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Abstract Index

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Deep Neural Network Classifier for Analysis of the Debrecen Diabetic Retinopathy Dataset

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Diabetic retinopathy (DR) is a serious complication that can occur in individuals who have diabetes. This disease affects the blood vessels in the retina, a part of the eye that is important for vision. Early detection of DR is key to preventing further complications and saving the patient's vision. The goal of Diabetic Retinopathy Debrecen Data Set Analysis is to get the best, most accurate results for medical professionals to receive appropriate Diabetic Retinopathy Debrecen prediction results through the stages of data collection, evaluation, and classification. Data is collected from existing secondary sources and then assessed using a deep neural network algorithm with various variations. The classification algorithm in this research uses the Python programming language to measure accuracy, F1-Score, precision, recall, and receiver operating characteristic (ROC) area under the curve (AUC). The test results show that the accuracy of the deep neural network algorithm is 79.94%, the F1 score reaches 79.16%, the precision is 79.58%, the recall is 79.60%, and the AUC is 79.56%. Thus, based on this research, the deep neural network data mining technique with variations of the four hidden layer encoder-decoder, sigmoid activation function, Adam optimizer, learning rate 0.001, and dropout 0.2 is proven to be effective. When compared with other variations such as decoder-encoder, 3-8 hidden layers, learning rate 0.1 and 0.01, the average difference in values between this variation and the others are 0.07% accuracy, 2.03% F1 score, 0.25% precision, 0.80% recall, and 0.90% AUC. Therefore, the deep neural network algorithm with the variation used shows significant dominance compared to other variations.

Keywords: algorithm, classification, diabetic retinopathy, deep neural network.

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Design of Two-Phase DC-AC Interleaved Boost Inverter with Voltage Control System using PI Controller

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DC-DC Interleaved Boost Converter (DC-DC IBC) topology was developed through the interleaving technique since conventional DC-DC Boost Converter has many problems related to complex circuit control, harmonics, and output power. In this research, DC-DC IBC was developed into a Two-Phase AC-AC Interleaved Boost Converter (TP AC-ACIBC), then combined with a Two-Phase Full Bridge Inverter to become a Two-Phase DC-AC Interleaved Boost Inverter (TP DC-ACIBI). TP DC-AC IBI has several advantages, including minimal current and voltage ripples and greater output power because it consists of two AC-AC IBCs. This research aims to meet highly regulated AC voltage needs with the renewable energy source input using the proposed topology, by implementing Proportional Integral (PI) close loop control system. The output voltage is detected using a voltage transducer LV-25P, then compared with a reference voltage and controlled using a PI controller to keep the output voltage consistently stable. The switching signal setting uses the Sinusoidal Pulse Width

Modulation (SPWM) technique by modulating the control output with a high frequency. As a verification step, testing was carried out using Power Simulator (PSIM) software and then validated by hardware testing in the laboratory. Testing was carried out using several test signals, and it was found that the proposed method worked well. System efficiency and Total Harmonic Distortion (THD) tests carried out using various load values, and a maximum efficiency of 93.87% and a minimum THD of 2.46% were obtained.

Keywords: DC-AC interleaved boost inverter, full-bridge inverter, PI Controller, voltage control

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Power Regulator Design Using LM317 for Precise and Efficient Power Management

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The Indonesian government plans to transition its transportation sector to electric vehicles (EVs) by 2025. Achieving this ambitious target will necessitate advancements in power management technologies. Therefore, the government is boosting research on energy efficiency, cutting power dissipation, and enhancing the reliability and lifespan of EV components. This study focuses on designing a power-efficient linear voltage regulator using the LM317, which is essential for EV power management. The regulator employs a voltage comparator to monitor feedback voltage and select the correct input voltage, ensuring efficient and stable output power. We tested the LM317 against the LM338 and LM350 in various setups. The results showed that the LM317 performed better in terms of voltage precision, efficiency, power dissipation, and temperature stability. Moreover, the LM317 achieved 75% efficiency in single-source setups and 85% in multi-source configurations, with a voltage precision of ±0.1%. The system's ability to dynamically select input sources ensures optimal performance for small-signal EV applications.

Keywords: power dissipation solution, LM317, regulated power supply, voltage regulator, electrical vehicle application.

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Compact Dual Port UWB MIMO Antenna with WLAN Band Rejection

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This research presents the design of a compact dual-port ultrawideband multiple input multiple output (UWB MIMO) antenna. The primary challenge in designing UWB MIMO antennas is achieving operation at the low-frequency band of 3.1 GHz while maintaining a small size. By modifying the patch shape to a tapered configuration, incorporating an inset feed, and adding a slit for the wireless local area network (WLAN) notch band, a rectangular monopole patch antenna successfully overcomes these limitations. The MIMO configuration of this antenna achieves a wide UWB bandwidth of 3.1-12 GHz with compact dimensions of 20×28.5×1.6 mm. The antenna exhibits excellent characteristics, including low mutual coupling (-15 dB), maximum gain of 3 dBi, low envelope correlation coefficient (ECC<0.01), high diversity gain (<9.95), low total active reflection coefficient (TARC <-20 dB), and nearly omnidirectional radiation pattern. These results demonstrate the suitability of the proposed antenna design for UWB applications.

Keywords: mutual coupling, UWB, MIMO, band notched, C-slot.

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Enhancing Remote Sensing Image Resolution Using Convolutional Neural Networks

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Remote sensing imagery is a very interesting topic for researchers, especially in the fields of image and pattern recognition. Remote sensing images differ

from ordinary images taken with conventional cameras. Remote sensing images are captured from satellite photos taken far above the Earth's surface. As a result, objects in satellite images appear small and have low resolution when enlarged. This condition makes it difficult to detect and recognize objects in remote-sensing images. However, detecting and recognizing objects in these images is crucial for various aspects of human life. This paper aims to address the problem of remote sensing image quality. The method used is a convolutional neural network. Our proposed method consists of two main parts: the first part focuses on feature extraction, and the second part is dedicated to image reconstruction. The feature extraction component includes 25 convolutional layers, whereas the reconstruction component comprises 75 convolutional layers. To validate the effectiveness of our proposed method, we employed the peak signal-to-noise ratio (PSNR) and structural similarity index (SSIM) as evaluation metrics. The test datasets consisted of Landsat-8 images, which were segmented into three regions of interest (ROI) of sizes 16×16 pixels, 24×24 pixels, and 32×32 pixels. The experimental results demonstrate that the PSNR/SSIM values achieved were 28.94/0.822, 30.24/0.089, and 33.24/0.925 for each respective ROI. These results indicate that the proposed method outperforms several state-of-the-art techniques in terms of PSNR and SSIM.

Keywords: remote sensing, convolutional neural network, image enhancement, deep learning, object recognition.

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Object Detection Approach Using YOLOv5 For Plant Species Identification

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Accurate identification of plant species is crucial for biodiversity conservation in modern agriculture and horticulture. However, manual identification methods often struggle with the complexity and overlapping visual characteristics of different plant species, making the process challenging. To address this issue, this research proposes using the YOLOv5 deep learning algorithm for automated plant species detection. The goal is to develop a model that is both effective and highly accurate in identifying plant species under various environmental conditions. The study utilized a dataset of 1,220 images representing nine plant species, such as Alocasia Macrorrhizos, Cactus, Costus Spicatus, Euphorbia tirucalli, and Sansevieria. The training process, which ran for 200 epochs and took approximately 53 minutes, resulted in a model with mAP of 85.73%, precision of 98.27%, and recall of 94.36%. The model demonstrated strong performance, accurately identifying plant species in both single and multiple object scenarios. The findings confirm that the proposed YOLOv5-based model is highly effective for plant species identification, offering both accuracy and efficiency. The success of the model in detecting plant species makes it a valuable tool for biodiversity conservation efforts and further development of AI-driven plant recognition technologies.

Keywords: AI (Artificial intelligence), deep learning, YOLO (You Only Look Once), plant species identification.

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Development of the Android Application for the Landslide Disaster Mitigation Real-time System Based on Firebase Server and OneSignal

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This article presents the development of SIDASIBELO (Landslide Information and Mitigation System), an Android-based application for real-time landslide monitoring and early warning. This system integrates data from several sensors that measure soil moisture, rainfall, slope angle, and ground vibrations at the monitored locations. The Firebase Real-time Database stores and transmits sensor data, while Firebase Cloud Messaging and OneSignal enable push notifications to alert users about potential landslide risks. There are four output status levels: SAFE, ALERT,

CAUTION, and WARNING, which are determined on the basis of a comprehensive analysis of the monitored parameters. Mitigation strategies include monitoring of parameters in real time, early warnings, evacuation guidance, and user education on landslide preparedness. Testing on several Android devices demonstrated high compatibility, with an average successful server connection rate of 92.86%. The latency tests indicated an average response time of 894 ms from the input device to the database, 1.29 ms from the database to the Android device, and 2725 ms for push notifications. The total daily bandwidth usage of the system for real-time data transmission is 27,648MB, indicating high efficiency without overburdening the server's performance. While the app operates efficiently under ideal conditions, unstable network connections can lead to data retrieval failures or, in the worst cases, to app malfunctions. This remains a key challenge for our system. This system aims to increase awareness of landslide risks and allow rapid evacuation, which could potentially reduce the negative impacts of landslides in vulnerable areas.

Keywords: Landslide early warning system, Firebase, mobile application, OneSignal.

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Enhancing Solar Panels Efficiency: The Impact of Robotic Cleaning and Optimal Trajectory Tracking in the Presence of Disturbances Using Model Reference Adaptive Control

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The output power of photovoltaic systems (PV) can be significantly reduced by dust accumulation. Among various cleaning methods, robotic cleaning is currently the most popular choice because it minimizes human effort and reduces the risk of damaging PV cells. However cleaning robots can be impacted by various external disturbances, including wind, rain, lightning, snow, thunder , and vibrations. Additionally, sensor errors related to slip, position, velocity, acceleration, and varying electrical parameters can also affect their performance. Several methods have been proposed in the literature for tracking the robotic cleaning trajectory of PV systems. Nevertheless, most of these methods struggle in the presence of disturbances and often have prolonged convergence times. This paper aims to propose a Model Reference Adaptive Control system to maintain optimal performance and extend the lifespan of PV panels, minimize power losses, reduce convergence time, achieve optimal tracking of the desired cleaning trajectory amidst disturbances, and decrease the dependence on multiple sensors. In our study, we utilized the iRobot solar panel developed by Aravind et al., which has a power capacity of 250 W and weighs 250 kg. This iRobot can effectively clean approximately 930 solar panels of the Kyocera Solar KC 130 GT module, which measures 1.425 m in length and 0.652 m in width. The iRobot operates for 4 hours, covering an area of 864 m², and can clean a surface area of 0.06 m² in one second. We conducted simulations using the proposed MRAC algorithm in Matlab/Simulink software, comparing the results with those obtained from a Proportional Integral Derivative (PID) algorithm. The results demonstrate that the MRAC approach achieves a shorter convergence time and greater precision in following the desired cleaning trajectory of the robot, even in the presence of disturbances, compared to the PID algorithm.

Keywords: Robotic, Model Reference Adaptive Control, Cleaning, Trajectory, PV System

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The implementation of Mamdani Fuzzy Logic Control on a Hexapod Robot as a Guide for Visually Impaired People

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The limitations of visually impaired individuals have encouraged innovations in human aid for them. One of those innovations is a robot that can act as guides for visually impaired individuals, and there are numerous studies focused on using robots as

guides for them. However, these robots still face some limitations, particularly in navigating rough and uneven terrain. To handle this issue, we tried to develop a hexapod robot capable of traversing uneven surfaces more effectively than wheeled robots. The hexapod robot in this research is designed to be autonomous and employs fuzzy logic as its control method. The result shows that the hexapod robot has outstanding performance, attaining a 100% success rate in navigating the specified path and demonstrating a reliability of 79.78%. The constraints faced by visually impaired individuals have spurred various human-created innovations to aid them. One such innovation is the use of robots as blind guides. Numerous studies have explored using robots as guides for visually impaired individuals. However, these robots still face limitations, particularly in navigating rough and uneven terrain.

Keywords: visually impaired individuals, hexapod robot, autonomous robot, fuzzy logic.

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On the Impact of the Number of Tiles and Partitioning of RISs on the Maximum Achievable Intensity

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Reconfigurable intelligent surface (RIS) is a key technology to enable the concept of a smart radio environment (SRE), which is envisioned to meet the ever-increasing demands of connectivity in the upcoming decade. However, most existing works consider an RIS that is seen as a whole surface. However, most existing works consider an RIS that is seen as a whole surface. In this paper, we study the performance of an RIS that consists of multiple tiles, each of which is capable of performing certain wave manipulations, by deriving the physics-compliant analytical formulation of the received signal at the receiver. We also introduce the numerical approximation of the signal for different operating regimes and different functionalities. Based on the obtained result, we study the impact of the number of fixed-size tiles and partitioning of a fixed-size RIS on the maximum achievable intensity. The validity of our findings is confirmed through extensive simulation results.

Keywords: Reconfigurable intelligent surface, smart radio environment, multi-tile RIS, maximum achievable intensity.

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