جامعة أحمد زبانة-غليزان
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ICAISD`25

مخبر الهندسة الصناعية و التنمية المستدامة

International Conference on Artificial Intelligence and Sustainable Development

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Faculté des Sciences et de la Technologie

ELECTRICAL ENGINEERING AND AUTOMATION
RELIZANE
DEPARTMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Abstract Proceedings

12-13 APR 2025
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ICAISD '25
April 12-13,2025
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A modified Reconfigurable Patch Antenna Design for MIMO Systems: Enhancing Performance through Dynamic Frequency Tuning and Compact Integration

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Abstract:

This paper presents the design, simulation, and experimental validation of a modified reconfigurable patch antenna optimized for MIMO systems. The antenna, built on a single-layer FR4 substrate with a permittivity of 4.3 and a partial ground, measures 28.4mm x 30.01mm, making it suitable for compact devices. A single switch enables dynamic resonance frequency adjustment. Experimental measurements validate the simulations, confirming the antenna's effectiveness for MIMO applications, including wireless sensor networks, IoT, and biomedical implants.

Keywords: Reconfigurable antenna, MIMO systems, FR4 substrate, Permittivity, Gain, Radiation pattern.

Modeling of an Asynchronous Motor for using in photovoltaic Panel Control

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Abstract:

In this work, we present the simulation results of the commands applied to an asynchronous machine for the purpose of elaborating a well-defined model of this machine. Thus, we will explain how to create models of vector control and sliding mode control to perform a complete synthesis of the induction machine. Our simulations are performed using Matlab / Simulink and the results are satisfactory. The modeling of an asynchronous motor for use in a solar tracking system involves integrating various components to enhance the efficiency of photovoltaic (PV) energy conversion. In this paper is cited a detailed overview of the key elements and methodologies in our system.

Keywords: Induction machine, Solar tracking system, Sliding mode control, Vector control.

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Abstract:

We have seen the trend of using meta-heuristic methods in recent years for system optimization especially for economical dispatching. This paper is used to present the application of the technique based on Teaching-Learning Based Optimization (TLBO) algorithms to solve Economic Dispatch (ED) problems. The proposed method is based on the effect of the influence of a teacher on the output of learners in a class. The basic philosophy of the method is explained in detail. TLBO uses two different phases; 'Teacher Phase' and 'Learner Phase', and uses the mean value of the population to update the solution. Unlike other optimization techniques, TLBO does not require any parameter to be tuned, thus, making its implementation simpler. TLBO uses the best solution of the iteration to change the existing solution in the population.

The performance of various algorithms includes the genetic algorithm (GA), particle swarm optimization algorithm (PSO) and Teaching-Learning-Based Optimization algorithm (TLBO) are evaluated for economic dispatch problems. Simulation results are compared with those of other studies reported in the literature, and the comparative results demonstrate our proposed method is more feasible and effective. This method can be deemed to be a promising alternative for solving the (ED) problems in real systems.

Keywords: Economic Dispatch, Meta-heuristic Optimization, Teaching-Learning Based Optimization, PSO, GA.

Differential Evolution in a Uniform Step Nine-Level Inverter for Harmonic Elimination

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Abstract:

The differential evolution technique is used in this study to determine the best switching angles for a single-phase, nine-level inverter in order to enhance the output voltage quality. In order to produce numerous voltage levels, the suggested inverter in this article uses a straightforward cascade converter topology made up of two H-bridge cells with non-equal DC voltage sources. To enhance the generated AC output voltage waveform, the selective harmonic elimination pulse width modulation (SHPWM) technique is employed. The non-linear transcendental equations required for the SHPWM are solved using the differential evolution (DE) optimization algorithm. The theoretical predictions and the computational results from computer simulations showed good agreement. To verify the simulation results, a lab prototype based on the STM32F407 microcontroller was constructed. The experimental findings demonstrate how successful the suggested modulation technique is.

Keywords: Multi-level inverters, SHE, differential evolution.

Performance of Direct Torque Control for Permanent Magnet Synchronous Motor with SMC speed controller

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Abstract:

Due to their attributes of high power density and efficiency, Permanent Magnet Synchronous Motors (PMSM) are gaining popularity. In applications requiring high-performance servo systems, there is a strong preference for rapid and precise torque control, ideally without the use of motion state sensors. The combination of PMSM with a Direct Torque Control (DTC) scheme presents numerous opportunities to achieve this goal. This paper explores the theoretical foundations of Direct Torque Control for PMSM drives. It has been mathematically demonstrated that the rise in electromagnetic torque within a PMSM is directly proportional to the increase in the angle between the stator and rotor flux linkages, enabling a swift torque response by rapidly adjusting the rotating speed of the stator flux linkages. Furthermore, it is indicated that zero voltage vectors should be avoided, and stator flux linkages must consistently be kept in motion relative to rotor flux linkages. DTC is a technique that leverages the ability to impose torque.

Keywords: Direct Torque Control (DTC), Permanent Magnet Synchronous Motor (PMSM), PWM inverter, sliding mode controller (SMC).

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Study of the Effect of Temperature on Carbon Nanotube-based Nanotransistors under the Influence of a Longitudinal Magnetic Field using First-order Non-Local Methods

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Abstract:

The aim of this work is to model a nanotransistor as a carbon nanotube integrated into a Winkler-type elastic medium and to study the effect of temperature, which induces deformation of the structure under the influence of the intensity of a longitudinal magnetic field. Utilizing a nonlocal Timoshenko beam theory (N-TBT), the study incorporates both small-scale effects and transverse shear deformation. By leveraging nonlocal elasticity and the force of Lorentz magnetic derived from Maxwell's equations, the buckling stability equation of simply supported SWCNTs is derived, leading to a closed-form solution for the non-dimensional critical buckling temperature. The influences of various parameters, including the nonlocal parameter, Winkler foundation modulus, length-to-diameter ratio, transverse shear deformation, and rotary inertia, are systematically examined under the combined influence of thermal and magnetic fields. These insights offer valuable guidance for developing the next generation of nanodevices that leverage the thermal buckling properties of carbone nanotubes.

Keywords: Nanotransistor, Magnetic field thermal buckling, Carbone nanotube, Winkler medium, Timoshenko beam theory, Nonlocal elasticity.

The solar photovoltaic energy capacity project at Higher school of electrical and energy engineering of oran,''ESGEE''

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Abstract:

A significant shift toward the integration of decentralized energy resources into electrical grids is underway. This article explores the photovoltaic potential of the Higher School of Electrical and Energy Engineering of Oran (ESGEE) and the integration of the solar energy generated into a planned photovoltaic microgrid to be implemented at ESGEE in Algeria. With its extensive space and numerous buildings, the school serves as an ideal source for photovoltaic energy production. As a site with excellent solar exposure, ESGEE offers a major opportunity for harnessing solar energy through a microgrid. This article analyzes the photovoltaic energy generated, considering the total surface area of the buildings to determine the optimal capacity for solar panel installation on the site.

Keywords: Solar photovotaic – Renewable energy – Micro-grid – Hybrid power systems – Distributed energy systems.

AI-driven Vibration Signal Analysis for Accurate Bearing Fault Detection

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Abstract:

Bearing fault diagnosis is crucial to ensure rotating machinery reliability and efficiency. Vibration signal analysis remains the most effective technique for identifying bearing faults at an early stage. However, conventional methods often have limits in isolating fault signatures from complex background noise. This paper introduces a machine-learning-based approach that leverages Accugram to improve bearing fault diagnosis through vibration analysis. Using K-nearest neighbor (KNN) classifier, Accugram selects the most sensitive frequency bands, which are most susceptible to bearing faults. The classification model, which is trained on both healthy and faulty bearing signals, quantifies the differences between the frequency bands, enabling the selection of fault-relevant features. Experimental results demonstrate that this AI-driven Accugram based approach significantly improves fault detection by accurately detecting and classifying bearing faults under varying operational conditions. This study highlights the potential of integrating machine learning into vibration signal analysis, offering a highly scalable and intelligent solution for predictive maintenance in industrial applications.

Keywords: Fault diagnosis, bearing, machine learning, predictive maintenance, vibration analysis.

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Dynamic Analysis of Shear-Thickening Fluid Jets Using Advanced Image Processing Techniques in MATLAB

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Abstract:

This work introduces an advanced image processing approach for analyzing the dynamics of jets formed by discontinuously shear-thickening (DST) suspensions, utilizing a custom-developed MATLAB script with advanced processing inspired techniques. The DST suspension, composed of concentrated calcium carbonate (CC) microparticles in water (68% volume fraction) and varying concentrations of polyamide (PA) microfibers, exhibits complex flow behaviors under gravitational forces. High-speed footage (300 fps) of the suspension's jet emerging from a vertical pipe was processed using the MATLAB program, which employs a graphical user interface (GUI) and sophisticated algorithms for real-time analysis. By defining the background intensity through the GUI, the program autonomously detects jet properties such as width d(z), lateral deflection x(z), and segmentation in cases of jet break-up. Gaussian fitting and automated segmentation methods are employed to enhance accuracy, while parallel processing (230 ms/frame on a 6-core processor) ensures computational efficiency. The intelligent system adapts dynamically to variations in jet behavior, from stable viscous threads to coiling and periodic rupturing instabilities caused by extensional stress exceeding the DST onset threshold. Experimental results demonstrate that the addition of PA microfibers stabilizes jet dynamics, likely due to flow-induced fiber alignment and increased extensional viscosity. Through smart driven image processing, this study establishes correlations between fiber concentration and instability parameters. These findings provide novel insights into the mechanics of fiber-reinforced materials, underscoring the potential of smart image processing-enhanced tools in advancing fluid dynamics research and industrial applications.

Keywords: Image processing, DST, Suspension jet.

Optimizing Machine Learning Models for Accurate Battery State-of-Charge Estimation

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Abstract:

Accurately estimating the State-of-Charge (SoC) of Lithium-ion (Li-ion) batteries is essential for the safe and efficient operation of electric vehicles and renewable energy systems. This study focuses on optimizing machine learning models for real-time SoC estimation. Using a NASA dataset with key battery parameters—voltage, current, and temperature—three algorithms, Extreme Gradient Boosting Regressor (XGBR), Gradient Boosting Regressor (GBR), and Decision Tree Regressor (DTR), were evaluated. GridSearchCV was used to fine-tune parameters like learning rate, tree depth, and the number of estimators, resulting in significant accuracy improvements. Among the models, XGBR performed best. These findings demonstrate the importance of hyperparameter optimization in developing reliable and scalable solutions for Battery Management Systems (BMSs).

Keywords: Machine learning, battery state-of-charge, optimization, regression.

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Accurate multi-faults diagnosis in gearbox using advanced signal processing and machine learning

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Abstract:

In this paper, we propose an improved signal decomposition method, termed Maximal Overlap Discrete Wavelet Packet Transform (MODWPT), which enables the extraction of signals associated with predefined frequency bands. This represents a significant advancement over traditional methods, which require post hoc identification of the frequencies linked to extracted signals. Subsequently, a set of health indicators is derived from raw signals to extract features corresponding to various bearing and gear conditions under three different speeds (25 Hz, 35 Hz and 45 Hz) and under variable loads (0%, 25%, 50% and 75%). Machine learning classifiers are then employed for automated fault classification, including the identification of seven different bearing and gear fault states. The proposed approach is tested on a real benchmark dataset, demonstrating its robustness and efficiency in condition health monitoring.

Keywords: Bearing, Gear, Machine learning, Predictive maintenance.

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Fault Detection System for Robot Manipulators using Neural Networks

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Abstract:

This research investigates the diagnosis of robot manipulators with two degrees of freedom. The primary objectives are to detect faults related to viscous friction at the robot joints and to identify the specific joint affected. The diagnosis system consists of two modules: the first is a fault detection (FD) module aimed at identifying viscous friction faults, and the second is a fault localization module that indicates the threatened joint. Furthermore, several ANFIS models have been utilized to support the FD and localization modules. Simulation results demonstrate that the proposed method effectively mitigates the impact of faults using data received from a remote supervisory robot.

Keywords: Fault detection, Viscous Friction, Viscous Friction Defect, Robot Manipulator, MLP.

Machine Learning-based Intrusion Detection for Unmanned Aerial Vehicles using Black Widow Optimization Algorithm

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Abstract:

Intrusion detection in Unmanned Aerial Vehicle (UAV) networks is a critical challenge in ensuring the security of wireless systems, given their vulnerability to malicious attacks. This paper presents an innovative approach for intrusion detection using the bioinspired Black Widow Optimization Algorithm (BWOA) to optimize feature selection and enhance the performance of machine learning classifiers. The dataset utilized includes various types of attacks relevant to UAV communication, such as Denial of Service (DoS), and Replay attacks, alongside normal traffic samples. After thorough preprocessing, including handling missing values and normalization, BWOA was used to select the most relevant features, aiming to improve classification accuracy and computational efficiency. A comparison with other algorithms was conducted and the experimental results demonstrate the effectiveness of BWOA in enhancing the performance of machine learning models, confirming its suitability for complex intrusion detection tasks in UAV environments and cybersecurity challenges.

Keywords: Intrusion Detection System (IDS), Unmanned Aerial Vehicles (UAVs), Black Widow Optimization Algorithm (BWOA), Cybersecurity, Feature Selection.

Robust Finite-Time Tracking Control for Consensus Protocol of Unicycle-Type Agents with Non-Holonomic Restrictions

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Abstract:

The purpose of this paper is to develop a finite-time consensus protocol control for non-holonomic unicycle-type robots. The objective is to achieve consensus and organize the robots into a specified regular shape within a limited time frame, encompassing both rendezvous and alignment. At the point of convergence, the agents should reach the desired trajcetory, characterized by their position and orientation, while ensuring zero velocity to avoid singularities. The simulation consists of a certain number of robots required to meet at an unknown rendezvous point while forming the shape of a regular polygon. However, there are some contributions achieved: First, unlike the existing research, which envisages exactly six unicycles, our simulation supports a variable number of unicycles, and consequently, so does the regular polygon they generate: as many agents as there are sides from which the polygon is composed. Secondly, they are required to come into formation in a finite time. In order for them to be able to place themselves in formation in finite time.

Keywords: Finite-time, Consensus protocol, Unicycle robot, Distribured controller, Nonholonomic systems, persistently exciting.

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Investigation in the Miniaturization of a Circular Patch Antenna with Enhanced Bandwidth for 5G Mobile Applications

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Abstract:

A miniaturized compact patch antenna with enhanced bandwidth, based on a one-layer substrate and low-cost structure, is introduced. The size is reduced by 47% through the optimization of two slots on the radiating element. Two design steps are incorporated into the miniaturized antenna, measuring 31.6 x 35.9 mm², to improve the bandwidth from 60 MHz to 300 MHz. The measured results of the antenna show a return loss of less than -10 dB at 3.5 GHz, with a simulated gain of 2.6 dBi. The proposed antenna can be integrated into small devices for 5G technology.

Keywords: Circular patch antenna, miniaturized antenna, enhancement bandwidth, 5G technology.

Deep Learning Classifier for DDoS Attacks Detection Across CSE-CIC-IDS2018 Dataset

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Abstract:

A Distributed Denial of Service (DDoS) attack aims to make a computer system or network unavailable to its intended users by overwhelming it with a flood of incoming messages and connection requests. This paper proposed a Deep Neural Network (DNN) leveraging CSE-CIC-IDS2018 dataset. This DNN model incorporates binary classification, multiclass classification with both label encoding and one hot encoding, and multilabel classification techniques. As part of preparing the data, duplicate records were removed, missing values were handled, and categorical features were processed. Data normalization and standardization techniques were applied so feature values fit within a common range. L2 regularization was utilized during model training to prevent overfitting to the training data. According to the simulation results, the DNN model achieves best accuracy values of 100%, 99.87% 99.84% and 97% for binary classification, multi-label classification, multi-class classification (one-hot encoder), and multi-class classification (label encoder) respectively. The suggested model evaluates their performance through comparison with previous research.

Keywords: Security, Classification, DDoS attack, Deep learning, Dataset, Pre-processing.

ICAISD`25

INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

The Automation of Critical Clearing Time Determination based on SIME and PSAT in Presence of Photovoltaic Generators

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Abstract:

In recent years, power systems have seen the emergence of renewable energy sources that impact the system stability. They require to adapt the tools used for power system planning and control. In our work, the single machine equivalent method was adapted for a power system with photovoltaic generation and implemented on the Power System Stability Toolbox (Psat). The algorithm proposed determines the critical clearing time in an automated manner. The results prove the viability of the algorithm in studying the transient stability in presence of photovoltaic generation.

Keywords: Transient stability, Photovoltaic generators, SIME, Critical clearing time.

Leveraging Deep Learning for Accurate Electricity Consumption Forecasting: A Practical Deployment on NVIDIA Jetson Nano

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Abstract:

Deep learning advancements enable accurate electricity consumption forecasting using historical data, significantly impacting environmental factors and energy costs. This study proposes a deep learning method to predict power usage based on past data for model training and evaluation, with the performance assessed using several metrics. The system was deployed on an NVIDIA Jetson Nano to validate practicality and reliability, allowing performance evaluation on development boards and assessing efficiency and effectiveness.

Keywords: Prediction, Deep Learning, Convolutional Neural Networks, Nvidia Jetson Nano.

ANN Control of Permanent Magnet Synchronous Motor fed by SVM Matrix Converter

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Abstract:

This paper presents a space vector modulation control of matrix converter fed permanent magnet synchronous motor drive with artificial neural networks control. Matrix converter is an important alternative to the traditional two-level voltage source inverter in controlling 3-Phase motor drives. The stator windings are supplied by the grid through the matrix converter. The speed and the torque of the PMSM are controlled by two ANN to provide the reference rotor speed and reference quadratic stator current; this is used to generate gating pulses of the Matrix converter by Space Vector Modulation technique. The simulated results prove the excellent performance of the used controller.

Keywords: PMSM, Matrix converter, ANN control, SVM.

Precision Agriculture: Utilizing Deep Learning for Effective Plant Disease Detection

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Abstract:

This study introduces an innovative deep learning (DL) method for the detection of plant diseases, which are critical factors that adversely affect agricultural productivity. The early and accurate identification of these diseases is essential for effective management strategies. Our research leverages a convolutional neural network (CNN) tailored for analyzing images of plant leaves. We begin by discussing the importance of accurate disease detection for maintaining healthy crops and minimizing economic impacts. Our methodology encompasses advanced image preprocessing techniques and a well-defined neural network architecture, demonstrating remarkable efficiency in identifying various plant diseases. Experimental results reveal a high classification accuracy of 99.73% for leaf diseases, which we compare against existing literature to underscore the superior performance of our model. Additionally, we assess the broader implications of our findings for future research and practical agricultural applications. In conclusion, we underscore the significance of our contributions to plant disease detection technologies and offer suggestions for subsequent research aimed at enhancing the robustness and real-world application of our model. This work not only advances agricultural technology but also provides essential insights for researchers and practitioners utilizing deep learning for sustainable crop management.

Keywords: Agriculture, Robotic Vision, Plant disease detection, Deep Learning, Artificiel Intelligence.

Integration of Artificial Intelligence in Finger Vein Recognition Systems for Sustainable Development

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Abstract:

Biometric technologies have become increasingly integral to secure and sustainable digital ecosystems. Among them, finger vein recognition has gained prominence due to its accuracy, security, and non-invasiveness. This study delves into advanced artificial intelligence (AI) and machine learning (ML) techniques in finger vein recognition systems. We address challenges in scalability, accuracy, and usability while discussing their alignment with sustainable development goals (SDGs). The proposed AI-driven framework demonstrates improved recognition accuracy, data security, and resource efficiency, with significant implications for global sustainability objectives. In this work, we propose an identification system using feature-level fusion. A dimensionality reduction algorithm has been implemented to achieve very satisfactory results with various machine learning classifiers.

Keywords: Security, Finger veins, Deep learning, AI.

Egg incubator system control based on ANFIS

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Abstract:

The aim of this paper is to control an egg incubator system using a Fuzzy Logic Controller (FLC) and an Adaptive Neuro-Fuzzy Inference System (ANFIS) controller. The main parameters of the incubator system are the temperature and the humidity; therefore, the system is MIMO (Multiple input, Multiple output). Using the decoupling matrix, we can control each variable separately. First, we control the system using the FLC plus the derivative action (D) on the variation of the error for reducing the oscillation. The result shows a good response of the system. Next, we integrate the previous results in the ANFIS controller for optimizing the membership functions. Finally, a comparison result of the two controllers shows that the ANFIS gives a better result than the FLC+D controller.

Keywords: Fuzzy controller, Intelligent control, ANFIS, Artificial neural network, Temperature control.

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Optimization of the Training Process of an AI Model

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Abstract :

In this article, we will focus on software optimization and examine techniques that can be applied during the training phase of a deep learning model to accelerate the process. We begin by discussing the motivations behind optimizing the training process, followed by an in-depth exploration of the core topic: software-based techniques for optimizing model training.

Keywords: Deep learning, Learning rate, Optimizer, Accuracy.

Improved MPPT Performance in Standalone PV Systems Using a Hybrid FNN and PSO Algorithm Approach

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Abstract:

This paper introduces a hybrid Maximum Power Point Tracking (MPPT) approach designed for standalone photovoltaic systems, integrating a Feedforward Neural Network (FNN), a Fractional Order Proportional-Integral (FOPI) controller, and Particle Swarm Optimization (PSO) for parameter optimization. The performance of the system was modeled and validated using MATLAB/Simulink, revealing significant enhancements in both tracking accuracy and energy harvesting efficiency. The proposed method demonstrates effective adaptation to varying environmental conditions. Simulation results underscore the system's capability to improve overall performance, positioning it as a reliable and efficient solution for optimizing energy output in standalone PV systems.

Keywords: Maximum Power Point Tracking (MPPT), Feedforward Neural Network (FNN), Particle Swarm Optimization (PSO), Standalone Photovoltaic System.

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Minimising Inverter Losses by Optimised Control using Genetic Algorithms: Electric Vehicle Application

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Abstract:

Nowadays, artificial intelligence is playing a key role in various applications linked to sustainable development. Among these, electric vehicles are attracting growing interest because of their potential to reduce carbon emissions. However, the major challenge remains: ensuring optimum autonomy while minimising energy losses. To address this issue, an innovative architecture based on an Open-End-Winding-Induction-Motor fed with Dual Inverter (OEWIM-DI), powered by a common DC bus, has been proposed. Although promising, this configuration leads to a significant increase in power losses, requiring effective optimisation. This paper presents an approach to optimising losses at both inverters using decoupled generalised discontinuous PWM (D-GDPWM) control, coupled with a genetic algorithm. The methodology was validated using MATLAB/Simulink simulations and then implemented experimentally using a dSPACE 1104 board. The results show that the optimised strategy, with a saturation angle of 71°, reduces losses by 58% compared with the decoupled SVPWM (DSVPWM) strategy widely used in industry, while improving energy performance.

Keywords: OEWIM, DI, Loss Optimisation, Genetic Algorithm, Decoupled GDPWM.

Optimization of a Perovskite Solar Cell Structure Using Machine learning: AI-Powered Tensor Flow Simulations, for future photovoltaic energy

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Abstract:

This study explores the optimization of the structure of perovskite solar cells by employing simulation techniques in combination with artificial intelligence methodologies. It simulates first a simple-junction perovskite solar cell with configuration FTO/TiO_2/$MAPbI_3$/HTM under SILVACO, TCAD Tolols, the devices exhibit a current Jsc = 22.057 mA/cm², Voc = 1.15 V, FF = 50.03% and PCE = 12.68%. These theoretical values are compared with the experimental data Jsc = 20.62 mA/cm², Voc = 0.96 V, FF = 66.41%, and PCE = 13.15% from an external laboratory. Then, 40 configurations of perovskite solar cell with different layer thicknesses and performance metrics were used. The neural network of TensorFlow optimized this structure to the best configuration. Its metrics are as follows: Jsc=22.26 mA/cm², Voc=1.20 V, FF=79.81%, and PCE=21.32%. In this configuration, the thickness of each layer is FTO: 350 nm, TiO_2: 310 nm, $MAPbI_3$: 350 nm, and HTM: 230 nm. All these prove that AI will be an increasingly important factor for fast design in high-performance perovskite solar cells.

Keywords: Perovskite Solar Cells, SILVACO, AI Optimization, Power Conversion Efficiency (PCE), Layer Thickness Optimization.

Electric Vehicle Lateral Stability Improvement using Sensorless DTC with MRAS Observer

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Abstract:

This work focuses on developing a new electric differential system for an all-wheel-drive electric vehicle, integrating an innovative master-slave strategy that employs sensorless direct torque control. The proposed control system enhances the vehicle's road performance, replicating the dynamics of a mechanical differential and addressing specific powertrain constraints, particularly regarding torque management. This study focuses on supplying power to four electric machines via two three-phase inverters, which operate the four drive wheels of an all-wheel-drive electric road vehicle.

Keywords: Electric vehicle, Electric differential, Vehicle dynamic model, In-wheel motor, Master-slave.

Discrete IDA_PBC control of permanent magnet synchronous generator in wind turbine generator

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Abstract:

in order to accurate the performances of the permanent magnet synchronous generator in wind turbine system, discrete passivity control based on the interconnection and damping assignment is designed in this work. In this case, the port controlled Hamiltonian model of the permanent magnet synchronous generator is used, because it is the one structure which avoids the problem of instability and allows reaching the desired equilibrium rapidly. Discrete neural networks observer is used to estimate the generator's torque; this output is then used as the inputs of the designed controller. Three phases matrix converter based on the space vector modulation technique is modeled and simulated, used to link the wind turbine to the electrical grid. Simulation results of the whole system demonstrate the efficiency of the proposed controller during various tests.

Keywords: permanent magnet synchronous generator, matrix converter, discrete interconnection and damping assignment passivity based control, wind turbine, space vector modulation (SVM).

Enhancing PI Controller Performance in DFIM Using Genetic Algorithms

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Abstract:

The primary objective of this article is to enhance the proportional-integral (PI) controller performance in stator-flux-oriented vector control applied to a doubly-fed induction motor (DFIM) by leveraging genetic algorithms (GAs). The efficiency and robustness of the DFIM, widely used in applications such as wind energy conversion systems, depend significantly on the precise tuning of its control parameters. Conventional methods for tuning PI controllers often fall short in achieving optimal performance due to the complex and nonlinear nature of DFIM dynamics. Genetic algorithms, inspired by the principles of natural selection, offer a powerful optimization framework capable of navigating complex search spaces to identify near-optimal solutions. In this study, we develop and implement a GA-based approach to optimize the PI gains for the stator-flux-oriented vector control strategy. The proposed methodology aims to improve dynamic response, minimize steady-state errors, and enhance system stability under varying operating conditions. Simulation results demonstrate the effectiveness of the GA-tuned PI controllers in comparison with traditionally tuned controllers. The proposed approach not only achieves superior performance metrics but also reduces the computational effort required for parameter tuning. The findings underscore the potential of genetic algorithms as a valuable tool in advancing control strategies for high-performance electrical drive systems.

Keywords: DFIM, GA, PI.

Assessment of Repair Approaches on Hydrogen Tank Durability Under Thermal Stress

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Abstract:

Cryogenic tanks remain the most efficient means of fluid storage due to their ability to withstand damage caused by corrosion at low temperatures and internal pressure. In this study, the finite element method was employed to analyze the effectiveness of using a composite wrap to repair a corroded tank. A parametric analysis was conducted to examine the impact of low temperature and pressure on the thermo-mechanical behavior of the corroded structure and to predict stress development near the corrosion site. A strength-based approach was necessary to account for the size of the existing defect and the magnitude of thermal stresses. The obtained results demonstrate the influence of thermal loading on the structural strength and the reinforcing effect of the composite wrap repair for different corrosion lengths (Path 1, 2, 3) in the tank. Ultimately, utilizing FRP composites for repairing corrosion enhances the longevity, efficiency, and performance of cryogenic tanks, although the extent of improvement is dependent on operating conditions, such as temperature.

Keywords: Cryogenic tanks, temperature, Corrosion, Wrap, FRP Composite.

Revolutionizing Renewable Energy: Thermoelectric Generator (TEG) as a Viable Source of Sustainable Power

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Abstract:

In the pursuit of sustainable energy solutions, thermocouples have emerged as a promising avenue. This article embarks on a journey through the innovative realm of thermocouple-based renewable energy, illuminating their pivotal role in harnessing waste heat for sustainable power production. Beginning with an exploration of the foundational thermoelectric principles underpinning this technology, the study swiftly transitions into a compelling narrative of applications. The results demonstrate that the proposed TEG model can generate a significant amount of electricity with high conversion efficiency, while also being cost-effective and easy to manufacture. This new TEG model has the potential to accelerate the development of thermoelectric technology and pave the way for a more sustainable energy future.

Keywords: Thermoelectric power generation; Thermoelectric module; System modeling; Thermal efficiency; Concentration solar; Solar energy.

LP-Metric and E-Constraint-Based Multi-Objective Optimization of Cycle Time and Number of Machines in an AS/RS

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Abstract:

In this paper, we investigate the optimization of some parameters of automated storage and retrieval systems, specifically focusing on the unit-load configuration. The main characteristic of this configuration is its use of one crane by aisle. Unit-load is among the oldest studied configurations, due to its simplicity of design and operation. For this class of systems, we will propose an analytical model for single cycle time in the aim of optimizing the system dimensions as well as the number of cranes; Which will necessarily optimize the system cost; Knowing that, the cranes are the most expensive element of the installation.

Keywords: Automated Storage and Retrieval Systems (AS/RS), Unit-load AS/RS, Modelling, Optimization, Single cycle time.

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Adaptive LQR Control with Neural Network Tuning for Energy Saving in 6-DOF Quadcopter Systems

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Abstract:

This paper presents an advanced control methodology for a nonlinear 6-degree-of-freedom (6-DOF) quadcopter, leveraging the Linear Quadratic Regulator (LQR) and neural networks to achieve optimal performance. The LQR controller, traditionally used to balance performance and energy efficiency, is enhanced through adaptive tuning of its key parameters -Q, R, and K- using a neural network. By integrating machine learning, the proposed system addresses the limitations of fixed-gain LQR in handling nonlinear dynamics and environmental variations. The neural network dynamically adjusts the weighting matrices, optimizing the trade-off between fast response times and energy consumption. Simulation results demonstrate the superiority of the proposed approach in minimizing tracking errors, reducing energy usage, and maintaining stability under varying operating conditions. This work showcases the potential of combining control theory with machine learning for high-performance, energy-efficient control systems, particularly in autonomous aerial vehicles.

Keywords: 6-DOF Quadcopter, LQR Control, Neural Network Tuning, Adaptive Control, Energy-Efficient Systems.

Intelligent Diagnosis of Misalignment Defects using Intrinsic Time Decomposition and Artificial Neural Networks

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Abstract:

Misalignment, both horizontal and vertical, is a major concern in mechanical systems, leading to premature wear, increased maintenance costs, and decreased system reliability. Traditional diagnostic methods, relying on manual inspection and vibration analysis, can be time-consuming and prone to inaccuracies. This paper presents a novel approach for the intelligent diagnosis of misalignment defects using Intrinsic Time Decomposition (ITD) and Artificial Neural Networks (ANNs). The proposed method combines ITD with Root Mean Square (RMS) calculations and Multilayer Perceptron (MLP) neural networks to detect and classify misalignment. The approach is validated using experimental data from a bearing test rig, demonstrating a high degree of accuracy in classifying misalignment conditions. This method offers a promising solution for real-time misalignment diagnosis and can be integrated into condition-based maintenance strategies.

Keywords: Misalignment Defects, Multilayer Perceptron, Intrinsic Time Scale Decomposition (ITD).

Experimental Comparison of a New Corona-loaded Separator Configuration with a Conventional Free-fall Separator

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Abstract:

Electrostatic separation is a high-performance method and an environmentally-friendly solution for recycling the plastics present in granular waste from WEEE. Its efficiency depends mainly on the capacity of the separator used. The process is based on an initial step of tribo-charging the granules, followed by separation in an intense electric field. To overcome the limitations of conventional separators, a new model has been developed, known as the “corona-charged conveyor belt electrostatic separator”. Unlike conventional models using a metal belt as the carrier electrode, this innovative separator employs a corona-charged plastic conveyor belt. In order to evaluate the performance of this new plastics recycling plant, a comparative experimental study was carried out on three separate separation devices: an unloaded (vacuum) conveyor belt separator, a corona-loaded insulating conveyor belt separator, and a conventional free-fall separator. Experimental analysis was carried out using granular mixtures of dry plastics comprising 50% PA (polyamide) and 50% ABS (acrylonitrile butadiene styrene) particles with an average particle size of 1 to 2 mm. The results obtained has been analyzed, and the results show that the use of the new separator has significantly improved the efficiency of the separation process.

Keywords: Electrostatic separation, Corona-charged, Granular mixtures.

Automated Animal Surveillance and Repulsion for Child Protection: a Hybrid Approach based on Sensors and AI

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Abstract:

Ensuring the safety of children from threats posed by wild animals is a major concern for parents. This project presents a cutting-edge automated surveillance and repulsion system that can seamlessly integrate into a child's wristband. Initially developed with PIR sensors for motion detection and an ultrasonic emitter to repel animals, the system evolved through various development phases. In its initial phase, the device employed a PIR sensor to detect animal presence and an ultrasonic emitter to produce sound waves aimed at driving the animals away. The second phase of the project introduced a vibration sensor and a Bluetooth module, allowing for better detection of unusual movements and real-time alert transmission to parents via a mobile application. The final phase marked a significant advancement with the integration of artificial intelligence (AI). AI enables sophisticated data analysis from the sensors, dynamically adjusting the system's responses based on detected behaviors. This integration enhances the effectiveness of the repulsion mechanism and reduces false alarms, making the system more adaptive and intelligent. The results demonstrate that the system, now equipped with advanced AI capabilities, provides an effective solution for protecting children from wild animal threats. The bracelet offers continuous monitoring and rapid intervention, while real-time communication with parents ensures an appropriate response to potential dangers.

Keywords: 4 keyword or phrasPIR Sensor, Bluetooth Module, Artificial Intelligence, Child Protection.

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Analysis of the FOPID System for Crane Stabilization and Control

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Abstract:

In this paper, we propose a new control strategy for anti-tipping of industrial cranes using fractional order PID (FOPID) controllers. The two-stage system stabilizes crane movements and regulates load oscillation by integrating five FOPID controllers. This approach aims to improve the robustness of the system in the face of disturbances and parametric uncertainties. We perform stability analysis and numerical simulations that demonstrate that the FOPID strategy outperforms traditional methods in terms of performance and efficiency.

Keywords: Fractional Order PID (FOPID) Controllers, Anti-Tipping, Control, Stability Analysis, Industrial Cranes.

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Garra_Rufa-Optimized Backstepping Controller for Drone Path Tracking in Windy Conditions

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Abstract:

This paper introduces an innovative control strategy for drone trajectory tracking that synergizes the robustness of backstepping control with the adaptive optimization capabilities of the Garra-Rufa method. While backstepping controllers are known for their inherent stability, their effectiveness diminishes under external disturbances such as wind variations. To address this, we present a Garra-Rufa-optimized backstepping framework that dynamically adjusts control parameters to counteract such disturbances, significantly enhancing both tracking precision and robustness. The proposed approach is tested on a detailed drone model that incorporates comprehensive geometric and dynamic characteristics, ensuring realistic evaluation conditions. Comparative analysis with a conventional backstepping controller under identical conditions demonstrates the superiority of the Garra-Rufa optimization in achieving precise trajectory tracking, even in challenging environments. Furthermore, comparisons with GWO-optimized backstepping highlight that Garra-Rufa delivers better adaptability and improved performance, affirming its potential as a more effective optimization strategy for drone control.

Keywords: Garra_Rufa, Nonlinear Drone Control, Drone Trajectory Tracking, Backstepping Control.

Design and Implementation of Trading bot based on Technical Analysis

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Abstract:

Stock markets are becoming the focus of many investors. These markets offer a wide range of investment tools and opportunities for individuals to grow their wealth and participate in the economy. However, investing in the stock market is not trivial and involves significant risks. Traders and financial advisors are required to frequently monitor market actions, research profitable companies and analyse stock price movements to generate various trading ideas, potentially leading to returns on investments.

Indeed, the objective of this article is to present and develop a new automated intelligent system for trading. This system is based on several components namely: the decision maker, the analyst and the scalping robot. The use of technical analysis during trading process is also the subject of this work. The aim of the trading bot is to execute trades automatically, process vast amounts of data and execute trades much faster than humans, taking advantage of minute price movements and market opportunities in real-time.

Keywords: Trading bot, Robot Scalping, Technical analysis, Trading strategies.

Automatic Heart Localization in Congenital Heart Disease using YOLOv8

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Abstract:

In this paper, we present a deep learning-based approach for heart localization in 3D CT scans, utilizing the YOLOv8n model as a preliminary step toward efficient heart segmentation. The ImageCHD dataset, containing high-resolution 3D CT images from 110 patients with various congenital heart diseases (CHD), was used to train the model. A data preparation process was employed to extract relevant heart slices from the scans. The results showed that the YOLOv8n model effectively localized the heart, optimizing computational efficiency by focusing on relevant regions in the CT scans. This approach significantly reduces processing time and computational power, making it ideal for use in medical imaging workflows, particularly in resource-constrained settings. Our findings highlight the potential of YOLOv8 in improving the speed and accuracy of heart segmentation tasks, paving the way for further advancements in automated CHD diagnosis and analysis.

Keywords: Congenital heart disease, Deep learning, Heart localization, YOLOv8.

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Vision-based approach for an autonomous landing system on moving target for quadrotor

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Abstract:

This paper introduces an autonomous landing system employing a vision-based method, enabling a quadrotor to autonomously and efficiently track and land on a moving platform using an onboard camera sensor. Additionally, we present a PID controller designed based on the target's image position to regulate the quadrotor's movement. Our system does not rely on external infrastructure like motion capture systems or GPS signals. We validated the system through simulations conducted in Gazebo and ROS, achieving successful landings on the moving platform in all tested scenarios.

Keywords: Autonomous landing, Unmanned aerial vehicle (UAV), Computer vision.

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A New Approach for the Identification of the Times Constants of Synchronous Machines from the Results of Frequency Response Tests

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Abstract:

This paper introduces an analytical approach for estimating the time constants of a synchronous machine based on Stand Still Frequency Response (SSFR) testing. The proposed method offers significant advantages over the traditional approach, which relies on curve fitting to represent the operational inductance as a function of frequency, often leading to imprecise and non-unique results. The analytical technique utilizes linear system theory to identify poles and zeros in the frequency response, determining the optimal order of the equivalent circuit to accurately model the machine. The method is straightforward, feasible, and highly effective, but it requires an optimization process.

Keywords : Synchronous Machine, Equivalent Circuit, Times Constants, SSFR tests.

Real-Time Image Watermarking for Drones: A C++ Based Reversible Data Hiding Approach

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Abstract:

The increasing use of drones for capturing images has introduced new challenges in ensuring the security of these digital assets during transmission. While drones provide unprecedented ease in capturing and sharing visual data, they also expose these assets to theft and unauthorized access. To address this issue, a secure and efficient solution has been developed using a reversible data hiding technique implemented in C++. This technique ensures the real-time embedding of ownership information directly into images, maintaining their integrity and quality. Leveraging the speed and efficiency of C++, the system is capable of securing images on the fly, making it particularly suitable for drone applications.

Keywords: Vision, Watermarking, Drones, C++.

Requirements Modeling for Self-Adaptive Embedded Systems: SysML4SAS Profile

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Abstract:

The model-based approach in requirements specification, grounded in the principle that "a picture is worth a thousand words," is essential for improving the clarity of requirements and minimizing the ambiguities of textual descriptions. SysML, among the widely used tools, offers significant advantages in this regard. In this paper, we introduce SysML4SAS, a new SysML profile that enriches requirements and block definition diagrams with specialized stereotypes and relationships tailored to capture the distinctive features of self-adaptive embedded systems.

Keywords: Self adaptive Embedded System; Requirements Engineering; Modelling; SysML.

Comparative Study of Agricultural Robots: Performance Analysis of SoilBot and Robocrop in Agricultural Soil Monitoring and Management

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Abstract:

This comparative study explores the technical features and performance of two agricultural robots: SoilBot developed by Michigan State University (USA) and Robocrop designed by the University of Lincoln (UK). The aim is to understand how these robots contribute to agricultural soil management by using advanced technologies to monitor crucial parameters such as soil moisture, temperature, compaction, and nutrient levels. By comparing their technical components, data processing algorithms, and autonomous navigation capabilities, this analysis highlights the strengths and limitations of each robot in optimizing agricultural practices. Although these technologies are not yet commonly used in Algeria, they offer promising solutions for improving sustainable agriculture, optimizing crop yields, reducing costs, and minimizing environmental impact.

Keywords: Agricultural Robotics, Soil Monitoring, Crop Management, Precision Agriculture.

Autonomous Robotic Collaboration Based On Deep Q-Learning for Optimal Performance and Safety

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Abstract:

Deep Reinforcement Learning (DRL) is a subset of machine learning that combines reinforcement learning (RL) with deep learning where an agent learns to make decisions by performing actions in an environment. Over time, it figures out the best strategy to maximize cumulative reward making DRL suitable for complex tasks like robotic control. In this research, we explore the application of deep reinforcement learning to holds the promise of enabling autonomous robots to learn large repertoires of behavioral skills and improve the performance of a robotic arm by enabling it to learn different tasks and effectively cooperate with a human worker. This method integrates deep Q-learning (DQL) reinforcement learning algorithm for human-robot collaboration to help the robot manipulator to select the best action, speed up the learning process, find the ideal trajectory, and provide the safety with the human interaction task in a complex environment and avoiding obstacles in the robot workspace with unknown positions. Looking at the obtained results, it is observed that the proposed method provides a more efficient and optimal solution to the problem.

Keywords: Human–robot interaction, Deep reinforcement learning, Deep Q learning, Obstacle avoidance, UR5 manipulator, Coppeliasim.

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Exploration of the YOLO Models' Potential in Fruit Health Detection

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Abstract:

The aim of this paper is to explore the use of cutting-edge YOLO models for fruit infection detection. YOLOv7, YOLOv8, YOLOv9, and YOLOv10 were trained on a large, curated dataset consisting of 5,745 images, enhanced through data augmentation techniques. The results demonstrated that all models achieved a mAP50 exceeding 96.5%, showcasing their ability to accurately detect infected fruits in real-world environments. The results contribute towards understanding of the potential of these models to support smart agricultural practices, representing a step forward for their integration into the agricultural sector.

Keywords: YOLO, Deep learning, Infected fruit detection, Smart agriculture.

Improving Traffic Conditions: A Hybrid Approach Using LSTM Networks and Reinforcement Learning

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Abstract:

The rapid economic growth and urbanization have worsened road congestion in major cities, posing significant challenges for Intelligent Transportation Systems (ITS) and urban mobility. This article presents a two-phase approach to tackle these issues. The first phase uses Long Short-Term Memory (LSTM) networks to detect traffic conditions by capturing temporal dependencies, while the second phase integrates reinforcement learning to optimize decision-making and traffic management. The results demonstrate the feasibility and effectiveness of this method. Additionally, the article provides a classification of existing AI methodologies and discusses the techniques used and challenges encountered in their implementation.

Keywords: Intelligent transportation systems (ITS), Traffic Prediction, Deep Learning, Congestion level.

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Control of Tram Signaling in an Urban Traffic Network

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Abstract:

In this article, we examine a green-wave coordinated control scheduling method for trams at a proposed intersection. By implementing this approach, we ensure that the intersection operates efficiently, prioritizing trams and preventing delays caused by vehicle queues. The study is divided into two main parts: first, we propose a mathematical model based on the optimal speed control of the tram. To determine this optimal speed, we employ a nonlinear programming optimization algorithm. A numerical experiment is conducted to validate the proposed model. In the second part, we identify the optimal placement of three detectors before and after the intersection. To validate our approach, we conducted experimental tests at a tram crossing located in Sidi Bel Abbes, Algeria. The simulation results demonstrate that the proposed scheme significantly reduces the average delay compared to the fixed-timing signal control approach.

Keywords: Tram signage, Intersection, Priority optimal control, Detector location.

Robust Integration of Fault Estimation and Fault Tolerant Control for Nonlinear Systems

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Abstract:

This paper presents a design methodology for a system capable of estimating and tolerating faults in a class of Lipschitz nonlinear systems affected by disturbances, measurement noise, actuator faults, and sensor faults. The proposed approach begins with the development of an observer that simultaneously estimates the system states, actuator faults, and sensor faults. Following this, an output feedback sliding mode fault-tolerant controller is designed based on the observer's outputs to stabilize the system's performance. To improve robustness and minimize the impact of disturbances on fault estimation, H-infinity optimization is utilized to determine the optimal gain matrices for both the observer and the controller. The effectiveness of the proposed method is demonstrated through a simulation example.

Keywords: Fault Estimation, Fault Tolerant Control, Sliding Mode, Unknown Input Observer, Optimization, Linear Matrix Inequality.

FLAMES: Federated Learning-Assisted Multi-Criteria Decision Making Solution for UAVs Service Selection

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Abstract:

This paper introduces FLAMES, an innovative framework integrating Federated Learning (FL) and Multi-Criteria Decision-Making (MCDM) to optimize service selection in Unmanned Aerial Vehicle (UAV) networks. By evaluating critical metrics including latency, end-to-end delay, throughput, residual energy, packet delivery ratio (PDR), jitter, and signal-to-noise ratio (SNR). FLAMES enables informed decision-making to enhance service delivery. Experimental results validate its effectiveness in improving performance and scalability, addressing the demands of the dynamic UAV ecosystem.

Keywords: Service selection; UAVs; federated learning; MCDM.

Adaptive Robust Fuzzy PI Speed Controller based Direct Vector Control Applied to Five-phase PMSM Drive

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Abstract:

This work has been focused on the design of the adaptive fuzzy proportional integral (AFPI) for the robust speed controller of five-phase permanent magnet synchronous motor (5P-PMSM). The main goal is to reduce steady-state error, rising time, settling time, overshoot and robustness against changes in machine parameters. In particular, when utilizing a traditional direct vector control (DVC) with a traditional controller PI. Simulations have been performed in MATLAB to validate the performance of the proposed model, and comparisons are made with DVC-PI of the5P-PMSM. The results of the comparison clearly show that the proposed control strategy provides better performance, in term of rise time, stability and faster dynamics response and robustness against changes in machine parameters.

Keywords: Adaptive fuzzy PI, Five-phase permanent magnet synchronous motor, Direct vector control, Proportional integral.

A Novel Keyframe Extraction Approach for Video Summarization Using Deep Features

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Abstract:

Keyframe extraction is a critical task in video summarization, enabling the concise representation of video content by identifying representative frames. In this research, we propose a novel method for keyframe extraction that combines a deep learning-based shot boundary detection (SBD) approach with density-based spatial clustering of applications with noise (DBSCAN). The shot boundary detection acts as a preprocessing step to segment the video, while DBSCAN clustering is utilized to extract keyframes from each shot. To address the variability in video content, we introduce a random search algorithm for the automatic optimization of DBSCAN hyperparameters, eliminating the need for manual tuning. This adaptive approach ensures an efficient and accurate selection of keyframes, regardless of the video's complexity or length. The experimental results on standard databases Open Video Project (OVP) show that the proposed method produces better results for diverse video summarization than existing methods.

Keywords: Keyframe extraction, Video Summarization, Shot Boundary Detection (SBD), Deep Learning, DBSCAN Clustering, Random Search.

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A Review of Fine-tuning Techniques in Large Language Models

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Abstract:

This paper provides a comprehensive review of fine-tuning techniques for optimizing large language models (LLMs) to address specialized tasks across diverse domains. It explores instruction-based fine-tuning and parameter-efficient methods, such as Low-Rank Adaptation (LoRA) and soft prompt tuning, which enable effective task adaptation while minimizing computational overhead. Key advancements in pretraining, prompting strategies, and evaluation metrics are discussed, alongside challenges such as catastrophic forgetting and scalability in fine-tuning. Through comparative analysis, this study highlights the tradeoffs between prompting and fine-tuning approaches, emphasizing their applications in privacy-sensitive, domain-specific, and enterprise-level use cases.

Keywords: Large Language Models (LLM) · Fine-tuning Techniques · Instruction-based Fine-tuning · Parameter-efficient Fine-tuning (PEFT).

Grey Wolf Optimised TS-type Fuzzy Modeling

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Abstract:

In this paper, for the first time, a new methodology for extracting data-based fuzzy models by using Grey Wolf Optimiser (GWO) is proposed. The GWO is a novel metaheuristic algorithm introduced initially to solve numerical complex problems. The GWO-based proposed approach aims to find the fuzzy model structure and parameters simultaneously. The performance of the proposed GWO fuzzy modelling strategy is evaluated on complex modelling problems and compared to other advanced modelling methods.

Keywords: Data-driven modelling, Fuzzy system, Grey wolf optimizer, Swarm optimization.

Nonlinear Control of a Multi-Phase Induction Machine Supplied with a Renewable Power based Multilevel Inverter

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Abstract:

Electricity production primarily relies on the use of nuclear and fossil fuels. The increased consumption of these resources over the last century has led to severe atmospheric pollution. In response to this, exploring alternative energy sources like renewable energy has become crucial, given its ecological benefits and sustainability compared to traditional methods. The main objective of this work is the study of nonlinear control methods applied to speed regulation of a multiphase induction machine (MPIM), powered with renewable energy based multi-level converters (MLC). Multi-level converters achieve smoother operation by reducing harmonic currents in the output waveform, leading to lower torque pulsations in the connected motor. The first method involves fuzzy logic controller (FLC) with an indirect field oriented (IFOC) technique which operates on speed error and its derivative. The second method use a sliding mode controller (SMC) utilizing a variable structure approach. Simulations conducted using MATLAB-Simulink demonstrates that the fuzzy logic controller exhibits superior efficiency, performance, and robustness in comparison to the sliding mode controller. Furthermore, by increasing the number of levels, both techniques achieve a significant reduction in Total Harmonic Distortion (THD).

Keywords: Sliding Mode Controller, Fuzzy Logic Controller, Multiphase Induction Machine, Multilevel Inverter.

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Optimized BI-GRU Models for Enhanced Heart Disease Prediction Through Data Mining Techniques

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Abstract:

This work demonstrates predicting heart disease using the optimized Bi-GRU models and advanced data mining technologies techniques. The proposed framework contains all the necessary process steps which comprise the collection of information, as well as complete data preprocessing, feature selection as well as model optimization, with the aim of improving the predictions of heart disease to a higher extent. There is a dataset set patient related which contain demographics, clinical, and lifestyle variables, which is processed by imputations and outlier's eliminations. Features relevant for identification of heart disease and discriminative with respect to other diseases can be selected using the method of Recursive Feature Eliminator (RFE). In order to optimize the models, a Bayesian Optimization framework is applied to optimize important learning dependencies such as the size of batches, number of training layers, and the learning rate. Results from the experiments as reported out are quite within reasonable expectations revealing quite evidently that this optimized Bi-GRU model outperform the baseline models with respect to accuracy. Therefore, it has considerable advantage as a tool for prevention of heart diseases and risk evaluation.

Keywords: Heart disease prediction, Bayesian Optimization, Feature Selection, Machine Learning, Time-Series Analysis, Health Informatics, Model Optimization, Deep learning, Time-Series Analysis, Clinical Data, Bidirectional Gated Recurrent Unit(Bi-GRU).

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Fuzzy Logic Control of an Agricultural Greenhouse

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Abstract:

Agricultural greenhouses allow growers to control environmental factors such as temperature, humidity, and light, enabling year-round production of vegetables, fruits, and ornamental plants. Given the system's nonlinear characteristics, long time delays, and strong inter-variable coupling, a fuzzy logic control method was chosen as the control strategy. Through an analysis of fuzzy control theory and greenhouse environment needs, temperature-humidity deviation and deviation rate were defined as the input/output variables. A fuzzy controller was then developed to monitor and adjust the greenhouse environment. This fuzzy logic control specifically regulates the heating temperature in the horticultural greenhouse system. A dynamic model of the greenhouse environment was subsequently constructed, and simulations were performed. The simulation results showed a high level of agreement with experimental data, validating both the accuracy of the model and the feasibility of the control strategy.

Keywords: Agricultural greenhouse, Microclimate, Fuzzy Logic, Controller.

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Impact of Roadside Units Deployment Factors on Network Performance

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Abstract:

The significance of Vehicle-to-Roadside Units (V2R) communication in Vehicular Ad-hoc Networks (VANETs) is increasingly recognized due to its advantages in reducing latency, lowering transmission costs, and enhancing data security. Nonetheless, the intricate positioning of RSUs presents considerable challenges. The location of RSUs can profoundly influence network performance, affecting factors such as time delay and transmission efficiency. These issues pose substantial obstacles to the deployment of RSUs on a large scale, necessitating innovative solutions to harness the full potential of V2R technology within expansive VANETs. In this research paper we will performs a comparative study between four existing approaches that use : degree centrality (DC) intersection factor, density intersection factor, connectivity probability in road-segment factor, and random intersection factor, trying to highlight the importance of the deployment process and the impact of it on the network efficiency, the study is performed in a particular area taken from Oran city, we have analyzed the simulation results based on average end-to-end delay and PDR metrics, then we have drawn some conclusion.

Keywords: roadside units (RSUs), deployment, Probability of connectivity, Network performance.

Optimal Parameter of Three Phase Induction Motor: A hybrid approach Optimization

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Abstract:

Higher efficiency, flexibility, and lower operational costs are prime reasons that have placed induction motors as a prime choice across a wide range of industries. As far as the operational dynamics of induction motors are concerned, the identification of parameters of their equivalent circuit is one of the basic aspects related to their management and diagnostic analysis. In recent times, due to its effectiveness, simplicity of implementation, and fast convergence, parameter estimation using metaheuristic algorithms has gained prominence. In the paper, a study is described in which two hybrid metaheuristic methodologies involving Particle Swarm Optimization (PSO) and Manta Ray Foraging Optimization (MRFO) have been applied to estimate induction motor parameters. These metaheuristic approaches utilize the value of SAD between the actual outputs of the motor, and that obtained from the equivalent circuit model as a measure of goodness. Empirical data also showed that hybrid PSO-MRFO reached a minimum SAD value of 0.2756, which is quite good, whereas alone PSO obtained the maximum value of SAD as 0.6004 in an acceptable way

Keywords: Induction motors, Identification of parameters, Hybrid metaheuristic.

Comparative Study of CFAR Techniques to Enhance GNSS Receiver Acquisition Performance

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Abstract:

This article discusses the analysis of the acquisition process performed by a Global Navigation Satellite System (GNSS) receiver. Signal acquisition determines the presence or absence of the GNSS signal by comparing the tested signal with an adaptive threshold provided by a GO-CFAR (Greatest of CFAR) or SO-CFAR (Smallest of CFAR) detector or through a fusion of different detectors in a noisy environment. The performance of these detectors is evaluated through a simulation study.

Keywords: GNSS acquisition, GO-CFAR, SO-CFAR, Fusion center.

Prediction of Photovoltaic Power Output: A Machine Leaning Approach

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Abstract:

Accurate forecasting of photovoltaic (PV) power output is essential for improving grid stability and optimizing renewable energy systems. This study leverages machine learning regression models to predict PV power output using detailed weather parameters, including temperature, solar irradiance, wind speed, and direction, collected at the SolarTech Lab, Politecnico di Milano. Data preprocessing involved handling missing values, outlier removal, and feature scaling to ensure robust model training. Three machine learning algorithms—Linear Regression, Support Vector Machines (SVM), and Ensemble Bagged Trees (BT)—were trained using the MATLAB Regression Learner Toolbox. The dataset was split into 80% training and 20% testing sets, and a 10-fold cross-validation strategy was employed to enhance reliability and prevent overfitting. Model performance was evaluated using standard metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R^2 score. Results indicate that Ensemble Bagged Trees outperformed the other models, achieving the lowest prediction errors (MAE: 11.36 W, RMSE: 16.75 W) and the highest R^2 score (0.94), demonstrating superior accuracy and robustness. These findings highlight the capability of machine learning in addressing the variability of solar energy and optimizing PV system performance. The study provides a foundation for the integration of advanced predictive tools in renewable energy management and planning.

Keywords: Machine learning, Power output, Photovoltaic (PV), Regression.

Classification of photovoltaic Efficiency States: A Machine Leaning Approach

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Abstract:

This study presents a machine learning-based approach to classify the efficiency states of photovoltaic (PV) systems, using weather parameters such as solar irradiance, temperature, and wind speed. The dataset, collected from the SolarTech Lab, Politecnico di Milano, includes minute-resolution measurements of PV power output, which were categorized into high, moderate, and low efficiency states using quantile thresholds. The study explores the performance of three classification algorithms: Decision Trees (DT), Support Vector Machines (SVM), and K-Nearest Neighbors (KNN), evaluating them using accuracy, precision, recall, and F1-score metrics. The SVM model demonstrated the highest accuracy (89.7%) and balanced performance across all metrics, highlighting its potential for real-time monitoring and optimization of PV systems. These results contribute to enhancing PV system management and renewable energy integration.

Keywords: Classification, photovoltaic (PV), PV Efficiency.

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Study and Comparison of the Performances of MPPT Techniques based on Artificial Neural Networks

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Abstract:

The maximum power point tracking (MPPT) technique in the photovoltaic (PV) system achieves maximum power through the solar PV system. In this context, this paper aims to study and compare the performance of four different Maximum Power Point Tracking (MPPT) techniques four MPPT techniques, i.e. sliding mode control (SMC), fuzzy sliding mode control (FSMC), artificial neural network (ANN), and artificial neural network fuzzy sliding mode control (ANNFSMC) are implemented and their performance is analyzed.

Keywords: PV system, Conventional boost converter, Four MPPT techniques.

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Particle Swarm Optimization for Optimal Sizing of Hybrid Renewable Energy

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Abstract:

The potential for hybrid renewable energy systems (HRES) to provide reliable and sustainable energy has gained significant attention. This paper focuses on optimizing the size of an autonomous HRES, combining photovoltaic (PV), wind turbine (WT), battery storage, and diesel generator using particle swarm optimization (PSO). The objective is to minimize the levelized energy cost (LCOE) while maintaining a high reliability index, expressed by the loss of power supply probability (LPSP).

Keywords: Hybrid renewable energy system (HRES), Optimal design, Meta-heuristic algorithms, Particle Swarm Optimization (PSO).

Machine Learning Clustering Techniques for IoT Networks: Comparative Study

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Abstract:

Clustering is the process of dividing a sample of data points into groups called clusters. Nodes in the same group share some commonalities, while every group differs from others. In this paper, we compare multiple Machine Learning (ML) clustering techniques. We study to what extent every considered approach compares to each other in the context of the Internet of Things (IoT) networks, the latter being based on battery-empowered devices and in which clustering is commonly used for topology management and maximizing the network durability. A comprehensive comparative study of the different clustering algorithms is presented. These clustering algorithms are compared in detail based on various parameters, namely; the cluster number that impacts the energy consumption, the energy consumption since energy optimization is a major concern for energy-constrained wireless networks, and the network lifetime that indicates the network durability, the cluster stability that denotes the rate of the required re-clustering process that can be very heavy in a dynamic network.

Keywords : IoT, ML, Clustering.

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Strip Attention-Enhanced U-Net for High-Resolution Retinal Vessel Segmentation

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Abstract:

This research introduces a unique U-Net architecture enriched with Strip Attention methods for retinal vascular segmentation utilizing the High-Resolution Fundus (HRF) dataset. Our model delivers competitive results with state-of-the-art approaches, displaying an accuracy of 0.9686 and an F1 score of 0.7821. The suggested architecture successfully blends spatial and channel-wise features to increase segmentation accuracy.

Keywords: Retinal vessel segmentation, U-Net, Strip attention, Deep learning, Medical image analysis.

Hardware-in-the-Loop Real-Time Application for Wind Turbine and DSIG Integration

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Abstract:

Several approaches have been put out to capture wind energy and transform it into electrical energy. The modeling and control of a dual stator induction generator (DSIG) incorporated into a wind energy conversion system is the particular focus of this study. The controls on the generator side and the conversion system's output parameters must be adjusted to achieve the best possible power flow to the grid and guarantee peak system performance. Alternative machine control is popular for PI controllers. Creating PI gains is difficult in this situation because the rectifier powering the DSIG is simultaneously controlled with a phase angle change of thirty degrees. A nonlinear backstepping control approach is suggested to lessen this difficulty. This investigation's comparison analysis compares the effectiveness of the two control systems using a variety of simulated tests. In steady-state settings, the tracking performance of both controls is similar. However, the backstepping control performs better in a transient mode in terms of overshoot and response time. A thorough analysis and validation of the suggested control mechanism is performed using sophisticated simulations in the Plecs/RT BOX environment.

Keywords: Field-Oriented Control (FOC), PI Regulator, Wind System, Dual Stator Induction Generator (DSIG).

Fractional order_Predictif_Direct Power Control for Power Quality Improvement of Microgrid Connected System

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Abstract:

This paper discusses the modeling, management, and enhancement of power quality in a hybrid-connected system. This system was chosen as a multi-converter setup, including a wind turbine, photovoltaic panels, and battery storage systems. All these energy sources are linked through a DC bus, which supplies power to a nonlinear load via a DC/AC converter and a three-phase multifunctional voltage source inverter. This component is used to improve the performance of the proposed system by providing compensation for reactive power and harmonics. The wind turbine and photovoltaic systems are regarded as the main power sources, while the grid is employed to absorb excess power generated by these sources once the battery is fully charged. Direct Power Predictive Control (P_DPC) is an highly effective method for managing energy production and usage in complex systems, such as hybrid systems. Fractional Order Direct Power Predictive Control (FO_P_DPC), which incorporates fractional-order elements, offers several key advantages over traditional P_DPC. This approach enables more effective handling of system complexity and dynamic variations. FO_P_DPC provides a more robust, flexible, and efficient solution for power management in complex hybrid systems, while enhancing stability, energy quality, and the longevity of the equipment. Moreover, a comparative study between FO_P_DPC and the P_DPC control in order to affect high performance in harmonic compensation control. The simulation of the proposed solution is carried out in Matlab/Simulink. The results obtained show that the FO_P_DPC control offers the optimal solution in terms of robustness, accurate tracking, performance optimization, fast dynamic response, and low total harmonic distortion (THD).

Keywords: hybrid power generation system, P_DPC control, FO_P_DPC control.

Fuzzy logic control of a microgrid comparative analysis with conventional PI control

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Abstract:

This paper treats a photovoltaic (PV) system. The global system is composed of PV panels, DC/DC boost converter, Lithium Battery associated with bidirectional DC/DC converter, three-phase multifunctional voltage source inverter (MFVSI) connected to utility grid through an inductor filter and nonlinear load. MFVSI is used to improve the performances of the system ensuring both reactive power and harmonics compensation in the power grid. In addition, a fuzzy logic intelligent control is implemented in order to achieve high performance in harmonic compensation control. This allows an adequate regulation in active and reactive power exchanged with the power grid, particularly in a dynamic condition. As this study tried to regulate the voltage in the DC-bus according to THDi and THDv values with unity power factor. Moreover, the maximum power point (MPP) of the PV generator is extracted using the proposed control strategies for controlling the DC/DC boost to ensure best tracking efficiency. Finally, the simulation results of these techniques carried out in MATLAB/SIMULINK.

Keywords: Microgrid, Fuzzy logic control, THD, MPPT MVSI inverter, Battery energy storage.

Feature-Based Discrimination of Breast Cancer Types Using the BACH Dataset

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Abstract:

In breast cancer, understanding the stages and types of tumors is vital for accurate diagnosis, effective treatment, and reliable prognosis. This study investigates the potential of nuclei features in distinguishing different breast cancer subtypes using the BACH histological dataset. In the absence of nuclei ground truth, a pretrained StarDist model was employed to segment nuclei. Morphological and textural features were extracted from the segmented nuclei to provide insights into their shape and size characteristics. Statistical analysis, including the calculation of p-values for each feature, revealed their discriminative power in differentiating tumor types. These findings enhance the understanding of breast cancer pathology and provide a foundation for future research using the BACH dataset.

Keywords: Breast cancer, Nuclei segmentation, Feature extraction, Statistical analysis.

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A Comparative Study between P&O and PSO Algorithms for Maximum Power Point Tracking in Photovoltaic Systems

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Abstract:

This paper presents a comparative study of two prominent Maximum Power Point Tracking (MPPT) algorithms, Perturb & Observe (P&O) and Particle Swarm Optimization (PSO), for a 100 kW photovoltaic (PV) system. The performance of both algorithms was evaluated under similar environmental conditions using a detailed simulation model. Results demonstrate that the PSO algorithm exhibits superior performance in terms of tracking speed and accuracy compared to the conventional P&O method, under ideal conditions. These findings highlight the potential of PSO for enhancing the efficiency and energy yield of large-scale PV systems.

Keywords: Maximum Power Point Tracking (MPPT), Perturb and Observe (P&O), Photovoltaic Systems (PV), Practical Swarm Optimization (PSO).

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APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Dynamic Intrusion Prevention in PV Grid-Connected Systems Using Real-Time Neural Networks

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Abstract:

The integration of photovoltaic (PV) grid-connected systems into modern power grids has significantly advanced renewable energy adoption. However, these systems are increasingly vulnerable to cyberattacks, such as data injection, false data injection attacks (FDIAs), and denial-of service (DoS) attacks, which can compromise grid stability and safety. Traditional intrusion detection and prevention methods often lack real time adaptability and struggle to detect novel or sophisticated attacks. This paper proposes a real-time neural network (NN)-based approach for dynamic intrusion prevention in PV grid-connected systems. The proposed NN architecture is designed to process sensor data and communication logs in real time, enabling the detection and mitigation of cyberattacks with minimal delay. The system is trained on a dataset of labeled sensor data and attack scenarios, achieving high accuracy (98.5%), detection rate (97.8%), and low false positive rate (1.2%). Experimental results demonstrate the superiority of the proposed approach over baseline methods, such as support vector machines (SVM), decision trees, and convolutional neural networks (CNN), in terms of accuracy, detection rate, and response time (15 ms). The lightweight architecture of the proposed NN ensures efficient operation in resource-constrained environments, making it a practical solution for real-time implementation in PV grid systems. The integration of the proposed solution into existing PV grid infrastructure is feasible, requiring minimal hardware modifications and operating independently of the underlying communication protocols. This work contributes to the development of secure and resilient PV grid connected systems, ensuring their continued role in the global transition to renewable energy.

Keywords: Photovoltaic Grid Connected Systems, Intrusion Prevention, Real-Time Neural Network, Cybersecurity.

Neural network Active and Reactive power control of doubly fed induction generator combined to NPC5 Level

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Abstract:

This research paper presents a study of the dynamic response of a grid-connected variable-speed wind energy system based on a doubly fed induction generator. While the rotor of the DFIG is connected to the grid through a PWM NPC 5 level inverter, the stator is directly connected to the grid. Reactive and active powers are controlled separately based on field oriented control (FOC) and using artificial neural network regulators (NN).

Keywords: Doubly fed induction generator, NPC 5 level, Wind turbine conversion system, Neutral network regulator.

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Accurate Sizing of a Resonant Passive Filter based on TLBO Algorithm for Harmonic Distortion Suppression

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Abstract:

In principle, harmonics are due to the presence of nonlinear electrical loads in an electrical network, they cause heating and degradation of the operation of electrical equipment. In this article, a more rigorous optimization algorithm called teaching-learning based optimization (TLBO) is proposed for the optimal design aimed at suppressing harmonic disturbances. The simulation results obtained are very satisfactory and clearly indicated the effectiveness of the optimized filtering. The proposed filtering system with optimal sizing has greatly eliminated the harmonic content of the source current. The proposed optimization algorithm makes clear its superiority, and its excellent performance reflects its relevance and efficiency.

Keywords: Harmonics, Nonlinear load, Optimization, Passive filter, THD, Teaching-learning based optimization (TLBO).

Enhancing Energy Consumption Forecasting Using Machine Learning: A Comprehensive Study with Hourly Data

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Abstract:

Accurate forecasting of electricity consumption at high temporal resolution is increasingly important as the global energy landscape shifts towards renewable energy sources. This transition presents challenges for power grid operators who must balance supply and demand in real-time while integrating intermittent renewable energy sources such as solar and wind. Traditional forecasting methods struggle to capture the complex, non-linear relationships inherent in electricity demand, leading to inaccurate predictions, especially during periods of high variability.This study addresses these challenges by applying advanced machine learning techniques to predict hourly electricity consumption, with the goal of improving forecast accuracy and supporting effective grid management. We conduct a comprehensive comparative analysis of several machine learning models, including Linear Regression, Random Forest, XGBoost, CatBoost, LightGBM, and Multi-Layer Perceptron (MLP). These models are evaluated based on key performance metrics such as RMSE, MAE, and R^2, to assess their ability to capture complex temporal patterns in the data. Our results demonstrate that ensemble models, particularly Random Forest, XGBoost, and LightGBM, significantly outperform traditional models like Linear Regression, providing more accurate and reliable forecasts. Additionally, while the MLP model shows potential, it requires further optimization to achieve its full performance. This study underscores the potential of machine learning to enhance the accuracy of energy consumption forecasts, contributing to more efficient grid management and supporting the transition to sustainable energy systems.

Keywords: Accurate forecasting of electricity consumption, Machine Learning, hourly energy consumption.

Optimizing The Electrical Parameters of Solar Photovoltaic (PV) Panels Using New Stochastic Approach

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Abstract:

The estimation of photovoltaic (PV) Electrical Parameters plays a crucial role in optimizing the performance and efficiency of PV systems. Various methods are employed for solving this challenge, ranging from analytical techniques to numerical optimization algorithms. In this paper a recent metaheuristic optimization algorithm called Sparrow Search algorithm (SSA) with Newton Rapson (NR) method to estimate solar PV system parameters. Which is one such powerful optimization approach. The root mean square error (RMSE) has been widely employed as an objective function in prior research for parameter extraction in PV solar models. Experimental results demonstrate that the proposed approach outperforms two other state-of-the-art algorithms like the Particle Swarm Optimizer Algorithm (PSO), and Moth Swarm Algorithm (MFO). According to these results, it is evident that this method outperforms other powerful metaheuristic algorithms in terms of solutions, dependability, precision, and rapid convergence for identifying the PV parameters of the single diode models.

Keywords: Parameter estimation, photovoltaic (PV) parameters, metaheuristic algorithms, Sparrow Search algorithm (SSA), Single -diode models.

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APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Optimized Control for Series-Connected Two Five-Phase Permanent Magnet Synchronous Machines Using Fuzzy Logic

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Abstract:

This study focuses on the development and analysis of a fuzzy logic control system for a series-connected configuration of two five-phase Permanent Magnet Synchronous Machines (PMSMs) powered by a single inverter. A fuzzy logic-based speed controller has been designed and utilized to drive the two-motor system. The models of the two-motor configuration, inverter, and fuzzy logic controller were implemented and evaluated using MATLAB/Simulink. The simulation results demonstrate the effectiveness of the proposed control model in regulating speed under various operating conditions. Additionally, it was observed that a suitable phase-order transposition enables the independent control of the two machines.

Keywords: Five-phase permanent magnet synchronous machines (PMSM), Fuzzy logic control, Series-connected, Two-motor, Vector control.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Solving the Optimal Power flow problems of The Algerian Electric Transmission Network Appling Stochastic Algorithm

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Abstract:

Nowadays, power systems have expanded significantly, this paper presents the application of a recent stochastic optimization method called Thermal Exchange Optimization (TEO) to address the Optimal Power Flow (OPF) management problem on the Algerian 114-bus electric transmission system. The study focuses on optimizing four objective functions: total fuel cost, emission gas, total real power losses, and total voltage deviation. The performance and efficiency of the TEO algorithm have been validated on the practical Algerian 114-bus electrical network. The results obtained using TEO demonstrate its effectiveness in solving large-scale OPF problems.

Keywords: Optimal power flow; Thermal exchange optimization (TEO), DZA-114 bus Algerian electrical transmission network.

Realization of Mixed A/D Treatment-based Power Converter Emulator used for HVDC Experiments

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Abstract:

In this paper, a power converter emulator used in the study of HVDC transmission line is designed and realized. Most previously reported are based on expansive-cost development platforms such as DSPACE or FPGA development boards, despite that the common topologies of HVDC transmission line are simple to realize and to study; for this, the main purpose of this work is to obtain real-world data and validate the simulation results of theoretical developed HVDC models by using a low-cost prototype.

Keywords: HVDC, Power Converter, Low-Cost Emulator, Microcontroller.

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Machine learning-based quantification of subsurface cracks in aluminium alloy plates using non-destructive testing signals

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Abstract:

This study explores the use of a novel eddy current testing (ECT) technique for detecting cracks of varying lengths and depths in aluminium and its alloys. A simulation model of the ECT system is developed to analyse the distribution characteristics of electromagnetic signals around the defect area. The normal magnetic component, Bz, is identified as the key signal for addressing the inverse problem of crack sizing. A deep learning inversion method is proposed to estimate the crack's geometric parameters based on Bz signals. The results obtained show that signals obtained from the new ECT probe enable comprehensive characterization of the cracks in terms of both length and depth, thereby strongly validating the effectiveness of the proposed ECT method.

Keywords: Eddy currents testing, Crack detection, Deep learning, Depth identification.

Cleaning Photovoltaic Panels using a Needle/Rectangle Configuration Ionic Wind Actuator

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Abstract:

This study focuses on the development of an innovative device for cleaning solar panels, utilizing the electrostatic forces generated by corona discharge. The design includes a high-voltage electrode consisting of multiple parallel needles and a grounded counter-electrode. The system is mounted on two motorized wheels located at both ends, allowing it to glide just a few millimeters above the surface of the solar panels. Dust removal is achieved through the generation of ionic wind, which flows from a narrow 5 mm-wide slot positioned beneath the device. The investigation involved evaluating the wind speed and cleaning efficiency in relation to both the speed of movement and the applied voltage. Experimental tests conducted using Sahara sand particles from Algeria demonstrated an ionic wind speed of approximately 2 m/s and a cleaning efficiency of up to 90%, with a power consumption of around 15 W.

Keywords: Corona discharge, Electric wind, Photovoltaic panel.

Instantaneous Histogram Normalization for Medical Image

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Abstract:

Our project focuses on leveraging histogram normalization to enhance the quality of medical images in real-time using an FPGA (Field-Programmable Gate Array). By implementing a normalization circuit described in VHDL (VHSIC (Very-High-Speed Integrated Circuits) Hardware Description Language), our work ensures an optimal dynamic range of pixels in the images, thereby improving the clarity of anatomical structures. By exploiting the parallel processing capabilities of FPGAs, our approach demonstrates the efficiency of this technology in meeting the performance requirements of real-time medical imaging. The results obtained highlight the importance of histogram normalization in improving medical images and offer a robust solution for a wide range of applications, including computer vision, video surveillance, and medical image processing.

Keywords: Medical image, FPGA, Real-time, Histogram normalization, VHDL.

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Binary Tree Growth Optimization for Feature Selection Applied in Bearing Fault Diagnosis

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Abstract:

This study proposes a novel approach to bearing fault identification using Artificial Neural Networks and Binary Tree Growth Optimization. The Case Western Reserve University's Bearing Centre provided the vibration dataset of defective bearings. Feature extraction has been applied to this dataset. Feature selection involved using Binary Tree Growth Optimization to eliminate unnecessary features. Finally, the classification based on Artificial Neural Networks occurs. This method achieves 98.8% accuracy, demonstrating its benefits in bearing faults diagnostic.

Keywords: Bearing Fault Diagnosis, Feature Selection, Binary Tree Growth Optimization, Artificial Neural Networks.

Study Electron Energy Exchange Processes in Vacuum Arc

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Abstract:

The objective of this study is to examine the underlying mechanisms that initiate an electric discharge in a vacuum. The objective is to elucidate the phenomenon of the generation of electrical charges (electrons and positive ions) that are essential for the transfer of current from the metal electrodes into the initially assumed "vacuum" medium. The initial phenomenon to be examined is the emission of electrons from the cathode, which is influenced by the electric field and the temperature at the cathode surface. Subsequently, the emission of electrons is followed by heating due to the Nottingham effect and the Joule effect. This results in the melting and evaporation of the cathode and/or anode metal, thereby providing a solution to the problem of creating the necessary material to carry the current.

Keywords: Electric arc, Electrical charges Nottingham effect, Current density.

ICAISD`25

INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

High-Efficiency MPPT Algorithm for PV Systems under Partial Shading and Fault Conditions

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Abstract:

This paper presents an advanced Maximum Power Point Tracking (MPPT) technique for photovoltaic (PV) systems based on the Grey Wolf Optimization (GWO) algorithm, inspired by the hunting behaviour of wolf packs. The proposed method efficiently addresses partial shading and short circuit faults, improving power generation stability and tracking accuracy by achieving the Global Maximum Power Point (GMPP). Results demonstrate the GWO-based MPPT's effectiveness in enhancing PV system performance under challenging conditions.

Keywords: Maximum power point tracking, Photovoltaic system, Grey Wolf Optimization, Faults.

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APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Common and Differential Modes for Series Chopper and Synchronous Switching Chopper

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Abstract:

Power electronics, more accurately termed 'energy conversion electronics,' is less than 50 years old. It has grown so rapidly that nearly 15% of the electrical energy produced today is converted in one form or another. Over the years, the size, weight, and cost of converters have steadily decreased, largely due to advances in electronic switches. The drives of receiving turbomachines, such as pumps, fans, blowers, and compressors, require adjustment of the operating point to align the machine with the process's operating parameters. In this context, this paper is dedicated to a simulation aimed at comparing a series chopper and a synchronous switching chopper, as well as analyzing electromagnetic interference (EMC) in conduction mode for both common mode (CM) and differential mode (DM). Both converters will drive a DC motor.

Keywords: EMC electromagnetic interference, CM common mode, DM differential mode, DC Direct Current motor.

Evaluation of Machine Learning Algorithms for Predicting Failures in Elevator Systems

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Abstract:

This project presents a comparative analysis of five machine learning algorithms for elevator fault prediction, aimed at optimizing predictive maintenance. Based on real elevator operation data, we evaluated the performance of each model (logistic regression, random forest, support vector machine, decision tree, k-nearest neighbors) using metrics such as accuracy, precision, recall, F1 score, and AUC. This study seeks to identify the most effective models for practical application in predictive maintenance, thus providing avenues to reduce maintenance costs and improve elevator reliability.

Keywords: Prediction, Failures, Maintenance, Elevators, Machine Learning.

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Federated Learning Framework for Respiratory Illness Detection using CNN-Attention

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Abstract:

This study presents a novel attention-based convolutional neural network (CNN-Attention) designed to classify pneumonia and COVID-19 in pediatric chest X-ray images. The architecture integrates attention mechanisms within the CNN framework to enhance feature extraction and improve classification accuracy. We evaluated this model against established architectures, including MobileNet, AlexNet, and ResNet-18, in both centralized and federated learning environments. The CNN-Attention model consistently outperformed its counterparts, achieving over 90% accuracy in centralized learning and demonstrating robust performance across clients in federated learning settings. These results underscore the effectiveness of the CNN-Attention architecture for respiratory illness classification and its potential for practical applications in healthcare.

Keywords: Pneumonia, Covid-19, Respiratory Illness, Deep Learning, CNN-Attention, Federated Learning.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

A Chaotic Gaining-Sharing Knowledge Algorithm with Opposition-Based Learning for the Infinite Impulse Response System Identification Problem

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Abstract:

In this paper, we propose a Chaotic Gaining-Sharing Knowledge-based algorithm integrated with Opposition-Based Learning (CGSK-OBL) to address the Infinite Impulse Response System Identification (IIR-SI) problem. The IIR-SI involves estimating the parameters of an IIR filter to accurately model the behavior of a given system. The CGSK-OBL is benchmarked against six prominent metaheuristic algorithms to validate its effectiveness. Performance evaluation is conducted using metrics such as mean squared error, execution time, and the number of function evaluations. The comparative analysis is further refined through the Friedman ranking test, which reveals that the CGSKOBL consistently achieves the lowest rank, demonstrating its superiority over the compared algorithms.

Keywords: Infinite Impulse Response System Identification, Chaotic Maps, Opposition-Based Learning, Gaining-Sharing Knowledge-based algorithm.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Assessment of magnetic Pollution Generated by Power Transmission Lines

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Abstract:

Electromagnetic pollution generated by overhead power transmission lines is a significant issue due to its potential impacts on the environment and human health. This study presents a numerical simulation-based investigation of these phenomena using finite element analysis software. The objective is to evaluate and compare the electromagnetic fields generated under different configurations, particularly in terms of line voltage, tower height, and conductor arrangement. The results provide insights into the intensity and distribution of electric and magnetic fields around overhead lines, considering various topographical and environmental parameters. The simulations also highlight the influence of structural modifications on reducing electromagnetic pollution levels. This numerical approach serves as an effective tool for optimizing the design of overhead power lines and proposing mitigation solutions that comply with international standards. It enhances the understanding of electromagnetic interactions and helps minimize their impacts, contributing to the development of sustainable and environmentally friendly power networks.

Keywords: Electromagnetic, Finite element, Line, Transmission.

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Fault Tree Analysis of a Robot KUKA KR 1000 titan

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Abstract:

This paper proposes a fault tree (FT) analysis technique to analyze the KUKA KR 1000 titan industrial robot, this analysis by Fault Tree (FT). This paper discusses the structural decomposition of subsystems, the different subsystems KUKA KR 1000-titan industrial robot, their technical characteristics, and the structure of the robot. The simulations and results obtained are presented and discussed.

Keywords: Fault Tree, KUKA KR 100 titan, Industrial robot, LabView, Modeling.

A Federated Meta-Learning Framework for Adaptive Edge Caching in IoV: Enhancing Scalability and Privacy

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Abstract:

The Internet of Vehicles (IoV) faces challenges such as high mobility, dynamic topology, and intermittent connectivity, which complicate efficient content caching. This paper proposes a novel Federated Meta-Learning (FML)-based adaptive edge caching framework for IoV. The framework combines federated learning (FL) and meta-learning to enable decentralized, privacy-preserving, and personalized caching strategies that adapt to the dynamic behavior of vehicles and content popularity trends. Experimental results show that the proposed framework improves cache hit rates by 30%, reduces latency by 25%, and achieves a 50% reduction in communication overhead compared to baseline methods.

Keywords: Internet of Vehicles (IoV), Federated Meta-Learning (FML), Federated Learning (FL), Meta-Learning.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Advancements in Computer-Aided Diagnosis Systems using Deep Multimodal Fusion: A Comprehensive Review

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Abstract:

Deep learning-based approaches are proven to have great results in learning informative representations from heterogeneous multimodal data. This review article examines advances in deep multimodal data fusion using deep neural networks for medical CAD1 systems. First, we present an overview of the main techniques used to combine information from numerous modalities. Also, we define the various challenges of the fusion approaches. Finally, we discuss the advantages and limitations of different neural network architectures used for multimodal data fusion.

Keywords: Data Fusion, Multimodality, Deep neural networks, Computer-aided diagnosis (CAD).

Fault Diagnosis of Capacitor Failures in Modular Multilevel Converters Using Artificial Intelligence based Technique

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Abstract:

The modular multilevel converter (MMC) has attracted considerable research interest in recent years due to its outstanding performance and flexibility. However, its complex configuration increases vulnerability to various faults, posing a significant challenge to reliability. Among these, capacitor failures are particularly critical, as they cause severe distortions in the converter's output. This study proposes a fault detection and identification (FDI) method for capacitor failures in MMCs, leveraging the Discrete Wavelet Transform (DWT) and Artificial Neural Networks (ANN). The capacitor voltages of individual submodules (SMs) are processed using DWT to extract detailed coefficients, which serve as input features for ANN training. The effectiveness and accuracy of the proposed approach are validated through MATLAB/Simulink simulations, highlighting its potential for reliable fault diagnosis.

Keywords: Modular multilevel converter (MMC), Capacitor failure fault, Fault detection and identification (FDI), Artificial neural network (ANN).

Rolling Bearing Defects Diagnosis based on EEMD, MED, and Correlation Coefficient

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Abstract:

This paper introduces a method for rolling bearing defect detection based on Ensemble Empirical Mode Decomposition (EEMD), Minimum Entropy Deconvolution (MED), and correlation coefficients. First, the original signal is decomposed using EEMD to extract the Intrinsic Mode Functions (IMFs). Next, relevant modes are selected by calculating the correlation coefficient between the obtained IMFs and the original signal. Then, the MED technique is applied to denoise the selected modes. Finally, the reconstructed signal is obtained by summing all the denoised modes. The proposed method is tested on experimental vibration signals, and the results demonstrate its ability to enhance kurtosis sensitivity, facilitating early fault detection in bearings.

Keywords : Empirical mode decomposition, Minimum entropy deconvolution, Bearing rolling defectss, Correlation coefficient.

Detection of weld defects in radiographic images using a chan-vese model, C-Means clustering, and an enhanced wavelet-based denoising approach

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Abstract:

In this paper, we propose a method for detecting weld defects in radiographic images, organized into three steps. First, image denoising is performed using an enhanced wavelet-based approach. Next, the fuzzy c-means (FCM) clustering algorithm is applied to the denoised image, allowing the selection of the relevant cluster as the initial contour. Finally, the Chan-Vese segmentation model is used to segment the image. The proposed method was tested on various radiographic weld images from the GDxray database. The results demonstrate the effectiveness of our approach compared to existing methods in the literature.

Keywords: Chan-vese model, Denoising, Fuzzy C-means clustering, Radiographic image, Weldin fault.

Effective Broken Rotor Bar Fault diagnosis in Induction Motor: A Hybrid Signal Processing and Machine Learning Approach

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Abstract:

This paper presents a novel approach for detecting and classifying rotor broken bar faults in three-phase induction machines using vibration signals and machine learning techniques. The study focuses on extracting time-domain features from vibration data to identify different rotor bar conditions, including healthy states, one broken bar, two broken bars, three broken bars, and four broken bars. Several machine learning classifiers, such as Decision Tree, K-Nearest Neighbors (KNN), Ensemble Tree, Support Vector Machine (SVM), and Random Forest, were employed to evaluate the system's performance. Machine learning was utilized to optimize the classification process, achieving high accuracy in fault detection. Among the classifiers, Random Forest demonstrated superior performance, providing the highest accuracy and system stability. The proposed method offers a reliable and efficient solution for early fault detection in induction machines, contributing to improved maintenance strategies and operational reliability.

Keywords: Fault diagnosis, Machine learning, Rotor Broken bar, Fault classification.

A Novel Machine Learning Approach for Driver Fatigue Detection Using ECG Signals

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Abstract:

Driver fatigue is a major contributor to road accidents, necessitating the development of robust detection systems to enhance road safety. This study proposes a machine learning-based framework for fatigue detection using electrocardiogram (ECG) signals. The publicly available DD-Database was utilized, containing physiological recordings from 10 healthy participants undergoing a driving simulation designed to induce drowsiness. ECG signals were preprocessed using a Butterworth filter, followed by feature extraction through Short-Time Fourier Transform (STFT). The Minimum Redundancy Maximum Relevance (mRMR) algorithm was employed for feature selection to optimize classification performance. Three machine learning classifiers—K-Nearest Neighbors (KNN), Support Vector Machine (SVM), and Naïve Bayes—were evaluated using 10-fold cross-validation. The results demonstrated that KNN achieved the highest classification accuracy (94.2%), outperforming SVM (90.7%) and Naïve Bayes (85.3%). These findings highlight the potential of ECG-based machine learning approaches for real-time driver fatigue monitoring. Future research will explore deep learning models to further improve detection accuracy and generalizability.

Keywords: Driver fatigue detection, Electrocardiogram (ECG), Machine learning, K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Short-Time Fourier Transform (STFT), Feature selection, mRMR algorithm.

Smart Nonlinear Control for a Parallel Active Filter

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Abstract:

Harmonic pollution is one of the major problems that degrades the quality of electrical energy in distribution systems. In this paper, we focused on the study of the parallel active filter based on a fuzzy PI regulator. The parallel active filter is studied is only a voltage inverter controlled for the compensation of the harmonic and reactive current circulating in the network based on a fuzzy regulator.

Keywords: parallel active filter, Intelligent artificial, Harmonic pollution, Compensation.

High Temperature Impact on Semiconductor CZTS Coating

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Abstract:

Magnetron sputtering is a method that deposits thin films. It works by firing ions at a material. This makes the material release atoms that then coat another surface, called a substrate. In solar cell manufacturing, this technique is essential. It helps in making very accurate layers of different materials, such as conductive layers and absorber layers. These are crucial for turning sunlight into electricity. Using this method boosts the efficiency, durability, and scalability of solar cells, which is vital for advancing solar energy technologies. In this study, we will focus on two semiconductors: silicon and CZTS, known as Copper Zinc Tin Sulfide. These materials are important for creating effective solar cells. By combining two programs, we will apply magnetron sputtering and create a model of a vacuum chamber. Through this setup, we will examine how high temperatures affect the plasma during the sputtering process. Additionally, we'll assess the quality of the thin film produced. Our findings will shed light on how temperature within the plasma positively influences the coating process.

Keywords: Sputtering, Thin film, Cells, Vacuum chamber, Coating.

ICAISD`25

INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Fractal and Wavelet Analysis of Leakage Current on High-Voltage Insulators

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Abstract:

This study presents an algorithm using the box-counting method to calculate the fractal dimension (FD) of leakage current signals in a high-voltage insulator model under various pollution conditions. Validated with fractional Brownian motion signals, the algorithm showed a 2% error. It was applied to leakage current signals and their wavelet transforms, decomposing them into 10 levels. FD increased with voltage and pollution conductivity in uniform pollution and also rose in non-uniform pollution. The approach helps diagnose the condition of polluted insulators.

Keywords: Fractal dimension, Leakage current, High-voltage insulator, Wavelet transforms.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Design Dual-Band Microstrip Patch Antenna by Using a Rectangular Hole

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Abstract:

Patch antennas are used in different types of equipment for transmitter and receiver signals that operate at high frequencies many devices such as mobiles, wireless devices and satellites, because they have different features like small size, directivity, space-saving, and efficiency. By using this kind of antenna, wireless communications are remarkable and rapid development, to be used in the medical, industrial, educational, military and the Internet of Things and other applications.

We designed a dual-band frequencies patch antenna in this paper, by using a new approach, by making a rectangular hole in the patch antenna microstrip, we got it a dual-band antenna in one layer. Our This patch antenna was designed to work at 3.8GHz for the first band and the second band is 6GHz, and it works in the open frequencies field. The values of the attenuation (S11) are equal to -42dB for the first band and -32dB for the second band, which are good and suitable values for both frequencies, and the same for the radiation patterns such as gain, radiation efficiency, and directivity.

Keywords: Microstrip Patch antenna, Antenna, Dual-band, ADS.

Automated Classification of SPS levels on High-Voltage Insulators Using Random Forest and Edge Detection

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Abstract:

This study presents an automated method to classify the pollution severity of High-Voltage insulators using discharge images, focusing on Site's Pollution Severity (SPS) levels. Discharge images from a glass insulator model, artificially polluted, were classified into three categories based on ESDD and NSDD values. The Random Forest classifier applied to 450 images, using features extracted through edge detection, achieved 88.58% accuracy. These results highlight the method's effectiveness for non-invasive insulator assessment and optimizing grid maintenance.

Keywords: High-voltage insulator, SPS, RF classifier, Discharge images, Edge detection.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Efficient and Compact MIMO Antenna Design for 5G Applications

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Abstract:

This article introduces an advanced dual-band 5G MIMO antenna design utilizing Coplanar Waveguide (CPW) technology. The structure features two semi-circles positioned on the lateral edges of the main feed line, centered by a rectangle on the same surface. The antenna operates efficiently in two frequency bands, making it highly suitable for modern communication systems.

Performance analysis was conducted using HFSS software, revealing simulation results for the S-parameter and bandwidths up to 10 GHz. The results demonstrated excellent alignment in current distribution, group delay, envelope correlation coefficients (ECC), and diversity gain, highlighting the antenna's high efficiency and versatility for dual-band applications.

Keywords: MIMO antenna, coplanar waveguide (CPW), 5G.

Design and Assessing the Performance of a Solar Heating System for a Cold Climate: Case Study of a School in Ain Tarek, Relizane, Algeria

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Abstract:

Maintaining comfortable indoor temperatures is vital for education quality, especially in cold regions. This paper simulates a solar-based heating system for a school near Ain Tarek, Relizane, using TRNSYS software. Results indicate efficient, sustainable heating throughout winter, reducing dependence on traditional energy sources, with a solar fraction of 0.82 and peak collector efficiency of 0.78.

Keywords: Solar heating, Building School, TRNSYS, Relizane, Simulation.

A New Approach for Integrating Hybrid Renewable Energy Systems into the Grid

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Abstract:

The integration of renewable energy sources into an unpredictable power grid is hindered by the absence of a dependable storage system and the need for a backup renewable energy source. To address these issues, many effective energy management strategies have been developed. In this research, we present a MATLAB/Simulink simulation model to demonstrate a novel approach to energy management for renewable energy sources. Our plan involves the integration of solar energy into the grid and the use of a hybrid photovoltaic system with storage. Our findings indicate that when solar energy is integrated into the grid and 25% of the energy is harvested, hydrogen gas (1631 ml/min) is produced and stored in a tank.

Keywords: Hybrid Hydrogen-Photovoltaic Storage System, Energy Management System, Solar Energy, Power Grid, Energy Storage.

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INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND SUSTAINABLE DEVELOPMENT

APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

High Efficiency Induction Motor Control (HEIM) Using Fuzzy Logic Type-1 and Type-2

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Abstract:

The aim of this work is to propose an approach to improve the performance of a high efficiency induction motor. Knowing that among the performance improvement techniques for machines that are already built is the adaptation of speed as needed firstly. In the other side we took advantage the richness of the control domain, starting with the order by classic PI, fuzzy -1 up to fuzzy type -2. We have tried to apply these techniques on a high efficiency induction machine whose parameters of the equivalent scheme are deduced by the optimized design of a conventional machine and hybrid genetic algorithms. The obtained results are satisfactory especially from the response time and the disturbance rejection.

Keywords: HEIM, Vector Control, Type-1 Fuzzy, Type-2 Fuzzy.

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APRIL 12-13, 2025 IN RELIZANE UNIVERSITY, ALGERIA

Fault Analysis in Robotic Machining and Finishing Cells using Lambda Petri Nets (λPN)

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Abstract:

This article focuses on the increasing importance of robots in manufacturing, particularly in machining and finishing operations. This paper proposes a new approach for modeling and analyzing faults within a machining robot cell. Therefore, we decided to use a hybrid analysis associating a Petri Net (PN) to a Fault Tree, resulting in a new technique called Lambda Petri Net (λPN). This work has been implemented in the LabView environment (Laboratory Virtual Instrument Engineering Workbench). Lambda Petri Nets in fault analysis allow natural language descriptions of process entities. The simulations and results obtained from the state of the operating system without and with fault are presented and discussed.

Keywords: Fault Tree, Finishing Operations, Machining Robot Cell, Modeling, Petri Net Lambda (λPN).

Predicting Smart Grid Instability Using Machine Learning Algorithms and Dynamic Feature Analysis

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Abstract:

Ensuring the stability of smart grids and enhancing their resilience against disruptions are critical challenges in energy management. This study explores the effectiveness of machine learning techniques in predicting the stability of electrical grids using a multidimensional dataset comprising dynamic parameters such as "rate" (tau), "pressure" (p), and "gradient" (g). Four popular algorithms were evaluated: Random Forest, Support Vector Machine (SVM), K-Nearest Neighbors (KNN), and Decision Tree. The results demonstrate that the SVM algorithm achieved the best performance with an accuracy of 98%, followed by Random Forest with 95%, showcasing their high capability to classify grids into stable and unstable states. Performance was assessed using confusion matrices and classification reports, highlighting the models' efficiency in minimizing errors. These predictions enable real-time grid parameter adjustments, enhancing their stability and operational efficiency. The study also suggests integrating additional data, such as weather conditions and consumption patterns, to extend the results and improve practical applications. This opens promising avenues for future research focused on optimizing smart grid performance using hybrid techniques and enriched datasets.

Keywords: Smart grids, Machine learning, Stability prediction, Dynamic parameters.

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Energy-efficient Resource Management in Cloud Computing

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Abstract:

Energy management has now become a critical and urgent issue in green computing. A lot of efforts have been made on energy efficiency computing at various levels from hardware components, system software, to applications. In this research, a novel artificial intelligence algorithm is proposed, called double threshold Q-learning VM migration (TQVM). The proposed algorithm is capable of setting two thresholds and Q-learning that is applied to address resource usage and energy consumption effectively. The experimental findings demonstrate that in spite of varying workloads, the technique is efficient.

Keywords: Cloud Computing, Q-learning, Energy consumption, VM migration.

Sustainable Energy Solutions for Greenhouses: A Case Study in M'ziraa, Biskra, Algeria

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Abstract:

Greenhouse cultivation has become essential for year-round food production, especially in regions with challenging climates. However, traditional energy sources for greenhouse operations (fossil fuels) incur high costs and contribute significantly to greenhouse gas emissions. This study investigates the feasibility of sustainable energy solutions, such as solar PV and potentially wind power, for greenhouse operations in M'ziraa, Biskra, Algeria, a region with abundant solar radiation but also extreme temperatures. A multifaceted approach, combining data collection, TRNSYS simulation modeling, will be employed to identify the most suitable and sustainable energy solutions for greenhouse operations in M'ziraa. This research will provide valuable insights for enhancing food security and mitigating climate change by promoting the adoption of sustainable energy practices in the greenhouse sector. The simulation outcomes demonstrated consistent Battery State of Charge (SOC) levels throughout the entire evaluation period. A Loss of Power Supply Probability (LPSP) of 0.15 was observed. These findings suggest that this approach presents a viable solution for addressing energy challenges in the greenhouses.

Keywords: TRNSYS, M'ziraa, Biskra, , Simulation, Greenhouse, Renewable energy.

Smart Energy Management: Machine Learning-Based Forecasting of Power Consumption

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Abstract:

Accurate energy consumption forecasting is critical for optimizing energy distribution, minimizing costs, and enhancing grid reliability. Traditional methods often struggle with nonlinear dependencies, necessitating the adoption of machine learning (ML) models.

This study explores multiple ML algorithms to predict energy consumption using diverse environmental and operational features. The methodology includes data preprocessing, feature selection, and model training, followed by performance evaluation using standard regression metrics. The results demonstrate that ML models effectively capture complex consumption patterns, offering promising insights for smart energy management. The findings highlight the importance of feature selection and model choice in achieving optimal predictive performance.

Keywords: Energy consumption forecasting, machine learning, predictive modeling, feature selection, regression analysis.

Elimination Circuits Heuristics for Electrical Distribution Networks Reconfiguration

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Abstract:

Distribution network reconfiguration during restoration prcess can be obtained at the expense of prohibitive cost due to combinatorial explosion on open/closed state switches. To avoid this problem, undirected graph associated with an instance of minimum spanning tree algorithms is used to span but the default zone. When distribution network includes more than one feeder, resulting solution do not respect radial network structure constraint. Heuristics rules associated to binary decision trees are then used to overcome this difficulty. Simulation results obtained from modified three feeders IEEE 16 bus distribution system test cases demonstrates the effectiveness of the proposed approach.

Keywords: Network reconfiguration, Minimum spanning trees, Binary decision tree, Radial network structure constraint heuristic’s rules.

Analysis of the Correlation between the Surface Potential of the Charged Conveyor Belt and the Efficiency of Electrostatic Separation

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Abstract:

Several electrostatic separators for metal belt conveyors have been designed and are currently in use in both research laboratories and industry. The main constraint of these separators is the impossibility of significantly increasing the electrostatic force by increasing the electrostatic field. One way of overcoming this drawback is to replace the metal conveyor belt electrode with a corona-charged plastic belt. The aim of this work is twofold: firstly, to characterize the surface condition of different types of polymer (PET, EVA and PVC) charged by corona discharge, mainly using non-contact measurement of surface potential; secondly, to evaluate the effects of two factors that can influence the efficiency of the corona-charged insulating belt conveyor-type electrostatic separator, namely the nature of the belt material and the polarity of the electrode systems. The effectiveness of these processes shows that they can improve the recovery and purity of products from industrial waste.

Keywords: Electrostatic processes, Triboelectricity, Triboelectric separator, Corona charging.

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Experimental Evaluation of Aerosol Collection Efficiency using a Capacitive Electrostatic Sensor based on Electric Charge Measurement

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Abstract-This work presents an experimental study aimed at evaluating the aerosol collection efficiency in an electrostatic precipitator using a new, small, and lightweight capacitive electrostatic sensor (CEC) based on total electric charge measurement with a sensitive electrometer. The adopted approach involves quantifying the electric charge of submicron particles from incense smoke in flow conditions, before and after their passage through the precipitation system. The collection efficiency of a two-stage electrostatic filter was determined by combining two methods: electric charge measurement using capacitive sensors placed downstream of each stage and optical analysis of submicron particles using a PALAS aerosol spectrometer. The results obtained allow us to characterize the collection efficiency and analyze the influence of operating parameters, particularly the applied voltage and flow rate, on the performance of the electrostatic precipitator.

Keywords: Electrostatic precipitator, Submicron aerosols, Electric charge measurement, Capacitive electrostatic sensor, Collection efficiency.

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Coot Optimizer Algorithm-based MPPT for PV Systems under Partial Shading Conditions

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Abstract:

Partial shading conditions (PSCs) complicate the power-voltage (P-V) curve of photovoltaic (PV) systems, featuring a single global maximum power point (GMPP) alongside multiple local maxima. Traditional MPPT algorithms often fail to locate the GMPP under these conditions. This study introduces a Coot Optimization Algorithm (COA) as an innovative approach for tracking the GMPP in PV systems. The drawbacks of conventional MPPT algorithms under PSCs are addressed by the suggested COA algorithm, as well as those of particle swarm optimization (PSO), including reduced tracking efficiency and prolonged tracking times. A comparative analysis conducted using MATLAB/Simulink evaluated the performance of the COA-MPPT in a PV array during PSCs, with results compared to those obtained using the PSO-MPPT. The simulation outcomes demonstrate that the COA technique consistently achieves efficiencies exceeding 95% under various conditions, underscoring its efficacy in enhancing the performance of PV systems. Furthermore, the findings indicate that COA surpasses the PSO technique in both tracking efficiency and speed.

Keywords: Photovoltaic Systems (PV), Global Maximum Power (GMP), Coot Optimization Algorithm (COA), Partial Shading Conditions.

Differentiation between Rotor Cage Faults and Mechanical Load Oscillations in an Induction Motor using a Neural Network

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Abstract:

The aim of this paper is to explore the contribution and effectiveness of using a feed-forward Multi-Layer Perceptron (MLP) Neural Network (NN) to differentiate between Rotor Cage Faults (RCF) and Mechanical Load Oscillations (MLO) in an induction motor. This approach leverages relevant information from both current and voltage measurements, utilizing various instantaneous power metrics, including active power, reactive power, and power factor. The advantages of employing the NN technique as a viable solution for discrimination are evaluated through simulation work.

Keywords: Rotor Cage Faults, Mechanical Load Oscillations, Induction Motor, Active Power, Reactive Power, Neural Networks.

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Euler Lagrange Control for Thermoelectric Generator System

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Abstract:

Thermoelectric generator converts heat directly into electricity using the seebeck effect. To maximize their efficiency, it is essential to operate TEGs at their maximum power point. The perturb and observe method is a commonly used technique for MPP tracking. However, it can exhibit oscillations around the MPP and may struggle with rapid change in thermal conditions. The Euler Lagrange-passivity technique is used with the classical P&O MPPT in a new approach.

Keywords: Euler Lagrange, thermoelectric generator, MPPT.

Mathematical Algorithm Model to Investigate the Nanoparticle Networks Behavior

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Abstract:

This work presents mathematical algorithm model used to investigate the nanoparticles networks for the bending and buckling analysis of simply supported nanowires using various classical and non-classical HSDT theories. Where we consider in the model of one-dimensional structure with including the surface effects based on the Gurtin-Murdoch with a surface elasticity theory (the SE non-classical beam theory) for small-scale effects based on Eringen's non local theory (the NL nonlocal beam theory), with the displacement divided into two components of bending and shear. The governing equations of the system are derived using the principle of minimum total potential energy and solved via Navier's solutions. Several numerical results are presented and compared to those given in the literature. The results showed that the influence of surface effects on the bending and buckling load of nanowires is greater than that of the non-local parameter.

Keywords: Algorithm, Non-local effect, Surface effect, Nanowires, Buckling analysis, Bending response.

Shockley-Read-Hall lifetimes effect on the power conversion efficiencies of Silicon solar cell

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Abstract:

The enhancement associated with maximum efficiency of silicon solar cell is achieved by obtaining the largest maximum power. Our electronic optimization of the silicon solar cell involves realistic Gaussian doping profiles of the bulk. We optimize contact material and practically feasible Shockley-Read-Hall (SRH) lifetimes. As the cell-thickness increases, the short-circuit current the open-circuit voltage of the cell increases due to more light-absorbing material, leading to a new optimum silicon solar cell cell-thickness. This balance between light-absorption and bulk recombination suggests an optimum thickness larger than that of the corresponding front contact solar cell. We consider a wide range of SRH lifetime and study the effect of lifetime variation on optimum cell-thickness. Our results suggest that for SRH lifetimes exceeding 1 ms, the optimum silicon solar cell thickness is 15 μm, in contrast to 110 μm optimum thickness of the hypothetical Lambertian cell. For SRH lifetimes 1 μs and 1 ms yields power conversion efficiencies of 27.2796 % and 31.6767 % respectively.

Keywords: Solar cell, SRH lifetimes, Cell-thickness, Conversion efficiencies.

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Urban sounds Classification using a Convolutional Neural Network (CNN) based on Short-Time Fourier Transform (STFT) features

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Abstract:

Urban sound classification has become a recent domain of research due to its applications in environmental. This study presents a classification model using a Convolutional Neural Network (CNN) combined with Short-Time Fourier Transform (STFT) features, designed to recognize various urban sounds. The model was trained on a dataset consisting of 1,302 annotated audio recordings, segmented into ten classes representing typical urban noises such as traffic, construction sounds, and human activities. Key steps in the model include feature extraction via STFT, data augmentation for robustness, and CNN architecture optimization. Evaluation results indicate a strong performance, achieving approximately 80% accuracy on validation data. This study contributes to developing effective urban sound classification systems that could enhance smart city initiatives and urban planning.

Keywords: urban sound classification, CNN, STFT**.**

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