Artificial Intelligence of Things

Istanbul, Turkiye

Abstract Book

December 2024

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Disease Detection and Control in Field Crops with UAV and Image Processing Techniques

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Abstract. The use of unmanned aerial vehicles (UAVs) and image-processing techniques has revolutionized disease detection and control in field crops. This essay aims to explore the potential of UAVs and image-processing techniques for monitoring and managing plant diseases, particularly in large-scale crop production. Several studies have demonstrated the efficacy and accuracy of using UAVs to capture high-resolution images, which can be processed with machine learning algorithms to detect and classify crop diseases. The utilization of UAVs in crop disease management can significantly reduce labor costs and improve the accuracy and timeliness of disease detection. In addition, UAVs can be equipped with precision sprayers that apply fungicides and insecticides to targeted areas, reducing chemical use and minimizing environmental impact. However, despite the potential benefits, several challenges remain in realizing the full potential of UAVs in crop disease management. These challenges include regulatory and legal barriers, issues with data storage and analysis, and technical limitations of UAVs. Nevertheless, the use of UAVs and image-processing techniques remains a promising approach that could transform how we monitor and manage crop diseases. The paper explores techniques for identifying plant diseases using leaf images, as well as the segmentation and feature-extraction algorithms employed in the detection process.

Keywords: Crops Disease Detection, Image Processing, Leaf Images.

Comprehensive Survey on Network Slicing in 5G

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Abstract. The advent of 5G technology has ushered in a new era of connectivity, promising incredible speeds, reduced latency, and greater reliability. In comparison, 5G would transform our environment by enabling vertical industries to access the telecommunications landscape. Vertical industries will benefit from 5G's support in realizing Omni-Current's "Internet of Everything" dream: wired, highly secure, ultra-low-latency connectivity for massive devices. On the other hand, the growing use of multimedia content and consumer demand for high-quality services have resulted in a fundamental shift in how we handle networks, with greater abstraction, separation, and visualization of service aspects related to routing, control, and management. This paper explores network slicing in the context of 5G networks. It highlights the components, benefits, and technological innovations associated with network slicing. The paper emphasizes the need for upgrading existing network architectures and discusses the importance of interoperability, orchestration, and business models. It provides a concise overview of network slicing terminology and its significance in enabling customized services. By synthesizing existing research findings and identifying gaps in the literature, this survey aims to provide researchers, practitioners, and policymakers with valuable insights to foster the development and deployment of network slicing in 5G networks.

Keywords: 5G, Network, Slicing, NFV, SDN

Fine-Tuning Hyperparameters for Performance Comparison of Fruit Ripeness Classification Using a Convolutional Neural Network

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Abstract. Fruits, especially bananas, are among the world's most popular and widely consumed, known for their nutritional value and convenience. However, achieving optimal consumer satisfaction and reducing supply chain wastage requires an accurate assessment of banana ripeness. Accurately determining banana maturity is crucial for optimizing harvest and distribution while preserving the right vitamins or substances. Current methods rely heavily on manual judgment, making them subjective, inconsistent, and labor-intensive. Therefore, a more efficient and consistent solution is needed to determine banana ripeness. Hyperparameters that are essential for neural network deployment, and tuning them, can greatly affect convergence speed and the quality of the learned model. In this work, the focus was on fine-tuning hyperparameters, such as batch size, number of epochs, optimizer type, and rectified unit, and evaluating them for banana ripeness classification. The dataset used is the Banana Ripeness Images dataset, which consists of 4 classes, each containing 2011 images, for a total of 8044 images. The dataset is split into two parts: 80% for training and 20% for validation. For testing, randomly selected images are taken from Google for each class. The results show that the highest training accuracy is 99.63% with the RELU activation function, the NADAM optimizer, a batch size of 64, and 20 epochs. When the model is tested on the test dataset, it achieves 100% accuracy across all categories.

Keywords: Banana ripeness, Convolution Neural Net.

Machine Learning Techniques for Wastewater Treatment Plant Threat Classification and Effluent Quality Prediction

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Abstract. In wastewater treatment plants (WWTPs), this study assesses how well several machine learning models predict effluent quality and categorize effluent threats. In the first task, regression models such as Linear Regression, Random Forest, AdaBoost, and Gradient Boosting are used to predict Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). Mean Absolute Error (MAE) and R-squared (R^2) were used as evaluation metrics. Using the same models, the second task's objective was to categorize effluent threat levels. Accuracy, precision, recall, and F1 Score were used to gauge performance. With the lowest MAE of 6.09 and the best R2 of 0.82, the results demonstrate that Linear Regression and Gradient Boosting performed similarly in terms of COD prediction. Random Forest had the lowest MAE of 1.61 and performed well in predicting BOD. With superior precision, recall, and F1 scores demonstrated by Gradient Boosting, AdaBoost, and Logistic Regression, classification models attained an overall accuracy of 97%. According to the results, machine learning methods, particularly gradient boosting, can significantly improve effluent quality prediction and classification accuracy, thereby enhancing WWTP management processes.

Keywords: Waste treatment, Deep Learning, Feature Selection.

SmartSync: Revolutionizing Remote Work with AIoT Virtual Office Interactivity

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Abstract. Our homes are where we spend a significant portion of our time, engaging in activities from sleeping to dining. However, due to the COVID pandemic and various economic factors, an increasing number of people have started working from home, thereby escalating the demand for professional and smart home offices. A pivotal aspect of enabling effective work-from-home arrangements is integrating smart technology into these offices. This objective can be achieved in an intriguing way by applying the concept of Artificial Intelligence of Things (AIoT). In this work, we propose a system for real-time interaction between the user and the office environment, leveraging AIoT to collect and analyze data from both physical surroundings and virtual meetings. This approach empowers users, especially those participating in virtual meetings on platforms like Zoom, to have enhanced control over both their virtual and physical workspaces. Our initial research highlights the significant utility and necessity of AIoT-enhanced meetings, offering users flexible and intelligent options to manage their work and surroundings more effectively.

Keywords: Artificial Intelligence of Things, Real-time, Virtual meetings, Physical workspaces.

Smart Grid Technology of Self-Healing Electrical Power Distribution and Fire Detection System

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Abstract. The use of unmanned aerial vehicles (UAVs) and image-processing techniques has revolutionized disease detection and control in field crops. This essay aims to explore the potential of UAVs and image-processing techniques in monitoring and managing plant diseases, particularly in large-scale crops. Several studies have demonstrated the efficacy and accuracy of using UAVs to capture high-resolution images, which can then be processed with machine learning algorithms to detect and classify crop diseases. The utilization of UAVs in crop disease management can significantly reduce labor costs and improve the accuracy and timeliness of disease detection. In addition, UAVs can be equipped with precision sprayers that apply fungicides and insecticides to targeted areas, reducing the amount of chemicals used in crop treatments and minimizing environmental impact. However, despite the potential benefits, several challenges remain in realizing the full potential of UAVs in crop disease management. These challenges include regulatory and legal barriers, issues with data storage and analysis, and technical limitations of UAVs. Nevertheless, the use of UAVs and image-processing techniques remains a promising approach that could transform how we monitor and manage crop diseases. The paper explores techniques for identifying plant diseases using leaf images, as well as the segmentation and feature-extraction algorithms employed in the detection process.

Keywords: Distribution Automation, Smart Grid, Self-healing, Reliability.

Combatting Online Hate: A Study on Detecting and Preventing Hate Speech Across Social Media Platforms

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Abstract. Social media now plays a vital role in our daily lives, thanks to advances in technology and the ease of internet access. Especially on Twitter, thousands of tweets are shared every day. Alongside constructive comments, numerous tweets containing hate speech are also shared. Many comments on Twitter and other online platforms, such as e-commerce sites, forums, news sites, and other social media, contain hate speech. The widespread use of hate speech in online environments leads to the marginalization of different groups and thoughts that diverge from the established ideology in societies, resulting in prejudice and discrimination from the community. This study is conducted to prevent the negative consequences caused by hate speech. In the study, two datasets obtained from Kaggle were used. The first dataset comprises Twitter data, while the second comprises comments from other social media platforms. The Random Oversampling technique was employed to adjust the dataset imbalance. Random Forest (RF), AdaBoost, Extreme Gradient Boosting (XGB), CatBoost, Bidirectional Long Short-Term Memory (Bi-LSTM), Long Short-Term Memory (LSTM), and Gated Recurrent Unit Networks (GRU) were utilized. The accuracy rates, confusion matrices, precision, recall, F1 Scores, and accuracy/loss plots obtained from the algorithms were compared. Bi-LSTM achieved the highest performance at 94.58%.

Keywords: Hate Speech Detection, Random Oversampling, Machine Learning Algorithms, Deep Learning Algorithms.

Drone Detection and Recognition Using Visual Range Based on a Deep Convolutional Neural Network

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Abstract. The rapid development of unmanned aerial vehicles (UAVs), or drones, which can fly at different speeds and altitudes and are more affordable for civilians, has led to a rapid spread of their civilian use. These aircraft, due to the materials they carry on board, can pose negative effects, threatening the state's infrastructure and industries, as well as the security of the civilian population. For this reason, automated drone detection is considered an essential task within air security systems. Because of the great similarity between drones and birds, both physically and behaviorally, and they are often confused, this study proposes a new method based on visual range and recent developments in deep neural networks (DNNs) to effectively detect and identify drones and birds. The proposed approach was evaluated using image data and found to be a better detector than previous detection systems. Four models were trained and tested (Resnet50, Resnet18, Mobilenetv2, and Alexnet), and their results were compared in detecting drones and differentiating them from birds. To train the network, a diverse and comprehensive dataset (BVD) was used, which includes a wide range of scenarios under different environmental conditions, multiple drone types, with an equal distribution of drone and bird instances, and includes label information. The suggested deep learning method can detect a drone and distinguish it from a bird with an accuracy of 95% (Resnet50), 91% (Resnet18), 90% (Mobilenetv2), and 85% (Alexnet). The average precision values were also reported as 95% (Resnet50), 95% (Resnet18), 89% (Mobilenetv2), and 82% (Alexnet).

Keywords: Deep-Convolutional-Neural-Network, Detection & Tracking Systems.

Integrating Column Generation with Reinforcement Learning for Optimal Solutions in the One-Dimensional Cutting Stock Problem

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Abstract. The cutting stock problem (CSP) has long been a cornerstone of combinatorial optimization, addressing critical manufacturing challenges by efficiently cutting standard-sized materials to meet customer demands. Despite its significance, solving CSP remains a formidable task due to its NP-hard nature. Various exact and heuristic methods have been explored, including linear programming, cutting plane algorithms, heuristics, and metaheuristic techniques. Recently, there has been a growing interest in integrating Reinforcement Learning (RL) into CSP solutions, leveraging its ability to adapt to dynamic environments and optimize cutting patterns. This study presents a novel algorithm that combines Column Generation (CG) with RL to obtain optimal integer solutions that maximize the material utilization for real-world CSP instances. Unlike traditional RL methods, which aim to obtain integer solutions directly, our approach integrates CG to derive cutting patterns and LP relaxations, then employs RL to obtain integer solutions that maximize the utilization of standard-sized materials in the cutting process. This step-by-step learning process provides a direct solution for each sub-problem of the main large CSP instance related to demand changes, thereby enhancing efficiency and effectiveness in production planning. Case studies demonstrate the efficacy of our method in maximizing the utilization up to 92%, offering promising avenues for future research in this domain.

Keywords: Reinforcement Learning, Cutting Stock Problem, Production Planning.

Developing an Intelligent Wheelchair for Individuals with Congenital Disabilities in Somalia

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Abstract. The use of unmanned aerial vehicles (UAVs) and image-processing techniques has revolutionized disease detection and control in field crops. This essay aims to explore the potential of UAVs and image-processing techniques for monitoring and managing plant diseases, particularly in large-scale crop production. Several studies have demonstrated the efficacy and accuracy of using UAVs to capture high-resolution images, which can then be processed with machine learning algorithms to detect and classify crop diseases. The utilization of UAVs in crop disease management can significantly reduce labor costs and improve the accuracy and timeliness of disease detection. In addition, UAVs can be equipped with precision sprayers that apply fungicides and insecticides to targeted areas, reducing the amount of chemicals used in crop treatments and minimizing environmental impact. However, despite the potential benefits, several challenges remain in realizing the full potential of UAVs in crop disease management. These challenges include regulatory and legal barriers, issues with data storage and analysis, and technical limitations of UAVs. Nevertheless, the use of UAVs and image-processing techniques remains a promising approach that could transform how we monitor and manage crop diseases. The paper explores techniques for identifying plant diseases using leaf images, as well as the segmentation and feature-extraction algorithms employed in the detection process.

Keywords: Manual Wheelchair, Emergency Helping System, Control, Assistive devices, People with Disabilities.

Comparative Impact of Morphological Preprocessing on CNN-Based Plant Disease Detection

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Abstract. Effective detection of plant leaf diseases is crucial for enhancing agricultural productivity and minimizing crop losses. This study examines the integration of Convolutional Neural Networks (CNNs) with morphological operations, specifically skeleton and opening methods, for the precise identification of plant leaf diseases. CNNs are used due to their high capabilities in feature extraction and image classification. The CNN model trained on a dataset consisting of healthy and diseased leaf images exhibits robust performance in disease detection. Additionally, morphological operations are applied to facilitate a detailed analysis of leaf vein patterns and affected areas, enabling a more in-depth examination of the leaf structure. A comparison of results from CNN models using skeleton and opening operations shows that the opening operation achieves a 80% success rate in disease detection. This finding demonstrates that the effectiveness of the opening method in detecting plant diseases surpasses that of the skeleton method. As a result, this integrated approach has the potential to increase agricultural productivity by providing an advanced and reliable solution for plant health monitoring.

Keywords: CNN, Morphological Operations, Opening Operation, Skeletonization, Image Processing.

Optimizing Heart Disease Prediction Using Fusion Feature Selection and Stacking Ensemble Approach

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Abstract. As heart disease continues to be one of the leading causes of death worldwide, the demand for accurate and rapid prediction tools for early detection and risk assessment is becoming increasingly urgent. This study introduces a novel approach that combines a feature selection fusion method with an ensemble stacking technique to predict heart disease. The approach leverages a comprehensive dataset that includes personal information, medical records, lifestyle factors, and clinical data. The hybrid feature selection method used in this study is pivotal, as it identifies the most relevant features for machine learning models to predict heart disease. The approach combines the strengths of two statistical techniques: analysis of variance (ANOVA) and the chi-square test. ANOVA is useful for continuous data analysis, while the chi-square method is particularly effective for handling categorical data. Together, these techniques help identify the most important subsets of attributes. In addition to selecting these key features, a stacking ensemble method is applied to further enhance prediction accuracy. This technique integrates multiple machine learning models, optimizing the use of hybrid features to achieve maximum performance. The result is a remarkable 93.44% accuracy rate, demonstrating the effectiveness of this combined approach in improving cardiovascular disease prediction compared to previous methods.

Keywords: Heart Disease Prediction, Ensemble Stacking, Chi-squared, ANOVA.

Techno-Economic Assessment of Renewable Energy Integration in Higher Education Institutions in Somalia: Case Study of Jamhuriya University of Science and Technology

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Abstract. The integration of renewable energy sources, such as solar and wind power, into the energy mix of developing countries offers a promising avenue for sustainable development. This study investigates the economic viability of a hybrid solar, wind, and grid-connected energy system in Somalia, with a specific focus on Jamhuriya University. The aim of the research is to evaluate the potential economic advantages and feasibility of integrating renewable energy sources with the existing grid infrastructure. The analysis includes a comprehensive assessment of the cost-effectiveness, return on investment, and potential energy savings associated with the proposed hybrid system. Factors such as solar and wind resource availability, electricity demand profiles, and financial considerations are considered during the evaluation. The study's findings provide valuable insights into the economic viability and sustainability of hybrid energy systems in Jamhuriya University of Science and Technology. The results also highlight the economic and environmental benefits, as well as potential challenges, associated with adopting renewable energy solutions in the region, thereby offering a blueprint for other institutions and communities grappling with energy challenges.

Keywords: Photovoltaic, Economic Viability, Energy Transition, Economical Analysis, Hybrid PV-wind-grid Tied System.

IoT LWC Secure Data Communication for Devices: A Review

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Abstract. In terms of research and innovation, the Internet of Things is one of the most promising areas. IoT platforms are taking place in almost every sector, from healthcare to smart cities to smart agriculture. IoT mainly consists of three units: sensor units, a microcontroller/microprocessor unit, and an actuator. These sensors can generate enormous amounts of data wherever they are deployed to monitor. The transmission of this data is not secure, as there are no defined IoT architectures to date. The architecture of IoT varies depending on the application it is targeting. In this review article, we have discussed data transmission security, the reasons behind the lack of data security in IoT, a model for improving security-related issues in IoT, and the importance of cryptography, including lightweight cryptography, in IoT. This article addresses the issues in securing the data of Internet of Things devices.

Keywords: Algorithms, Lightweight Cryptography, Cryptography, Cyber Security, Internet of Things, Cipher.

A Comprehensive Analysis of the Impact of Artificial Intelligence on Advertising Strategies

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Abstract. In advertising, Artificial Intelligence (AI) plays a pivotal role in revolutionizing targeting strategies by analyzing vast datasets to identify precise audience segments. Additionally, AI-driven algorithms optimize ad placement and content creation, enhancing engagement and conversion rates. Its real-time analysis capacity empowers advertisers to adapt swiftly to evolving market trends, ensuring campaigns remain effective and competitive. This extensive review delves into the dynamic realm of Artificial Intelligence (AI) in the advertising domain, integrating insights from pivotal research. It delves into the multifaceted influence of AI on advertising, showcasing its ability to enhance ad precision and streamline operations through various machine learning techniques. Furthermore, the paper elucidates AI's revolutionary potential to foster personalized advertising and facilitate content creation. This review underscores the symbiotic relationship driving advancements in advertising strategies by highlighting the intrinsic interconnectedness of key AI components, including targeting, personalization, content generation, and ad optimization.

Keywords: Advertisement, Machine Learning, Targeting, Personalization, Ad Optimization, Sustainability.