zulchair Asyari and Muhammad Rafi Ramadhani

14:45 ***Identification of Fake News in Social Media Using Sentimental Analysis***
Seyed Ebrahim Hosseini

15:00 ***Face Recognition-Based Attendance System Using Haar Cascade: A Case Study Between Siblings***
Syed Farid Syed Adnan

15:15 - 15:30: Break (Venue: Courtyard, Level 1)

Date : November 7, 2023 (Tuesday)
Time : 15:30 - 16:45
Session : A24: Signal and Image Processing and Computational Intelligence 2
Room : Hall of Fame 1, level 1
Chair : Mohd Amran Mohd Radzi

15:30 ***Adaptive Ambiance Mode for Noise Cancelling Headphones***
Rajas Bhope, Kiran Talele and Tao Huang

15:45 ***Upper Body Human Pose Mimicking by Humanoid Robot Using Cosine Similarity Function***
Nathanael Hutama Harsono, Mauridhi Hery Purnomo, Dion Fandiantoro and Muhtadin Muhtadin

16:00 ***EmbryoSys: An Intelligence-Web-Based in Vitro Fertilization (IVF) Embryo Tracking & Grading System***
Rosheila Darus, Normasni Ad Fauzi and Iza Sazanita Isa

16:15 ***CNN-Based Augmentation Using Image Processing Techniques for Low Light Characteristics Images***
Normasni Ad Fauzi, Iza Sazanita Isa and Rosheila Darus

16:30 ***Covid-19 Readmission Prediction Using Different Feature Selection Techniques and Machine Learning Models***
Wei Kit Loo, Anwar Suhaimi, Khairunnisa Hasikin, Kareen Teo and Khin Wee Lai

ABSTRACT

A11: Signal and Image Processing and Computational Intelligence 1

Chaotic SFS-GTO Optimizer Algorithm for Flowshop Scheduling Problems
Tuan Ahmad Zahidi Tuan Abdul Rahman
This paper presents a video game-inspired metaheuristic algorithm and its application in flowshop scheduling problems (FSP). This optimizer algorithm is developed by assembling impressive features of previous well-known optimizer algorithms such as stochastic fractal search (SFS), artificial gorilla troops optimizer (GTO) and marine predators algorithm (MPA) with addition of chaotic operators. The main inspiration of this proposed chaotic SFS-GTO optimizer (CSGO) algorithm is the survival-of-the-fittest agent within a virtual map environment between two competitive groups in order to accomplish a mission using diverse strategies and information gathering-sharing activities. Then, the proposed CSGO's performance has been evaluated to solve ten distinguish flowshop scheduling problems taken from literature and treated as benchmark test cases. The study considers minimizing the processing cost by organizing a set of jobs, n on a set of non-identical parallel machine, m with separate release and due dates. The performance of CSGO algorithm is compared with its predecessor algorithms. Based on the statistical results and convergence curve analysis carried out, the proposed CSGO algorithm capable in solving lower dimension problems of FSP. However, as the number of FSP problem dimension increased, its results accuracy performance deteriorated significantly in comparison to its predecessor algorithms with the additional of high computational time taken due to excessive number of function evaluations involved.

Analysis of Microwave Reflectometry Data Using Empirical Mode Decomposition for Beat Frequency Estimation
Subramaniyan N, Janmejay Umeshbhai Buch, A Amalin Prince and Surya Pathak
In Fusion plasma diagnostics based on microwave reflectometry, the tokamak environment is highly noisy and turbulent. This makes it difficult to measure the beat frequency accurately. Traditional methods reported to remove noise involve filtering, wavelet decomposition etc. Since the Phase information is important for getting an accurate density profile, the noise removal methods employed should not alter the signal's phase. In this paper, Empirical Mode Decomposition (EMD) followed by energy-based thresholding and correlation-based thresholding are proposed for selecting the meaningful Intrinsic Mode Functions (IMFs). The results obtained from these two methods are compared based on the resultant signal's phase and certain evaluation metrics. These evaluation metrics include mean squared error (MSE), mean absolute error(MAE) and peak signal-noise ratio (PSNR). The analysis is carried out with the ADITYA -Upgrade tokamak back wall as a target, and it can be further extended to the plasma scenario.

A Power and Area Efficient Approximate Matrix Vector Multiplier Using Stochastic Computing
Mrinmay Sasmal and Bindiya TS
This paper presents a modification of the existing stochastic computing based approximate multiplier using a different stochastically generated bit stream, which results in architectural level improvements and reduced power and area consumption while maintaining computation accuracy. The power and area efficiency of different approximated multipliers(AM) and their performances are compared with those of the existing works. Later the power consumption, hardware area requirements and performance of the proposed AM based matrix vector multiplication unit is also illustrated.

An Attention Based Video Summarization Technique for Wireless Capsule Endoscopy Data
Nitish Kumar, Sudhish N George and Kiran B. Raja
Wireless Capsule Endoscopy (WCE) data captured from a pill-sized camera typically results in an 8 to 12 hours video from the start of the digestive system to the end of it. Viewing and analyzing such lengthy videos is a tedious task when clinical practitioners have limited time availability. Viewing long videos can also induce fatigue making the practitioners miss key or important segments needed for determining pathology. Video Summarization (VS) techniques aim to provide a concise yet comprehensive summary by selecting the most relevant segments of the video. Summarized WCE videos can be very useful in clinical settings saving time and resources. In this paper, a new approach for VS on WCE data is proposed. The proposed VS approach employs BiLSTM with attention to WCE data while performing both forward and backward pass during training. To implement the proposed approach in a supervised manner, an annotation assignment was done on the Kvasir Capsule dataset. The

proposed approach is validated empirically on the publicly available WCE video dataset of Kvasir Capsule videos where the average F-Score is noted as 84.57%.

Single Board Computing for Image Recognition on an Autonomous Drone
Siu Chung Kevin Shek, Joseph Butterfield, Adrian Murphy and Ivor Spence
Image recognition is a well-established method for extracting information from digital images. However, the selection, testing and integration of such methods when designing the software and hardware to enable situational awareness for autonomous systems in unstructured environments, remains a challenge. This is particularly the case when light weight and low cost are the driving requirements for the system. The main aim of this paper is to compare the k-nearest neighbours (K-NN) traditional machine learning method against a deep learning model for a character recognition task intended for implementation on a single board computer on an aerial drone. A series of image recognition experiments were carried out which attempted to identify a series of alphanumeric characters using a Raspberry Pi (RPi) image capture system (RPi V2.1 camera with a RPi 4 B) with a total cost of £97.50 and weight of 49g. The experiments identified that Tesseract optical character recognition recognised 2.12% higher on average than a K-NN algorithm but takes 58.30% longer on average to process a single image. Experiments also indicated that human-defined shape detection within unstructured environments is not feasible unless the parameters are adjusted for each required circumstance. This highlighted the importance of tailoring hardware and software selection to the application.

Spiking Neuron Model With Improved Plausibility Using Artificial Bee Colony Algorithm
Sruthi P v and Bindiya TS
This paper presents an artificial bee colony algorithm optimized Izhikevich neuron simulation, which more closely matches the various spike patterns produced by biological neurons compared to the existing works. Here, the artificial bee colony algorithm is used to find the coefficients for the approximated function of the Izhikevich model. From the simulation results, it can be seen that the obtained model closely matches with the theoretical model for the entire membrane potential range. An optimized Izhikevich neuron model is presented here, which is more biologically plausible than the existing works, and at the same time utilizes less hardware, making it suitable for neuroprosthetic applications.

A Simple Method for Equivalent Transmit Beamforming Using the Frequency Diverse Array
Yazan Youssef, Hasan Mir, Lutfi Albasha and Kainam T Wong
This paper presents a simple method for performing equivalent transmit beamforming at the receiver side of a frequency diverse array. Frequency increments are selected according to a pseudorandom sequence, and a minimum variance beamformer is used to solve for the optimal array weights that are applied at the receiver. Simulation results verify the ability of the proposed method to place peaks and nulls in the beampattern at specified spatial locations.

Multi-Fault Detection of Bearing in Water Pump Using Two-Dimensional Convolutional Neural Network
M Hendrik, Endah Suryawati Ningrum, Ali Husein Alasiry and Zaqiatud Darojah
This study aims to create a system that utilizes artificial intelligence to detect multi-faults in the bearings of a single-phase induction motor, specifically in a water pump. Bearings have the highest fault percentage among induction motor components, at 51%. Bearing faults can significantly impact the performance of the water pump; hence, early detection is crucial. This system can identify the faulty part of the bearing without the need to disassemble motor. A vibration sensor is used as a data collector to capture vibration signals generated by the bearings in the water pump while it is in an active state. The four types of vibration signals processed are: normal bearing condition, inner bearing fault, outer bearing fault, and ball bearing fault. These one-dimensional vibration signals (in the time domain) require conversion into a two-dimensional form to be processed as input in a Two-Dimensional Convolutional Neural Network (2D-CNN) as the artificial intelligence algorithm used in this study. The results demonstrate that the classification of bearing faults using 2D-CNN achieves a training accuracy of 99.16% and a validation accuracy of 99.05%. The classification results for bearing conditions are presented through a Graphic User Interface (GUI).

A12: Control Systems, Robotics and Mechatronics / Electrical Machines and Drives

An H-Infinity-Control-Based Approach to Anti-Sway Control of an Offshore Crane Without Measuring Its Sway Angle

Masayoshi Toda and Eimi Kinjo

This paper proposes a control method for anti-sway control of an offshore crane, that is, a gantry-type crane mounted on an oscillating base (ship or offshore structure) due to wave/wind, which mainly consists of the moving trolley along the rail and the cable hoisting a payload. Then, the objective of the control system is to move the trolley to the desired position while suppressing the sway motion of the hoisting cable with the payload. The proposed control method is based on H-infinity control and Proportional and Derivative (PD) control and does not require sway-angle measurements of the hoisting cable, which is the stark contrast to the previous methods. This advantage stems from exploiting the dynamics of the crane system and pre-knowledge of the base oscillation frequencies. Simulation results demonstrate the successful performances of the proposed method and hence prove its effectiveness.

Monitoring of Electric Scooter With Intermittent Fault and Working Condition Dependent Degradation Coefficients

Xianle Wu, Ming Yu and Rui Cheng

In this paper, a health monitoring method of electric scooter system with intermittent fault and working condition dependent degradation coefficients is proposed. Firstly, the bond graph model of electric scooter system is established to derive the analytical redundancy relations, and an integrated fault signature matrix is built, by which the intermittent fault detection and isolation can be implemented. Secondly, a sector search pigeon-inspired optimization algorithm is developed for intermittent fault estimation. After that, the fault duration feature is extracted with the aid of tumbling window, and a degradation model that includes working condition dependent degradation coefficients is proposed to describe the evolution trend of fault duration feature, based on which the remaining useful life of the faulty component can be predicted. Finally, the simulation results verify the effectiveness of the proposed method.

Prognosis of Steer-By-Wire System Using Degradation Model Selection

Rui Cheng, Ming Yu and Xianle Wu

In this paper, a prognosis method using degradation model selection is proposed for steer-by-wire (SBW) system with intermittent fault. First, the nonlinear bond graph (BG) models the SBW system, and the analytical redundancy relations and the fault signature matrix can be obtained based on BG for fault detection and isolation. Second, an improved mayfly optimization algorithm is developed for the intermittent fault estimation by introducing an adaptive inertia weight to the mayfly's position update process. According to the estimation results, the magnitude feature of intermittent fault can be constructed with the help of tumbling window. Since the degradation model is usually unknown in advance, the method of degradation model selection is developed for selecting the degradation model with the best fitting effect. Based on the selected model, the remaining useful life can be accurately predicted. Finally, the developed method is validated by experiment results.

A Sensorless Control Method for Doubly Salient Motor Based on Variant Park Transform

Zeqiang He and Tadahiko Shinshi

This paper focuses on the sensorless control of the bearingless doubly salient permanent motor (BDSPM) with a sinusoidal driver. Conventional sensorless control for interior permanent-magnet motors based on the extended electromotive force (EEMF) is not applicable to BDSPMs since the inductance of two types of motors alternate at different frequencies with the same electrical angular velocity. To solve this problem, we propose performing a Park Transform using a transform angle, which is half of the electrical angle. In the new dq coordinate frame, the inductance matrix is derived to be a constant diagonal matrix, which allows a typical extended electromotive force (EEMF) to be feasible. By observing the EEMF with the proposed frame, we effectively estimate the rotor angle with a sliding mode observer (SMO). The instructions on parameter selection of the SMO are presented, which guarantees the asymptotic convergence of the EEMF. We experimented with the proposed method with a BDSPM prototype, and the result shows that the sensorless observer can accurately track the angle at medium to high speeds.

A Novel Constrained Latin Hypercube Sampling for Electric Machine
Jnlong Li, Nadia Tan, Zhuang Xu and Weinong Fu
It is important to accurately construct a data-driven geometric model for the electric machine (EM) to avoid parts overlapping, which can result in the failure of performance analysis using FEM tools. This paper presents a novel approach that combines Latin hypercube sampling (LHS) and geometric repair operators to generate samples for the design of experiments (DoE). Firstly, the parametric geometric model, constraints, and the corresponding geometric reparations for EM are introduced. Then, the proposed approach is employed to address the geometric constraints when constructing the EM models for DoE. The proposed approach is numerically validated using a surface mounted permanent magnet synchronous machine, demonstrating the effectiveness in improving space-filling characteristics and feasibility through constrained LHS. Furthermore, the correlation analysis results based on the DoE can be used to reduce the design variables for multi-objective optimization and support surrogate modelling for EM performance prediction.

Investigation on Sensorless PI-IFOC Speed Control Based Flux and Speed Estimator for High Power Induction Motor for EV Drive Application
Shamsul Zulkifli, Muhamad Syazmie Sepeeh, Sim Sy Yi and Huang-Jen Chiu
This paper is to investigate the Proportional Integral (PI) controller that can be used with Indirect Filed Oriented Control (IFOC) mechanism. The PI controller used the parameters generated from the flux and speed estimator based on dq and park transformation of voltage and current at inverter outputs. This estimator represents the sensorless technique that can be applied to the high-power AC motor rated at 20 Hp. The results are in good agreement where the estimator has less than 5% error between the speed estimator and reference speed controller which give faster response based on speed and flux controller with a superior performance on the IM speed.

A13: Electronic Systems on Chip and Embedded Control / Industrial Automation, Communication, Networking and Informatics / Power Systems and Smart Grids

Design and Performance Benchmarking of 8T SRAM Cell Using Dynamic Feedback Control
Somesh Kumar
Random-access memory (RAM) is an information storage device commonly used for storing run-time variables and instructions in microcontrollers and processing units. The demand for portable devices has led to a need for ultra-low power consumption in electronic circuits. This has resulted in the development of new circuit topologies and optimization techniques that aim to minimize power consumption while maintaining performance and functionality. In this work, Dynamic feedback control (DFC) technique is applied to 8T static random-access memory (SRAM) to reduce power consumption while maintaining performance, and the performance benchmarking is done on 22nm technology nodes at different process corners i.e. SS, FF, SF, FS. From the results, it is seen that PDP has decreased by 54% in write 1 power when the comparison is done between 8T SRAM Cell without DFC and 8T SRAM Cell with DFC. From this analysis, we can say that 8T SRAM cell with DFC consumes less power and delay as compared to conventional 8T SRAM cell.

Hardware Efficient Edge-Detection Based Color Filter Array Interpolation for Industrial Cameras
Pranshul Goel, Midde Venkata Siva and Jayakumar E p
In manufacturing and industrial inspection, digital cameras are widely used for production monitoring, warehouse management, and detecting packing defects. Digital cameras require three separate image sensors to capture full-color images. However, due to the high cost of image sensors, many digital camera manufacturers are using a single image sensor with a color filter array (CFA), thereby reducing the overall cost of the camera system. In this paper, a computationally efficient algorithm for color filter array (CFA) interpolation is specifically designed to optimize hardware resource utilization. The algorithm focuses on utilizing simple additions, subtractions, comparisons and shift operations. Furthermore, an efficient hardware architecture for the proposed algorithm is designed and modeled using Verilog HDL. It is then synthesized using the Cadence Genus compiler with 90nm Generic Process Design Kit (GPDK 90nm) CMOS technology. The results of simulations and synthesis reveal that the proposed method is computationally efficient and requires less hardware resources as compared with the existing work making it suitable for the applications mentioned above.

Assessing the Effectiveness of Oversampling and Undersampling Techniques for Intrusion Detection on an Imbalanced Dataset

Fayruz Rahma, Reza Fuad Rachmadi, Baskoro Adi Pratomo and Mauridhi Hery Purnomo

The imbalanced class distribution in intrusion detection systems has been a significant issue. Imbalanced class distribution can negatively impact the performance of intrusion detection systems as they may be biased towards the majority class. We explore the effectiveness of oversampling and undersampling techniques to address this issue. Oversampling and undersampling techniques aim to balance the class distribution and improve the performance of the intrusion detection system. Oversampling increases the number of records in the minority class to make it closer in size to the majority class. Conversely, undersampling reduces the number of records in the majority class so that it is closer in size to the minority class. We assess the effectiveness of different oversampling and undersampling techniques, including Random OverSampling, SMOTE, ADASYN, Random UnderSampling, AllKNN, TomekLinks, SMOTEENN, and SMOTETomek. The experiment's findings indicate that the raw data achieved the highest accuracy score, 0.965. On the other hand, the Random Oversampling method yielded the highest F1 score, reaching a score of 0.589. When we see the evaluation scores of each class, the recall & F1 scores generally show high contrast between classes with a large amount of data and classes with (previously) a small amount of data, even though the data for training has been more balanced. We found that oversampling and undersampling can improve the performance of intrusion detection systems in specific ways, but this still needs improvement. These results can serve as a reference for researchers developing intrusion detection systems.

Automation of Characterization With Data Acquisition of Reverse Recovery and Gate Charge for IGBT

Nurul Afiqah Mohd Hasbullah, Aik Wan Chan and Muhammad Fakhrul Asyraf Abd Kadir

Reverse recovery and gate charge are several important behaviors in Insulated-Gate Bipolar Transistor (IGBT) that need to be taken as a consideration in order to produce a high quality IGBT device. The characteristics of reverse recovery are consisting of maximum reverse recovery current(Irrm), reverse recovery time(Trr), reverse recovery charge(Qrr), and reverse recovery energy(Erec) while the characteristics for gate charge consisting of gate-drain charge(Qgd), gate-emitter charge(Qge) and total gate charge(Qgtot) . The characterization for all of these test parameters needs to be accurate as it is a company standard to have a device with an acceptable value in the datasheet. Plus, the characterization lab is also required to meet customer request as it serves business purposes. Previously, the lab technician in the Characterization Lab will use the oscilloscope to characterize the Trr and Gate Charge parameter using the scope cursor. This old manual-scope acquisition is time-consuming and prone to human error. Hence, the cost is stretched within the cycle time and direct labor. Additionally, the waveform itself has an unwanted noise. By introducing LabVIEW software as an alternative to human acquisition, it has significantly improved the characterization through automating the process of acquisition. The acquisition process covers multiple aspect including filtering the noise on waveform, finding cursor point on oscilloscope, transferring test parameter results into a formatted Excel and exporting image into a local user drive. The application program written in LabVIEW has shortened the time difference with the manual acquisition by 91%. The correlation results between manual scope acquisition produces percentage of error less than 10%. The safe launch results indicates that the LabVIEW application program produced acceptable results as the results are having the same electrical characteristics with the datasheet of the device. Based on the time taken, correlation and safe launch results, it can be safely said that the LabVIEW migration is a game changer to the semiconductor industry with the Characterization Lab.

Potential Safety Hazard in Terrace Houses With Foundation Grounding Scheme

Chuen Ling Toh, Leong Soon Toh and Kok Wah Leong

Earth electrodes play a vital role in an effective grounding system for a building. These earth electrodes provide low impedance path to divert fault current to earth, enabling automatic disconnection of power supply. If the earth impedance is low, the fault current will be sufficiently high for the overcurrent protective device to open and clear the ground fault. Some international and local electrical codes and regulations have specified the earth resistance should be lower than 10 Ohms for domestic installations. To comply with this requirement, terrace houses projects use common ground slab steelwork as earth electrode. This earthing system is known as Foundation Grounding Scheme (FGS), where low earth resistance can be achieved using the massive steel bars. However, a major safety concern about this earthing scheme is the safe-touch voltage may exceed 50 Vac if one of the terrace houses is having fault occurrence. This paper presents a study on TT earthing system for terrace houses using FGS technique. A field test result confirms that low earth resistance value (1.24 Ohms) can be obtained easily with FGS technique. However, all houses which linked together are exposed to same level of potential touch voltage in the event of fault. The potential touch voltage of about 186 Vac is measured in the field test.

Equilibrium Optimizer for Community Microgrid Energy Scheduling
Emad Alzahrani, Md Shafiullah, Waleed M. Hamanah and Mohammad A. Abido
The local electricity grid that serves a particular small community is known as the community microgrid (CMG). Among many challenges of the CMG, the most critical one is energy scheduling through optimal utilization of available resources to minimize overall operating and maintenance expenditures. In addition, the energy storage systems (ESS) degradation costs are neglected in many formulations reported in the literature that should be considered in the modeling. This article proposes a cost-minimization mathematical formulation for CM energy scheduling incorporating the ESS degradation cost and other critical constraints. The equilibrium optimizer (EO), an effective and distinct meta-heuristic optimization algorithm, is employed to evaluate the modeled optimization formulation. The algorithm, inspired by control volume mass balance models, predicts equilibrium and dynamic states. The obtained results verify the efficacy and robustness of the employed optimizer in achieving quality outcomes. Thus, it reinforces the performance of the employed strategy over others for CMG energy scheduling.

A21: Power Electronics 1

Development of PV Emulator for Partial Shading Condition With Processor-In-The-Loop Simulation Utilizing Real-Time Microcontoller
Jordan Syuen Zhen Lee, Rodney H.G. Tan, Nadia Tan and Thanikanti Sudhakar Babu
This paper presents a new approach and development of a PV emulator capable of accurately emulating the output characteristics of a PV module under partial shading conditions. The use of the MATLAB Simulink platform, coupled with the integration of a DC-DC buck converter and PI controller, enables reliable and accurate emulation of the behaviour of PV module under partial shading condition. The resulting power-voltage curve exhibits three distinct peaks, closely matching the characteristics of a real PV module, with mean absolute (MAPE) error percentage of only 0.167%. The inclusion of Processor-in-the-Loop (PIL) simulation further enhances the accuracy of the PV emulator, resulting in an even lower MAPE of 0.142%. Overall, the proposed PV emulator demonstrates robustness with settling time as low as 3ms at the peak power operating point and effectiveness in dynamic load conditions, highlighting its potential for practical applications.

Enhanced Intermittent Modulation With Discontinuous Current Mode of A Three-Phase Dual-Active-Bridge Converter
Jiacheng Wen, Nadia Tan, Giampaolo Buticchi, Jiajun Yang and Sandro Guenter
This paper proposes an enhanced intermittent modulation (EIM) method with discontinuous current mode (DCM) to enhance power efficiency of a 700-V 20-kW three-phase dual active bridge (3p-DAB) converter during light load operation. The 3p-DAB converter using traditional phase shift modulation (PSM) will lose soft switching feature under low load condition, resulting in significant reduction in power efficiency in low load condition. Simulation results of the non-ideal 3p-DAB converter using Simulink and PLECS software have shown that the proposed EIM-DCM modulation is effective in improving the light-load power efficiency. Moreover, an optimal trajectory with high power efficiency could be found by changing the non-power transfer duration of the proposed EIM-DCM.

Improved Damping Filter for Grid Connected Solar PV Microinverter
Fouzey Aamara, Muhammad Ammirrul Atiqi Mohd Zainuri, Yushaizad Yusof, Zuhair Alaas and Mohamed Ramadan Ahmed
This paper presents the new damping filter to reducing the total Harmonics distortion of Grid current for the grid-tied PV microinverter, to improve the quality of PV microinverter must reduce the THD of current, this happens when it used the LCL filter, this is so high more than the IEEE standard of power system (must be smaller than 5%). There are many methods to solve this problem, I have used anew passive damping filter (R//LC), this method makes the microinverter not complex and to minimizing the total power losses to reach high efficiency of PV microinverter, which is the main goal of this study

Energy Analysis Between Wire-Connected and Wireless Battery Charger System for Electric Bike
Rahimi Baharom, Samshul Munir Muhamad, Wan Noraishah Wan Abdul Munim, Mohd Amran Mohd Radzi, Norazlan Hashim, Wan Muhamad Hakimi Wan Bunyamin, M. Zaid Zolkiffly, Ahmad Sukri Ahmad and Siti Nur Amira Shaffee
The wireless power transfer definitely holds promise for the future of energy delivery. This technology, if developed, could drastically reduce energy costs, enabling energy to be delivered faster and more efficiently than

ever before. With wireless power transfer, the energy can be sent to any location, with no wires or cables needed. Furthermore, it eliminates the need for bulky wires and expensive installations, making it an attractive option for many applications.

Nevertheless, there are a few main issues with wireless power transfer technology. The first is that it is not as efficient as traditional power transfer methods, such as wires. The second is that it is difficult to transfer power over large distances. The third is that it is not always possible to charge devices wirelessly. These facts limits the practical implementation and negatively affected the interest in wireless power transfer technology.

Therefore, this paper presents an energy analysis between wire-connected and wireless battery charger systems for electric bike (E-Bike). To perform energy analysis, two main equipments are used; a YOKOGAWA WT333E Digital Power Meter and a Fluke 435 Series II Power Quality and Energy Analyzer. The comparison of performance between wire-connected and wireless charging systems is based on the E-Bike battery charging period from 41.28 V (0%) to 54.95 V (100%) and the total energy consumption. The wire-connected battery charger used battery charging systems that come with the e-bike provided by the manufacturer (Model: CHR-48V/LI, STonBike). Meanwhile, the designed wireless battery charger is based on the output characteristics (voltage and current) of the wire-connected battery charger, focusing on improving the input power factor to meet the requirement of the MS IEC 60038 standard. It features low power losses resulting in high power density. The distorted supply current waveform due to the non-linear load is compensated through a proper switching algorithm of Active Power Filter (APF). It possesses low harmonic contents with a low Total Harmonics Distortion (THD) level, thus, improving the high-power factor.

The results of the input voltage and current profiles are presented including the energy profile of both wire-connected and wireless battery charger systems to verify the energy analysis. This paper shows that with the right control and algorithm, wireless power transmission can function well and be a viable alternative to wired power supplies, particularly for rotating or mobile applications.

Wireless Battery Charger With Power Factor Correction for Electric Bike

Wan Muhamad Hakimi Wan Bunyamin, Rahimi Baharom and Wan Noraishah Wan Abdul Munim

The Sustainable Development Goals (SDGs) of the UN are designed to lower carbon emissions and encourage environmentally friendly business and transportation practices. Electric bikes are becoming more and more well-liked as green modes of transportation due to their reduced carbon footprint. Typical Electric Bike (E-Bike) battery chargers, however, have concerns with a low power factor resulting in high Total Harmonic Distortion (THD) levels, affecting the power quality of the supply system. Therefore, this paper presents an improved rectifier circuit that incorporates Active Power Filter (APF), Wireless Power Transfer (WPT), Resonant Inductive Power Transfer (RIPT) technologies, and a battery charger at constant current and constant voltage. The proposed wireless battery charger with power factor correction can produce a high power factor that can reduce reactive power by using the active power filter method to compensate supply current in phase with supply voltage, a convenient charging system without the need for cables, and the CCCV charging method to prevent overcharging. The proposed switching algorithms and circuit design were assessed using computer simulation models and actual test rigs. Selected results are presented to verify the proposed wireless battery charger system.

Battery Charging Strategy of Electric Vehicles

Wan Muhamad Hakimi Wan Bunyamin, Muhammad Zaim Azizi Bin Zahari, Wan Noraishah Wan Abdul Munim, Rahimi Baharom and Khairul Safuan Muhammad

With the rising popularity of portable electronic gadgets, electric vehicles, and renewable energy storage applications, there is a greater need for efficient and dependable battery charging solutions. This paper discusses a method for designing battery charging systems, with an emphasis on enhancing charging effectiveness and overall performance. To optimize the charging process, the suggested system combines cutting-edge technology such intelligent charging algorithms, power electronics, and control schemes. Focus areas include battery longevity, charging speed, safety, and compatibility with different battery chemistries. The system includes high-power charging capabilities that increase charging speed by utilizing cutting-edge power electronics parts like silicon carbide (SiC) or gallium nitride (GaN) semiconductors for greater efficiency and power density. In order to reduce charging time while maintaining battery health, intelligent charging algorithms are also used to dynamically modify charging parameters while taking into account battery characteristics, state of charge (SoC), and temperature.

Dynamic Modeling of Multi-Phase Induction Machine With Indirect Rotor-Flux Field-Oriented Control
Nooradzianie Muhammad Zin, Wan Noraishah Wan Abdul Munim, Ahmad Farid Abidin, Hang Seng Che and Rahimi Baharom
This paper presents a dynamic modeling of the multi-phase induction motor developed using MATLAB Simulink. Multi-phase motors refer to induction motors with a stator that comprises more than three phases. In recent automation, motor drives with more than three phases have gained significant interest due to their numerous advantages compared to traditional three-phase drives. These advantages include reduced space-harmonic content, the ability to operate even in the presence of phase open faults, higher torque density, and improved efficiency. Nevertheless, there exists a knowledge gap when it comes to understanding such as induction motors or multi-phase drives. It is important to emphasize the significance of modeling multi-phase induction motors either for the purposes of teaching or conducting research in the field of power electronics and drives. Therefore, the dq-axis of six-phase and twelve-phase induction motor has been modeled under varying load conditions to observed their behavior.

Simulation Model of Uninterruptible Wireless Power Supply Based on Single-Phase Matrix Converter With Active Power Filter Functionality
Muhammad Shawwal Mohamad Rawi, Rahimi Baharom and Mohd Amran Mohd Radzi
This paper presents simulation model of Uninterruptible Wireless Power Supply (UWPS) using a Single-Phase Matrix Converter (SPMC) topology with active power filter (APF) functionality. In this work, the SPMC topology is used to operate as both inverter and rectifier operations to perform the proposed Uninterruptible Power Supply (UPS) using a single circuit configuration. The DC voltage of the UPS is then supplying to the load wirelessly using the Wireless Power Transfer (WPT) circuit, thus, achieving the aim of the proposed system to supply continuous and conditioned power to the DC load wirelessly. The proposed UWPS system using SPMC has achieved a power transfer efficiency of higher than 90%. In addition, the use of SPMC topology to perform both rectifier and inverter operations can reduce the number of power conversion stages, hence, improving the power density of the power supply system. A simulation model using MATLAB/Simulink was developed, and selected results are presented to verify the proposed system.

A22: Renewable Energy / Industrial Electronics and Education / Power Electronics 2

Fault Identification Technique for Fault-Tolerant Boost Rectifier Based on SPMC Using Simulink/MATLAB
Muhammad Hakiem Hayroman, Khairul Safuan Muhammad, Rahimi Baharom and Wan Noraishah Wan Abdul Munim
This paper presents an operation of the simulation model designed for fault identification within the proposed boost rectifier based on single-phase matrix converter (SPMC). The main goal of the fault identification technique is to locate a faulty switch during an open circuit fault (OCF) by observing the output voltage, the cycle of input supply and magnitude of inductor current. This is done by generating a binary code that acts as a signal for a controller to activate the relevant Current Option Route (COR) strategy-a setup meant to redirect current to working switches when a OCF occurs, ensuring the required current pathway in the circuit. The switching operation of COR strategy and fault identification technique is presented using Simulink MATLAB.

Minimizing the Partial Shading Effect by Connecting a Multi-Input Converter to Three PV Submodule Strings
Zaid Al Otaibi, Abdulmalik actionAlmutairi, Badr Alali, Mohammed Almoiqli and Khalid Alharbi
This paper is taking a step ahead to minimize the partial shading effect in PV projects specially roof top systems. The main idea is to introduce a modified PV module with an integrated DC optimizer or microinverter that can replace PV junction box eliminating its bypass diodes. This PV module is divided into three submodules which are connected separately to the integrated microinverter. The microinverter should be designed to have the capability of processing multiple inputs with separate MPPTs. By implementing this method, the partial shading effect, in specific, and mismatching, in general, is expected to be significantly reduced. In the paper, it is demonstrated that the percentage of energy loss under 50 percent of partial shading conditions is reduced from ~33% to ~12% in compare to the normal PV module which represents a significant energy saving. Simulations and practical experiments are done and their results show a good agreement.

Optimizing PV Array Performance: Comparative Study of Shading Mitigation Techniques and Row-Constrained Swapping

Lawrence Sii Ying Ting, Yi Lung Then, Hazrul M Basri and Abadi Chanik Azhar

Partial shading presents a recurring problem for PV modules, leading to uneven exposure and reduced power generation. Various setups have been proposed to mitigate shading effects by creating alternative paths for current flow. This comprehensive review examines different photovoltaic (PV) configurations like total-cross-tied (TCT), Sudoku puzzle pattern, and Futoshiki puzzle pattern, assessing their advantages and limitations. To overcome existing limitations, a new configuration pattern called Row-Constrained Swapping (RCS) is proposed. The performance of the RCS pattern is evaluated in three partial shading scenarios through MATLAB Simulink simulations, and the resulting power output characteristics are analyzed. The findings demonstrate the superiority of the proposed RCS configuration, surpassing other PV setups and establishing it as an optimal choice for large-scale PV applications. By optimizing PV array performance, this study contributes to maximizing power generation and addressing the negative impacts of partial shading. The RCS configuration decreases the number of shaded panels required for relocation by 30%, resulting in a corresponding increase in power generation.

Fault Detection and Classification in the Photovoltaic Arrays Using Machine Learning

Khaled Baradieh, Muhammad Ammirrul Atiqi Mohd Zainuri, Nor Azwan Mohamed Kamari, Yushaizad Yusof, Huda Abdullah and Mohd Hairi Mohd Zaman

Detection and classification of photovoltaic (PV) array faults are crucial for increasing grid susceptibility and decreasing power losses. Different PV array faults, such as Line-to-Line, Line-to-Ground, Partial shading, and Complete shading, make fault detection and classification challenging. The objective of this research is to propose a precise and rapid fault detection and classification technique based on the application and comparison of twelve supervised machine learning classifiers. Statistical analyses were utilized to construct the features matrix of the PV output current. Under challenging environmental and technical conditions, PV arrays with LL and LG faults were examined, and partial shading faults with single, double, and triple-shaded modules were distinguished from complete PV shading. After applying three cross-validation strategies, Extra Trees classifier showed the best performance among others, therefore, it was selected. Simulation results on unknown dataset demonstrated a 100 percent accuracy for fault detection and a 94.44% accuracy for fault classification.

Modeling and Simulation of Graphene-Based Working Electrodes for Highly Capacitive Energy Storage Devices

Mohammad Obaidur Rahman, Nursyarizal Bin Mohd Nor, Ramani Kannan, Muhammad Fadhlullah Shukur, Md. Mahmudul Hasan and Mohammad Golam Mostafa

The significance of supercapacitors in the energy sector is growing rapidly owing to their exceptional properties such as high specific power and long cycle of life. This paper presents the design and model of a working electrode for supercapacitors and examined the electrochemical performance of the model developed for 2-D cyclic voltammetry (CV) using COMSOL Multiphysics electroanalysis application. The electrode is designed to show maximum current density for an applied potential across it from where capacitive performance can be predicted. The simulation of working electrodes is carried out for CVs by sweeping the scan rates for different geometries of electrodes and the plots exhibit multiple graphs for CV, electrode potential for charge-discharge (CD), and surface concentration profile. The findings demonstrate that the highest peak currents of 0.08A, and 0.45A are visible in the plot for circular and squire-shaped geometries, respectively due to the highest scan rate of 100 mV/s in the applied potential range of -0.7V to 0.5V. On the other hand, a lower scan rate (5mV/s) shows the smallest peak currents of 0.02A and 0.01A for circular and squire-shaped geometries, respectively.

Grid Connected PV System for an Academic Building of KFUPM Campus in Saudi Arabia

Waleed M. Hamanah, Md Shafiullah and Mohammad A. Abido

Rising living standards through smart and sustainable development is crucial to advancing human life and protecting the natural environment. The smart grid is an ideal opportunity to create efficient and sustainable solutions for closed communities. This is to provide them with a robust and resilient infrastructure. Because the smart grid is a large system that can be developed in many forms, such as smart metering, sustainable power generation, demand response automation, and data management, each application can be developed independently and contribute to increasing the value of efficient and sustainable factors. This paper studies alternative power supplies for supplying an academic building in the King Fahd University of Petroleum & Minerals (KFUPM) Campus of Saudi Arabia. The extra power was sold to the electricity company and shared with the grid to reduce consumer bills. A small-scale PV system is modeled and analyzed using HOMER software for community purposes. A simulation-based model has been developed to optimize local power supply and demand

for residential communities. Electricity consumption has been defined and calculated, and the HOMER program has been applied to process the economic analysis and suggests possible alternatives. The simulation results indicate that the electricity supply for the buildings could be generated most effectively by installing a PV power system on the rooftop of the building. Though the total net present cost (NPC) and cost of energy (COE) of the system with PV is slightly larger than grid only system, it can be recommended by considering the ongoing increasing energy prices and nonrenewable energy sources.

Comparative Study of Designing Compensators Using Auto Tuning and Manual Pole Placement Techniques for Switch Mode Power Converters

Sumukh Surya, Ramani Kannan, Ahilya Chhetri, Paavana Raj and Arjun Mudlapur

DC-DC converters play a vital role in the electric vehicle (EV) industry in terms of delivering power at high efficiency. Preferably, these converters are operated in a closed loop for maintaining fixed output voltage irrespective of changes in the input voltage and output current. In this paper, a simple boost converter operating in continuous conduction mode is designed to operate in a closed loop. The closed loop operation is performed employing two methods viz; bode plot and auto-tuning techniques using MATLAB/Simulink software. The controller obtained using the bode plot technique is observed to be more realistic and reliable compared to that using AT. AT generates the controller parameters (Kp and Ki) by choosing a positive phase margin (PM) region, and a low crossover frequency is selected that decreases the bandwidth and increases the settling time.

A Usability Study of Mobile Augmented Reality-Based Learning Media for Heavy Equipment Safety in Indonesian Vocational School

Shofiyul Anam Al Mubarok, Ketut Ima Ismara, Ika Ruyanah, Surya Sumpeno and Mauridhi Hery Purnomo

Mining involves working in hazardous environments with various risks. The most common cause of mining accidents was mechanical failure, involving the use of heavy equipment. Thus, students who learn mining geology in vocational school must increase their knowledge of heavy equipment safety before they can work with it in the actual workplace. However, heavy equipment is very expensive and requires proper inspection and routine maintenance which needs high financial allocation for vocational schools. Thus, technology that can develop heavy equipment safety learning media reasonably affordable, interactive, and safe is needed. With the help of immersive technology, such as augmented reality (AR) will benefit students to attain important knowledge in heavy equipment safety. This study developed a learning module and a mobile AR application as learning media for heavy equipment safety and evaluated its validity and usability.

A23: Cloud Computing, Big Data and Software Engineering

Using Structure-Behavior Coalescence Method for Systems Definition 2.0

Hsien-Tzu Wang, Wei-ming Ma and William S. Chao

Systems definition is an artifact created by humans to describe what a system is. A system has been defined, by systems definition 1.0, hopefully, to be an integrated whole, embodied in its components, their interrelationships with each other and the environment, and the principles and guidelines governing its design and evolution. The definition of This system 1.0 defines the system possesses one cardinal deficiency. The deficiency comes from that it does not describe the integration of systems structure and systems behavior. The structure-behavior coalescence (SBC) method provides an elegant way to integrate the structure and behavior of a system. A system is therefore redefined, by systems definition 2.0, indeed, to be an integrated whole, using the SBC method, embodied in its assembled components, their interactions with each other and the environment, and the principles and guidelines governing its design and evolution. Since systems definition 2.0 describes the integration of systems structure and systems behavior, it is definitely able to form an integrated whole of a system. In this situation, systems definition 2.0 is fully capable of defining a system.

Efficient IoT Data Processing Framework for High Velocity Data to Non-Intrusively Track Machine Operation Status

Ken Why Goh, Boon Yaik Ooi and Xin Yi Kh'ng

Automation is a core component of the Industry 4.0 concept and is gaining popularity among manufacturing firms. This is where the Internet-of-Things (IoT) takes place and machine monitoring system is born. The growth of the Internet of Things (IoT) has led to an enormous number of connected devices being used all over the world. It was noted that the IoT generates a huge amount of data that requires high network bandwidth, energy and large

storage space, which are very costly. Therefore, many time-series data reduction methods have been introduced. This work aims to design a sound compression technique that can streamline the process of data acquisition and a sound recognition model that can reduce the network latency and cover all the information needed by the sound recognition model without losing too much accuracy. The proposed method reduces and compresses the sound data, achieving a compression ratio of 22.04. Then, the sound data will be transferred for sound recognition model training. The experiment shows that the model trained using the compressed data can achieve a high accuracy. Although the experimental results show high accuracy, further research and investigation are still needed to provide a better and more mature technique for the use cases.

A Sampling-Based Sentiment Analysis of Imbalanced Streamed Movie Reviews

Ary Mazharuddin Shiddiqi, Reza Wahyu Ramadhan, Gehad Adel Ali Dahman, Zulchair Asyari and Muhammad Rafi Ramadhani

Sentiment analysis has gained significant importance in analyzing individuals' attitudes and perceptions toward various products, services, and entertainment mediums, including movies. Evaluating the sentiment expressed in movie reviews can provide valuable insights into how users interpret and react to specific films. However, Movie review datasets often suffer from an imbalance in the distribution of positive and negative sentiment labels, which presents challenges for accurate sentiment classification. We propose a framework that harnesses streaming data for enhancing sentiment analysis algorithms. First, we create an initial model using an IMDB movie review dataset to categorize real-time review streams. To address the issue of imbalanced streamed data in movie reviews, we apply diverse sampling techniques, mitigating bias toward the dominant sentiment. This method bolsters the sentiment classifier's effectiveness. Additionally, we iteratively improve the initial model using recorded classification outcomes. We conducted comprehensive experiments on varied movie review datasets to assess our approach's effectiveness. Evaluation metrics were used for comparison, including accuracy, precision, recall, and F1-score. The results encompassed contrasting our sampling-driven method with baseline approaches. The SVC outperformed other algorithms in a native classification environment, whereas the extra tree excelled in a streamed classification environment. These outcomes underscored our framework's efficacy in enhancing sentiment analysis algorithm performance.

Identification of Fake News in Social Media Using Sentimental Analysis

Seyed Ebrahim Hosseini

This research paper focuses on finding the most effective models that promote detecting fake news from social media platforms. One of the ways to detect fake news is by text mining using sentiment analysis. In this paper, we will calculate the sentiment polarity using a lexicon-based approach and find out its role in fake news. In addition, we will compare the accuracy of Logistic Regression, Naive Bayes and Support Vector Machine which are supervised Machine Learning model for their performance in the detection of fake news in the Indian Fake New Detection dataset. As the result, we can see the role of sentimental score in detecting fake news and hyper tunning SVM model is the best model compared with the other supervised learning ML model, with an accuracy of 93 %.

Face Recognition-Based Attendance System Using Haar Cascade: A Case Study Between Siblings

Syed Farid Syed Adnan

Traditional attendance systems have long been recognized as inefficient and outdated. For the past of years, a lot of research and implementation have been using technological attendance such as web attendance, QR code attendance and mobile attendance. However, previously due to technological limitations, complexity, inflated costs, power consumption, and limited data transfer capabilities, face recognition systems were not viable options. Today, with significant advancements in technology, computers have become more efficient and powerful, marking a notable departure from the limitations of the past. In UiTM, currently, the implemented system is either web attendance or the traditional attendance system. Many students have pointed out the issue with the web system as students with bad internet reception or issues with their mobile devices will have an issue recording their attendance. On the other hand, traditional systems have impersonation issues, by having other people sign the attendance. In this paper, face recognition technology in attendance systems is explored with the benefits it offers, such as improved efficiency and accuracy. The method of the study is by using Python programming language in PyCharm with the implementation of Haar Cascade Adaboost Frontal Face Detector. Based on the test results, the accuracy for individual testing is calculated at 59.72% with 26 total true positives and 17 true negatives, while the precision was 57.77%. In the group testing, the subjects between three siblings, on the other hand, accuracy, and precision both went down to only a mere 50%.

A24: Signal and Image Processing and Computational Intelligence 2

Adaptive Ambiance Mode for Noise Cancelling Headphones
Rajas Bhope, Kiran Talele and Tao Huang
This paper introduces a novel and robust model for ambiance mode in noise-canceling headphones. Prior to this study, the focus in this domain has primarily been on Active Noise Cancellation as a comprehensive solution to eliminate unwanted sounds. However, the ambient mode has traditionally been regarded as a conduit through which most surrounding noises pass through. Although a few techniques, such as Transparent mode, Voice pass, and sound control, exist for ambient modes, these approaches mainly aim to modify the level of noise cancellation and not the type of noise that a user must hear. To address these limitations, the present study proposes an Adaptive Ambient Mode that leverages machine learning to classify audio signals and, based on the context, turns the Active Noise Cancellation on or off for a particular interval of time. In this regard, the paper categorizes ambient modes into three categories: Street Ambiance, Workspace Ambiance, and General Ambiance. A neural network is employed to classify the sound signals into three groups, yielding an accuracy of 93%. The Active Noise Cancellation component is implemented using the Least-Mean-Squared algorithm, which is highly effective, achieving a Karl Pearson's coefficient of correlation of 96.51%.

Upper Body Human Pose Mimicking by Humanoid Robot Using Cosine Similarity Function
Nathanael Hutama Harsono, Mauridhi Hery Purnomo, Dion Fandiantoro and Muhtadin Muhtadin
The habit of doing regular physical activity is a central protective factor for health. However, sometimes the motivation to engage in physical activity decreases with age. Luckily, this can be overcome by replacing the position of a physical trainer with a humanoid robot. The main difference between this study and some previous studies is comparing humanoid robot's pose with human's pose directly, which will be used in the process of mimicking of robots to humans. The main program in this study will be divided into 2 parts: RECORD and PLAY modes. In RECORD mode, human will do some poses and robot will imitate them while saving the movement. Whereas in PLAY mode, the robot will move according to the movements that have been stored in the previous mode and humans will imitate the robot's movements (the robot acts as a trainer). Then an assessment of human movement will be carried out based on robot movement using cosine similarity and the results will be obtained in percentage form. The greater the value, the more similar human pose and robot pose are, and vice versa. By using MediaPipe Pose for keypoint estimation in humans and RCNN Keypoint for robots, the created system is able to provide an accurate assessment of the similarity between the 2 poses.

EmbryoSys: An Intelligence-Web-Based in Vitro Fertilization (IVF) Embryo Tracking & Grading System
Rosheila Darus, Normasni Ad Fauzi and Iza Sazanita Isa
In Vitro Fertilization (IVF) is an Assisted Reproductive Technology (ART) that is aimed to overcome fertility problems among couples to get conceived through clinical procedure by obtaining sperm and ovum for fertilization. Selection of the fertilized ovum or embryo is crucial since the growth is visually observed for implantation. To ensure the success of implantation and healthy baby is born, selection of the best embryo quality was performed manually by at least two embryologists based on embryo morphological appearance. However, the conventional method could result in non-uniformity grading issues and increase the validation time. Therefore, this study is proposed a new grading method namely as EmbryoSys to optimize the grading and selection process of the embryo. A deep learning of Blast-Net segmentation model is trained to automatically grade and select the best embryo for implantation. The proposed method is developed in form of web-based application as the front-end with patient's medical information and IVF records database. Promising performances are reported in predicting the embryo grade from IVF microscopic images with degree of expansion has accuracy of 79%, ICM 69%, and TE 61%. The outcome from this research is expected to serve as a prognosis system for the embryologist in providing accurate grading for fertilised IVF embryo in microscopic images.

CNN-Based Augmentation Using Image Processing Techniques for Low Light Characteristics Images
Normasni Ad Fauzi, Iza Sazanita Isa and Rosheila Darus
The underwater images particularly in the shrimp pond are foggy and it is difficult to see shrimps through the water. For this analysis, data augmentation by using different image processing techniques is proposed which can increase the data use for better accuracy in CNN. This research was performed on shrimp dataset and underwater dataset to assess the classification accuracy of the proposed network. Therefore, data augmentation was conducted in order to evaluate the effect of image enhancement algorithms for underwater images in the CNN performance. In the data augmentation, image processing techniques used Grayscale Conversion and Gaussian noise whilst

histogram equalization was applied in order to improve the contrast of images. The result shows a significant improvement as the performance of training accuracy is 99.1% and 92.8 % for classification of the underwater object. Therefore, this study proposed different image processing techniques as part of data augmentation method for underwater images detection. This study may evolve the intelligence method in deep learning to enhance technology advancement in aquaculture field and food security area.

Covid-19 Readmission Prediction Using Different Feature Selection Techniques and Machine Learning Models
Wei Kit Loo, Anwar Suhaimi, Khairunnisa Hasikin, Kareen Teo and Khin Wee Lai
Coronavirus disease, or often known as Covid-19, emerged since 2019 and created massive impacts to multiple sectors worldwide. As a consequence of Covid-19 manifestation, many people suffered from the health side effects and complications post Covid-19 recovery. In addition, the healthcare sector has been impacted tremendously. To combat Covid-19, researchers and scientists over the world strived to produce practical and effective solutions. While most of the research is involved in the medical field, there are also studies utilizing the artificial intelligence. In this paper, a retrospective study was carried out with real-world patient data from Universiti Malaya Medical Centre (UMMC), Kuala Lumpur, Malaysia. After pre-processing, a final total of 441 patient data remained, with 399 non-readmitted cases, and 42 readmitted cases. The date of admission ranged from February 2021 to October 2021. The readmitted cases made up 9.52% of the total data collected. Two types of feature selection techniques were applied, namely Recursive Feature Elimination (RFE) and Chi Square Test. The common features of both feature selections are BMI, heart rate, systolic blood pressure, age, respiration rate, diastolic blood pressure, and SPO2. Selected features were fed into 2 machine learning models for model training, including logistic regression and Support Vector Machine (SVM). Comparing the feature selections, Chi Square Test outperformed RFE in both logistic regression and SVM. As the best result, when using features selected using Chi Square Test, SVM achieved the highest accuracy of 0.981, with AUC of 0. 942.

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