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AI and the Future of Computing Professions: Adapt, Evolve, Lead

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Presentation/Paper Type: Oral

Abstract **–**Artificial Intelligence (AI) is no longer confined to research labs or experimental models—it is actively reshaping the roles, responsibilities, and required skill sets of computing professionals across disciplines. This interactive session aims to engage participants in a dialogue about how AI technologies—from machine learning to generative models—are transforming software development practices, system design paradigms, cybersecurity frameworks, and the broader computing workforce. Rather than a one-way presentation, this session will foster mutual exchange, where the audience are invited to share their experiences, concerns, and expectations.

We will begin by outlining the macro trends driving change in the computing field: the automation of coding tasks, rise of AI-assisted development environments (e.g., GitHub Copilot, ChatGPT Code Interpreter), and evolving standards around data ethics, algorithmic accountability, and continuous learning. These shifts are introducing new types of collaboration between humans and machines, while also posing critical questions: What skills should computing professionals prioritize? How will career paths evolve? What new ethical or regulatory responsibilities might emerge?

Participants will be encouraged to reflect on their own roles and contribute perspectives on how AI is shaping (or disrupting) our work. Together, we aim to uncover practical insights and strategic directions for navigating a future where computing professionals are not only AI users, but also its architects, integrators, and critics.

Keywords –Artificial Intelligence in Software Development, Future of Computing Work, Ethical Challenges in AI, Continuous Learning in Tech Careers

Eyes in the Sky, Words on the Ground: Remote sensing image captioning for defense applications

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Presentation/Paper Type: Abstract

Abstract – In this work, the use of artificial intelligence to interpret and describe satellite and aerial imagery using natural language is investigated. This process is commonly known as remote sensing image captioning. The study begins by introducing how visual inputs can be processed and linguistically expressed by vision-language models, enabling complex remote sensing data to be better understood by analysts and decision-makers. A general overview of the image captioning process is provided, where it is explained how such models are trained on real-world image-caption datasets. Through this training, models are enabled to extract significant visual features and generate relevant textual descriptions. Commonly used datasets, including those containing urban, coastal, and industrial scenes, are presented, and the internal structure of the model is briefly described. Model performance is evaluated using standard captioning metrics, and the effectiveness of the generated descriptions is assessed based on their accuracy and relevance. Finally, real-world application areas are discussed, with particular emphasis placed on defense-related domains such as aerial, naval, and ground operations, as well as urban and regional planning. The study concludes with future perspectives on building more adaptive and real-time systems to support critical tasks in both military and civil contexts.

Keywords – Remote sensing, image captioning, vision-language models, defense applications, satellite imagery

Cognitive AI for Avionic Mission

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Abstract **–**Modern avionic mission systems operate under extreme conditions—high data throughput, rapid decision cycles, and mission-critical demands for precision and reliability. In such environments, traditional rule-based automation often falls short in adapting to dynamic contexts or supporting human cognition. This presentation explores the integration of Cognitive Artificial Intelligence (AI) into avionic architectures as a means of enhancing real-time decision-making, situational awareness, and human-machine collaboration in defence operations.

Cognitive AI systems emulate human mental processes such as perception, attention, memory, and decision reasoning. When embedded into mission computers, these systems can filter and prioritize sensor data, anticipate operator intent, and generate explainable recommendations under rapidly changing conditions. Through a scenario-based walkthrough of an ISR (Intelligence, Surveillance, Reconnaissance) mission, we demonstrate how Cognitive AI assists in detecting anomalies, prioritizing threats, and reducing operator workload without compromising safety or control.

The presentation also addresses integration challenges—including real-time constraints, explainability requirements, and compliance with certification standards like DO-178C—while outlining future directions such as hybrid Cognitive-Generative AI, adaptive autonomy, and ethics-aware system design. Ultimately, we argue that Cognitive AI is not a replacement for human decision-makers, but a strategic enabler that augments their capacity in increasingly complex mission environments

Keywords –Cognitive Artificial Intelligence, Avionic Mission Systems, Human-in-the-Loop Decision Support, Situational Awareness, Explainable AI in Defence Applications.

Autonomous Medical Evacuation and Patient Movement in Warfare

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Presentation: Oral

Abstract – In the AI era, the military organizations and the defense industry have to modernize all equipment and operational units to meet the changing needs of modern armed conflict. The application of AI in the military field has become a major topic of interest to support soldiers on the battlefield. Artificial intelligence can be used to enhance surgical and resuscitative intervention on the battlefield and systems that can improve the speed and accuracy. Integrating these systems into a medical treatment facility can minimize delays in the initiation and handover of life-saving interventions. Unmanned aerial vehicles and vertical take off and landing aerial vehicles with a life support care-capsule, can evaquate the wounded persons successfully. The autonomous systems can improve survival and reduce human risk when recovering and removing the wounded soldiers from the battlefield in crewless vehicles, in the high-stressed environments of severe trauma management. The system monitoring total battlefield data and continuous real time health data of the soldiers on the battlefield with wearable sensors. The system make a triage of the wounded soldier, evacuation him with a vertical take off and landing aerial vehicles wtih the capsule autonomously. The developed system, or rather its individual components such as portable measurement modules, provides high mobility and autonomy, which is vital in dynamically changing battlefield conditions. By harnessing these technologies, the Army health system may gain advantage in healthcare.

Keywords – Battlefield, AI, Unmanned Medical evacuation, Resuscitation, Emergency Triage,

Tactical Sign Language Recognition Systems: Deep Learning-Based Silent Communication

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Abstract – In modern defense and security operations, where speed, stealth, and communication reliability are paramount, traditional voice and radio-based systems often fall short, especially in environments constrained by noise, electromagnetic interference, or the need for absolute silence. Tactical Sign Language Recognition (TSLR) systems have emerged as a promising alternative, enabling non-verbal, gesture-based interaction among soldiers and between humans and machines. These systems utilize advanced multimodal sensing technologies, such as inertial measurement units (IMUs), electromyography (EMG) sensors, bending sensors, and depth-sensing cameras, integrated with state-of-the-art deep learning models to interpret manual and non-manual gestures in real time. This study provides a technical overview of the state-of-the-art TSLR systems, emphasizing recent advancements in sensor technologies, datasets, and deep learning models. CNNs, LSTM networks, and Transformer architectures are applied for spatial-temporal gesture modeling. At the same time, model efficiency is addressed through techniques such as knowledge distillation and the replacement of fully connected layers. These approaches enable the design of lightweight, high-accuracy, and user-independent models suitable for real-time, portable deployment. This research shows that deep learning-based TSLR systems using multimodal signals can improve silent communication and provide strategic benefits in defense scenarios where traditional methods fall short.

Keywords – Tactical Sign Language Recognition, Gesture Recognition, Silent Communication, Defence Industry, Deep Learning

Personalized Stress Relief System Using Emotion Recognition and Machine Learning

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Presentation/Paper Type: Oral

***Abstract*—**In today's fast-paced society, stress has become a pervasive issue, driven by demanding environments and societal pressures. Music, with its unique ability to connect with human emotions, has emerged as a powerful tool for stress relief. However, its effectiveness is limited when the selected tracks do not align with the listener's emotional state. Existing music players lack the capability to dynamically select content based on the user's emotional needs. This paper proposes an adaptive emotion-based stress management system that leverages facial expression analysis and real-time content recommendations. The system utilizes the Google Vision API to detect the user's emotional state (e.g., sad, happy, angry, or neutral) and recommends personalized content, such as songs, movies, or books, tailored to their current mood. By simplifying emotion recognition and providing real-time, personalized recommendations, the system offers a practical and user friendly solution for stress relief. The system achieves an accuracy of 92.19% in emotion detection, outperforming traditional methods like EEG-based systems, which are complex and resource-intensive. Key findings demonstrate the system's ability to reduce stress levels across various emotional states, such as anger, fear, and sadness, while reinforcing positive emotions like happiness and neutrality. The system's high accuracy, maintainability, and intuitive design enhance user satisfaction and accessibility.

Keywords—Stress Management, Emotion Recognition, Facial Expression Analysis, Personalized Recommendations, Google Vision API, Machine Learning

KeyphraseTrees: Enhancing LLM Prompts with Hierarchical Topic Extraction

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Abstract—Keyphrase extraction is a fundamental task in natural language processing (NLP). Despite advancements in the field, existing methods still struggle with scalability and accuracy, especially as data grows more complex. In the digital age, the overwhelming volume of information available online necessitates accurate and efficient keyphrase extraction methods. In this paper, we propose a novel approach to keyphrase extraction that leverages Large Language Models (LLMs) in conjunction with a custom hierarchical keyphrase tree designed to enhance the LLM's keyphrase extraction capabilities. By integrating hierarchical clustering with LLM-based embeddings, our method captures both local and global context in documents, improving the relevance of extracted keyphrases. We evaluate our model against the current state-of-the-art methods using three widely used benchmark datasets: Inspec, SemEval 2010, and DUC 2001. Experimental results indicate that our treebased approach, yields state-of-the-art outcomes compared to other state-of-the-art methods, demonstrating the effectiveness of hierarchical keyphrase trees in improving LLM-driven keyphrase extraction.

Keywords—Keyphrase extraction, Large Language Models (LLMs), Hierarchical Clustering, Natural Language Processing (NLP), Information retrieval

A Fused Modality Human Action Recognition System Based on Motion Saliency in RGBD Videos

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Presentation/Paper Type: Oral

***Abstract*—**Multimodal processing architectures have recently been applied to human action recognition (HAR) achieving higher classification accuracies than solutions based on a single modality. These solutions rely on machine learning techniques, where a substantial amount of time is required both for the training and the inference phases. Solutions such as the model-based multimodal network, which construct a spatiotemporal region of interest (ST-ROI) on which the RGB classifier is trained demand substantially less training time than video-based models while achieving comparable classification accuracies. However, the performance of these solutions depends on the generation and accuracy of the skeleton data. This paper presents a novel solution to reduce the size of the data that is processed during classification by constructing an ST-ROI using regions identified by a motion saliency detection algorithm. The results show that the proposed solution requires much less time for training and consumes less energy than the state of the art, while achieving a comparable classification accuracy.

Keywords—Human action recognition, motion saliency detection, region of interest, RGBD video

Bridging the Gap Between Educators and Game-Based Learning: A Study of an AI-Assisted Course Creation Tool for Minecraft Education

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Presentation/Paper Type: Oral

***Abstract*—** This paper explores the involvement of artificial intelligence in the context of educational technology. Specifically, it presents findings from a study evaluating CourseCrafter, an AI-enhanced prototype designed to assist to the creation of Minecraft Education courses by educators, regardless of their coding expertise or familiarity with Minecraft's controls.The study aimed to gather insights on user experiences, interface usability, and the effectiveness of AI integration within the tool. Ten educators, all of whom had some experience with Minecraft Education prior to the experiment, from different geographical areas, teaching grade and subject areas tested the prototype, completed a System Usability Scale (SUS) questionnaire, and attended a semi-structured interview. To ensure a controlled environment throughout the prototype testing, user personas were randomly handed out to participants, they were instructed to follow a detailed scenario, and alternative options would be explained with the Wizard of Oz method. The participants unanimously found the idea useful, agreed on the functionality of certain features, but shared varied concerns about the use of AI in education and the complexity of the platform. Additionally, feedback highlighted the importance of intuitive design, adequate instructional resources, and the potential impact of the tool on teaching and student engagement. These findings emphasize both the need for refinements to enhance user experience and maximize educational effectiveness but also the demand of such a tool in the industry.

Keywords—Minecraft, artificial intelligence, human-computer interaction, game-based learning

AI Meets Data Science: Preprocessing and Feature Selection Reimagined

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***Abstract*—**The rapid evolution of artificial intelligence (AI) has paved the way for substantial improvements in data science workflows, particularly in data preprocessing and feature selection. These two fundamental steps, which have traditionally been time-consuming and manual, significantly impact the accuracy and efficiency of machine learning models. This paper explores the potential of AI-driven optimization in automating data preprocessing and feature selection, with the goal of enhancing the quality of data and model performance. We delve into the utilization of machine learning algorithms, particularly deep learning and reinforcement learning, to refine these processes and reduce the reliance on manual intervention. The research focuses on three key aspects: automated data cleaning and transformation, AI-based feature selection, and the integration of AI techniques into existing data science tools. The findings contribute to the development of more efficient and accurate methods for handling large and complex datasets, addressing challenges in fields such as finance, medical research, and IoT data analysis.

Keywords—AI-driven optimization, data preprocessing, feature selection, machine learning, reinforcement learning.

Improving Math Problem Solving in Large Language Models Through Categorization and Strategy Tailoring

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***Abstract*—**In this paper, we explore how to leverage large language models (LLMs) to solve mathematical problems efficiently and accurately. Specifically, we demonstrate the effectiveness of classifying problems into distinct categories and employing category-specific problem-solving strategies to improve the mathematical performance of LLMs. We design a simple yet intuitive machine learning model for problem categorization and show that its accuracy can be significantly enhanced through the development of wellcurated training datasets. Additionally, we find that the performance of this simple model approaches that of stateof-the-art (SOTA) models for categorization. Moreover, the accuracy of SOTA models also benefits from the use of improved training data. Finally, we assess the advantages of using category-specific strategies when prompting LLMs and observe significantly better performance compared to non-tailored approaches.

Keywords – Large Language Models, Mathematics, Problem Categorization, Answer Extraction

Exploring Adaptive and Disruptive Changes in Brain Connectivity Under Stress

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Presentation/Paper Type: Oral

***Abstract*—**This study examines how stress impacts the communication between various brain regions, emphasizing the different ways individuals respond. Depending on the person, stress can result in either increased or decreased communication between different parts of the brain. Resilience and variations in brain anatomy are factors that may influence these changes. Certain individuals may show decreased brain connectivity under stress, while others may adapt by enhancing interregional communication. The findings revealed that around 60% of the participants experienced reduced connectivity mainly in the PFC area, suggesting that stress often disrupts communication among brain regions, while 40% showed compensatory patterns. Understanding these differences are essential for creating customized stress management strategies. The results of this study offer a strong foundation for further research aimed at improving mental health and well-being through targeted support and approaches.

Keywords—EEG, Stress, Connectivity, PFC, Interhemispheric

Enhanced Stress Prediction among nurses in their work environment using Clustered Chameleon Swarm Algorithm

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***Abstract*—**Stress is a critical health issue that can take a serious toll on both physical and mental well-being, particularly for professionals in demanding fields such as healthcare. Early detection and proper classification of stress levels are vital for timely intervention and effective management of stress-related health concerns. This study explores stress monitoring among nurses in their work environment, and to develop a reliable system to identify and assess stress levels. In earlier days, predictive models analyzed the historical data to identify patterns and factors that contribute to the stress level of nurses. Predictive models are trained on historical data and their performance is evaluated using validation data to ensure that they are accurate and reliable. This work focuses on improving the performance of the predictive model by segmentation followed by swarm intelligence classification techniques. Possibilistic Fuzzy C-Means (PPFCM) clustering techniques are used to categorize nurses into different segments based on shared characteristics or behaviors. This segmentation enables organizations to implement targeted interventions and support strategies, ensuring effective stress management and improved well-being for individuals in highstress environments. Once the segmentation is done, it can be used for the classification process using our proposed iteration steps. For classification, we used the Chameleon Swarm Algorithm. Various experiments were conducted on the collected benchmark dataset, yielding higher accuracy in stress level prediction. This improved accuracy enables better understanding of individuals' stress patterns, allowing organizations to implement proactive measures for stress management and enhance overall well-being.

Keywords—Nurse Stress Prediction, PPFCM, Chameleon Swarm Algorithm, Classification, Clustering

Active Logic-Based Behavior Modification in Physical Robots

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***Abstract*—**This paper explores how active logic empowers robots to reason about goals, actions, expectations, and deadlines during collaborative search tasks. These time-aware agents operate with future-oriented expectations and adapt their behavior when violations occur. We examine the challenges of managing expectations for time-situated robots and their outcomes, aiming to improve their ability to complete tasks effectively. On a target search task, we discuss initial results with two Clearpath robots, Husky and Jackal.

Keywords—Active Logic, Metacognition, Goal-Driven Autonomy, Reasoning, Commonsense Knowledge, Commonsense Reasoning

Fault Diagnosis of Wind Turbine Gearbox using CNN-AI

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***Abstract*—**This study presents an experimental investigation into gearbox fault diagnosis using a scaled-down model of an industrial wind turbine gearbox (Model MCTR15-23-02). The test rig, incorporating a planetary gear train alongside an electrical motor, parallel shaft gearbox, magnetic clutch, dynamometer, load cell, and wind-mill fan, simulates vibration monitoring under a broken gear tooth scenario. Fault conditions were induced by creating both partial and full gear tooth failures, and vibration signals were captured using a single-axis accelerometer with data acquisition via LabVIEW. The signals were analyzed using timedomain waveform techniques and Fast Fourier Transform (FFT), along with Power Spectral Density (PSD) and 3D spectrogram methods to differentiate between healthy and faulty conditions under various speeds and loads. A Convolutional Neural Network (CNN) was trained on spectrogram images to classify the gear states, achieving high accuracy during both training and validation phases. Although near-perfect validation results were observed, further evaluations are recommended to mitigate potential overfitting. Overall, the findings underscore the value of multi-dimensional spectral analysis and deep learning techniques for reliable early fault detection in gearbox systems.

Keywords—Gearbox Fault Diagnosis, Fast Fourier Transform (FFT), Power Spectral Density (PSD), Convolutional Neural Network (CNN)

Federated Learning-Based Intrusion Detection Systems for 6G IoT: Performance and Challenges

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Presentation/Paper Type: Oral

***Abstract*—**The paper offers a Federated Learning (FL)-based intrusion detection system for identifying cyber-attacks in IoT settings that respects data privacy while accounting for the demanding requirements of the 6G communication environment. FL enables collaborative model training without transferring raw data, ensuring privacy preservation. However, FL-based solutions face challenges such as communication overhead, non-IID data distribution, and adversarial attacks that degrade performance. Our proposed system is evaluated using the RT-IoT2022 dataset under different attack scenarios. The experimental results show that the FL approach achieves a high detection accuracy and a low error rate, while adapting to the challenges of 6G transmission, such as quantization noise and signal degradation. Compared to centralised learning, our system exhibits robustness to distributed data variations. Future improvements include the exploration of alternative FL aggregation methods, the analysis of energy efficiency, and the strengthening of security mechanisms against adversarial threats.

Keywords—federated learning, IoT security, 6G networks, intrusion detection

Advancing Idea Management Systems with Topic Modeling: Radical Innovation Patterns in Student-Driven Industry Cases

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Abstract - The integration of Topic Modeling (TM) in Idea Management Systems (IMSs) is gaining attention as organizations seek structured approaches to idea classification, trend detection, and knowledge discovery. This study investigates the application of BERTopic and K-Means clustering in an academic IMS, analyzing 5492 innovation ideas generated by multidisciplinary engineering students at Aarhus University as they tackled 47 real-world industry challenges in Denmark. By structuring idea generation through the Creative, Idea, Solution (CIS) framework and leveraging the Rosetta IMS, this research examines how radical innovation patterns might emerge and whether topic modeling can enhance the flow of activities in an innovation process. Findings indicate that BERTopic effectively categorizes industry-driven ideas into 19 meaningful themes, aligning with key sectors such as sustainability, automation, waste management, and health-tech. In contrast, K-Means clustering identifies 7 broader innovation clusters, highlighting mainstream vs. underdeveloped idea trajectories throughout the innovation process. TF-IDF analysis was used to track idea evolution across IMS stages, revealing that solution-oriented keywords dominate later phases, while many early-stage concepts are abandoned before full development. Results suggest that TM-based classification provides structure to innovation landscapes efficiently but requires qualitative validation from human interactions to confirm the emergence of radical ideas. The combination of BERTopic, K-Means, and GPT-based summarization enhances interpretability and trend forecasting, offering an initial AI-enabled framework for IMS implementation. This study contributes to innovation management research and practical IMS applications, demonstrating how AI models can streamline idea management and align student-driven innovations with industry needs.

Keywords – Clustering algorithms, innovation management, engineering education, business

Ethics in the Age of Artificial Intelligence

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***Abstract*—** Artificial Intelligence (AI) technologies are transforming many sectors by causing radical changes in the modern world. AI solutions that accelerate processes, increase efficiency, and improve decision-making mechanisms in areas such as health, finance, education, and transportation also bring with them important discussions in terms of ethics, security, and social harmony. In this context, the need for AI applications to be developed in a reliable, fair, and transparent manner is becoming increasingly important.

The concept of "Responsible AI" aims to design and implement AI in a way that respects human rights, is free from discrimination, is accountable, and is compatible with social values. The neutrality of algorithms, the protection of personal data, and the risk that AI applications may produce biased or erroneous outputs make it necessary to manage this technology in line with ethical principles. Ensuring public trust and increasing social acceptance of AI is a critical requirement for sustainable and successful innovation processes. In this context, various control mechanisms have been developed to ensure the security of AI applications and their compliance with ethical rules.

This study examines the necessity of a responsible AI approach, how it should be shaped within the framework of ethical principles, and the security mechanisms used in this context. Considering the long-term societal impacts of AI, the importance of protecting individual rights as well as creating a reliable and sustainable framework for companies and public institutions is emphasized. In particular, the examination of security tools such as Llama Guard is examined, and how they play a critical role in the process of responsible management of AI.

Keywords— Artificial Intelligence, Responsible AI, Ethics

Enhancing Chinese Historical Text Period Classification with Subgraph-wise Sampling

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***Abstract*—**The two main challenges in period dating Chinese historical text are the enormous size of the text and its intrinsic monosyllabic nature. In this study, we propose an efficient framework to enhance the Chinese historical text period classification task. This paper introduces a framework, TGGGS (TopicGraph Guwen GraphSaint), by combining four different model architectures. Using a combination of Topic, Graph, Neural Networks (NNs), and Transformer architectures together with a Subgraph-wise sampling technique for optimal feature extraction, we can effectively improve the overall performance of a Graph Neural Network (GNN). The overall model framework consists of a Topic and Graph architecture (TopicGraph), followed by a Subgraph-wise sampling technique (GraphSAINT), and a multiclass Transformer-based classifier (GuwenBERT and NNs). The inclusion of the Subgraph-wise sampling technique increases the performance in the model without reducing the efficiency of the model. Moreover, the original Chinese historical text is inputted without any preprocessing techniques where both punctuation marks and stop words are kept intact. In this way, we preserved the original contextual information of a Chinese historical text. Experimental results demonstrate the effectiveness of our proposed approach.

Keywords—Chinese Historical Text Period Classification, Graph Neural Network, Subgraph-wise Sampling.

Automatic Chaos Control of the Two-Dimensional Burger Map Through Genetic Algorithms

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***Abstract*—**Chaotic systems are highly sensitive to initial conditions, where even infinitesimal differences in starting points can lead to drastically different long-term behaviors. Since the 1990s, researchers have discovered that chaos can be regulated, a concept known as chaos control. In this paper, we describe a method for automatic chaos control of chaotic maps, aiming to stabilize chaotic dynamics into a periodic orbit with a predefined period. Our approach builds upon an existing technique that applies control pulses of constant pulse intensity and frequency, both being adjustable parameters of the method. We formulate this as a complex optimization problem involving multiple variables, nonlinearity, and a multimodal landscape, solved through a genetic algorithm approach. To validate our method, we conduct computational experiments using the 2D Burger map under different parameter configurations. The results confirm that our approach stabilizes chaotic behavior, showing a promising potential for automating chaos control in dynamical systems.

Keywords—Dynamical systems, chaotic maps, chaos control, evolutionary computation, genetic algorithms

The Evolution of Wireless Communication with the THz Spectrum: New Horizons in 6G

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***Abstract*—**Terahertz (THz) communication, which operates in the frequency range from 0.1 THz to 10 THz, has emerged as a key technology for next-generation wireless networks, especially in the 6G era. With its ultra-wide bandwidth and high data rate capabilities, THz communication enables applications such as high-speed wireless transmission, integrated sensing and communication (ISAC), and real-time intelligent networking. However, the practical deployment of THz systems faces significant challenges, such as high path loss, atmospheric attenuation, and hardware limitations. This paper provides a comprehensive overview of THz communications, discussing its fundamental principles, its role in 6G networks, and key enabling technologies such as multiple-input multiple-output (MIMO), beamforming, reconfigurable intelligent surfaces (RIS), and multicarrier modulation techniques. We also explore the limitations of THz technology and how artificial intelligence (AI)-driven solutions can address these challenges and improve system efficiency and security. Finally, we present future research directions that need to be explored in order to fully realize the potential of THz communications in 6G networks.

Keywords—THz Communication, 6G Wireless Networks, AI-enhanced enabling technologies

FedFZY: A Novel Aggregation Method for Federated Learning

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***Abstract*—** Federated learning facilitates distributed collaborative model training across decentralized computational nodes, ensuring data privacy through the maintenance of sensitive information locality. This paradigm enables the development of robust machine learning models by aggregating heterogeneous datasets distributed across numerous client devices, obviating the need for centralized data repositories. Federated learning systems employ a spectrum of aggregation algorithms, including weighted averaging (FedAvg), proximal optimization (FedProx), and adaptive optimization (FedOpt), to achieve a convergent synthesis of locally computed model parameter vectors, thereby enabling distributed model refinement while preserving data locality. Fuzzy logic furnishes a computational framework for approximate reasoning, facilitating the modeling of imprecise and uncertain information via the utilization of fuzzy sets and linguistic variables. This research articulates the development of a novel fuzzy logic-mediated aggregation mechanism, FedFZY, within a federated learning architecture. The implemented methodology obviates the requirement for computationally intensive mathematical operations and derivative calculations.

Keywords—federated learning, fuzzy logic, aggregation, machine learning

The Menace of Artificial Intelligence – A Critical Analysis

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***Abstract*—**Artificial Intelligence (AI) is a groundbreaking technological advancement of the 21st century, transforming industries such as healthcare, finance, transportation, manufacturing, and communication. It enables machines to mimic human intelligence through learning, reasoning, problem-solving, perception, and natural language processing. However, AI also presents significant risks, including ethical dilemmas, algorithmic bias, data privacy concerns, and the need for transparency in decision-making. To address these challenges, governments, researchers, and industry leaders must develop ethical AI systems, implement strong regulatory frameworks, and encourage interdisciplinary collaboration. Without proper oversight, AI could become one of the most dangerous forces of the century, impacting society in unpredictable and potentially catastrophic ways. Balancing AI's benefits with responsible development is crucial for ensuring its positive impact on humanity.

Keywords—artificial intelligence, human intelligence, reasoning, bias, ethics, privacy, regulation.

AI-Powered Virtual Mental Health Assistant for Early-Stage NLP-Based Mental Health Screening

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***Abstract* —** Mental health issues have become a significant global concern, affecting individuals' ability to perform daily tasks and increasing the risk of social prejudice. This paper presents a solution to address mental health challenges while reducing the burden on medical professionals. Our research includes a survey of 41 respondents to gauge public perception of mesntal health and their willingness to share their thoughts. We propose a web-based platform that provides mental health guidance and facilitates direct communication with psychologists. The platform integrates a speech-to-text model for audio transcription and a natural language processing (NLP) model to classify mental health conditions. Its architecture ensures secure data storage while enabling users to access essential resources without fear of discrimination.

Keywords— Natural Language Processing (NLP), RoBERTa, Mental Health, Video Streaming, WebRTC

Autonomous Medical Evacuation and Patient Movement in Warfare

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***Abstract*—** The paper illustrates SPARK-HUNT, a groundbreaking distributed framework for the real-time detection of cybersecurity threats by means of ensemble learning techniques on network traffic data. The system being proposed is built on Apache Spark's distributed computing functionalities to deliver the processing of high-volume network flows in tandem with a multi-classifier ensemble method to further the enhancement of detection accuracy. Our prototype incorporates five machine learning modelsincluding Random Forest, Gradient Boosted Trees, Support Vector Machine, Logistic Regression, and Deep Neural Networks--all of them being combined via a weighted voting mechanism that impacts notably on the overall threat identification. The experimental assessment effecting the use of the UNSW-NB15 dataset provides a demonstration showing the SPARK-HUNT framework presenting 94.7% overall accuracy in terms of incident detection, which is 23.5% more than the value obtained with traditional systems, and at the same time, it has a low false positive rate of 2.3%. The framework manages to process 35,000 events in a second along with a just 1.8 seconds detection latency and the rate of zero-day attacks it successfully identifies is 84.3%. When it was introduced in a simulated enterprise environment which was processing the traffic of 12TB a day, SPARK-HUNT identified 37 threats that had never been detected before and also generated 76% fewer false positive alerts compared to the previous setup. Therefore, SPARKHUNT acquires the status of being the very effective solution for the cybersecurity issues that need real-time detection of threats to be carried out at scale.

Keywords— Cybersecurity, Threat Detection, Apache Spark, Ensemble Learning, Machine Learning, Big Data Analytics, Network Traffic Analysis, Distributed Computing, Real-time Processing, Zero-day Attacks

Automated Pollen Recognition in Optical and Holographic Microscopy Images

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Abstract—This study explores the application of deep learning to improve and automate pollen grain detection and classification in both optical and holographic microscopy images, with a particular focus on veterinary cytology use cases. We used YOLOv8s for object detection and MobileNetV3L for the classification task, evaluating their performance across imaging modalities. The models achieved 91.3% mAP50 for detection and 97% overall accuracy for classification on optical images, whereas the initial performance on greyscale holographic images was substantially lower. We addressed the performance gap issue through dataset expansion using automated labeling and bounding box area enlargement. These techniques, applied to holographic images, improved detection performance from 2.49% to 13.3% mAP50 and classification performance from 42% to 54%. Our work demonstrates that, at least for image classification tasks, it is possible to pair deep learning techniques with cost-effective lensless digital holographic microscopy devices.

Keywords—automated pollen recognition, machine learning, holographic microscopy, medical imaging, veterinary medicine

A Hybrid Deep Learning-Based Approach in Agricultural Sustainability: Apple Orchard Study

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Abstract—In the agriculture domain, the detection and classification of fruit images are critical tasks. This study introduces a novel hybrid model for the detection and classification of apples. For this reason, an on-site image-capturing system with RGB sensors was installed in an orchard to capture images from two different angles of apple trees at night, aiming to create a diverse database. For the apple detection task, three different YOLO versions (YOLOv5, YOLOv7, and YOLOv8) were used to identify the best detection model. Three sub-datasets(Subdataset 1, Sub-dataset 2, and Sub-dataset 3) of our main dataset were used to fine-tune the YOLO versions. Each sub-dataset has its labeling and sampling methods. Sub-dataset 3, with the fewest images, significantly improved the YOLO network performance in all versions. The combination of YOLOv7 with sub-dataset 3 achieved 82% accuracy, effectively detecting apples under various conditions. In classification, the detected apple images were classified based on their ripeness into three classes. The classes are determined by the time remaining until harvest. In the classification of apple images, three classification techniques were compared. First, fine-tuned models (VGG16, VGG19, Xception, ResNet50, ResNet50V2, ResNet152, and MobileNetV2) were tested that VGG16 achieved the highest accuracy of 0.924. Second, combinations of CNN models as a feature extractors (VGG-16, RESNET-50) and machine learning algorithms as classifiers (SVM, Random Forrest, and XGBoost) that the VGG16 + XGBoost classifier achieved an accuracy of 0.923. Finally, a custom CNN model outperformed all others, achieving an accuracy of 0.983. Therefore, the combined YOLOv7-CNN hybrid model demonstrated efficient performance, making it a candidate for apple detection and classification in agricultural settings.

Keywords—Apple detection, deep learning, YOLO, CNN, smart farming, image classification

AI-Driven Mortality Prediction in COVID-19 Patients Using Advanced Feature Selection

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***Abstract*—**COVID-19 has caused significant global mortality, with early risk stratification being critical for effective clinical management. Using a dataset of 8,032 COVID- 19 hospitalized patients from a multicenter UK study, we developed and evaluated seven AI models, including deep and machine learning techniques, to predict in-hospital mortality. Key predictors were identified through a rigorous feature selection process combining statistical analysis, clinical expertise, and literature review. The Support Vector Classifier (SVC) achieved the best performance with 84% accuracy, 86% precision, and an AUC of 0.858, outperforming other methods in robustness and predictive accuracy. This study presents a novel application of AI on a large and diverse dataset, offering valuable insights for managing future pandemics/other clinical setting and improving clinical decision-making to reduce mortality.

Keywords—Deep Learning, Machine Learning, Combined Feature Selection, Predictive Models, Mortality, Covid-19

Evaluation of a Social Media Summarization System: A Multidomensional Approach

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***Abstract*—** Automatic summarization in recent years has increasingly attracted the interest of researchers because it is a technique tested in many applications and is now one of the most promising branches of research. The social media domain presents a challenge for the implementation of automatic summarization due to the peculiar nature of their content. Automatic summarization of information posted and commented on social networks is now essential for timely, valid and consistent public information. Through the culmination of research in the creation of summaries but also the culmination of technology, the demands of automatic summarizing capabilities are increasing more and more demanding readability and fluency of formulation similar to that of a human. On the other hand, conventional assessment measurement methods have not kept pace with the rapidly evolving forms of summary assignments. Differentiated solutions address different challenges by varying the metrics of different but important language assessment factors. This paper presents a summarization system of social media comments on posts of individual topics and evaluates it across diverse evaluation criteria. Since natural language generation evaluation is a multidimensional process a comparison is made in order to assess the generated summary for fluency, consistence, readability and semantic coherency.

Keywords— Social Media Summarization • Natural Language Generation • Automatic Evaluation, Transformers

Harnessing Social Media Sentiment for Predictive Insights into the Nigerian Presidential Election

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***Abstract*—**Political events are heavily influenced by social media, shaping public opinion and actions. Sentiment analysis of social media content helps policymakers, campaign planners, and analysts understand voter sentiments for informed decision-making. This study performs a comprehensive comparative analysis of traditional machine learning models— Logistic Regression, Random Forest, Naïve Bayes, and SVM— and deep learning models—FFNN, LSTM, and CNN—on tweets collected via the X (formerly Twitter) API regarding the 2023 Nigerian Presidential Election. All models underwent a proper optimisation process and were evaluated using key performance evaluation metrics. Over 1.9 million tweets were collected over eight months. Results show deep learning models outperform traditional ones, with LSTM achieving the highest accuracy (95%), followed by CNN (94%) and FFNN (94%).

Keywords—Sentiment Analysis, Deep Learning, Machine Learning, Social Media Analysis, Election

Tactical Sign Language Recognition Systems: Deep Learning-Based Silent Communication

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***Abstract*—**What criteria determine the beauty of a landscape photograph? The picturesque view in aesthetics suggests that non-aesthetic properties, such as composition, cause something aesthetic. This study empirically tests this idea by comparing humans and AI. We collected landscape photographs labeled for whether photograph images are well taken as beautiful landscape works, and conducted an image classification task. Humans successfully discriminated images based on these criteria, while CNN models trained only on image features performed at chance level. However, attention map analyses using human eye-tracking and Grad-CAM revealed minimal differences in focus between humans and the model. Interestingly, ChatGPT-4o, with few-shot learning, was comparable to human performance in classification. These findings highlight the role of background knowledge in aesthetic judgments and raise questions about the nature of aesthetic-value assessments.

Keywords—image classification, deep learning, few-shot learning, attention map, aesthetic value, picturesque, cognitive science

WASPO: Workload-Aware Spark Performance Optimization Using NSGA-II

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***Abstract*—**The rapid growth of data-intensive applications has heightened the need for efficient big data processing frameworks like Apache Spark. However, optimizing Spark cluster configurations remains a complex challenge due to the diverse workload characteristics, varying data sizes, and conflicting resource demands. This paper introduces WASPO (Workload-Aware Spark Performance Optimization), a novel framework using NSGA-II for multi-objective optimization of Spark configurations. WASPO dynamically balances performance, resource efficiency, and scalability by incorporating workload-specific characteristics and adaptive scaling strategies. The proposed framework addresses the limitations of existing approaches, including static configurations, single-objective optimization, and neglect of workload heterogeneity. Experimental results demonstrate significant improvements in resource utilization and processing performance for both Machine Learning and Mixed workloads across data sizes ranging from 0.1TB to 1,000,000TB (1000PB).

Keywords—Apache Spark, Multi-Objective Optimization, Workload-Aware, Big Data, Machine Learning, Performance Tuning

Advancing Personality Type Prediction: Utilizing Enhanced Machine and Deep Learning Models with the Myers-Briggs Type Indicator

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***Abstract*—**This study addresses key gaps in personality prediction research by conducting a comprehensive comparison of machine learning and deep learning models on a new, large dataset of MBTI personality types. Previous studies predominantly focused on the Big Five framework and overlooked MBTI due to limited datasets. Moreover, basic hyperparameter tuning techniques, label imbalance, and insufficient text lengths in training samples have constrained the accuracy and generalizability of past models. To address these issues, this research employs a large balanced MBTI dataset with sufficient text lengths and optimizes models using Bayesian optimization. Models compared include Logistic Regression (LR), Random Forest (RF), Support Vector Machine (SVC), Naïve Bayes, LightGBM, XGBoost, Multilayer Perceptron (MLP), and Bidirectional Encoder Representations from Transformers (BERT). Results demonstrate that deep learning models outperform traditional methods, with BERT achieving the highest accuracy (93%), followed by XGBoost (86%) and SVC (85%). The BERT model also significantly outperformed the models implemented in previous works in this field. This work provides actionable insights into model selection and optimization, showcasing the utility of advanced techniques like Bayesian optimization in enhancing predictive performance. By addressing these gaps, the study lays the foundation for robust, scalable personality prediction models applicable in psychology, career counselling, and personalized marketing.

Keywords—Deep Learning, Machine Learning, Large Language Model, Bayesian Optimization, Personality Prediction

Cloud-Based AI Surveillance for Motion Detection and Facial Recognition

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***Abstract*—** This research paper presents an automated monitoring system developed with diverse technologies combining cloud computing and Internet of Things (IoT). The system includes motion sensing, image capturing, and facial recognition by the cloud (AWS Rekognition) powered artificial intelligent (AI) algorithms for the better security measures of tracking and recognizing people within surveillance areas. When the sensor attached to the Arduino detects motion, then the camera captures an image of the moving element (the person). That image will be sent to Amazon S3, causing a trigger on an AWS Lambda function, and then using Amazon Rekognition to recognize faces.

By leveraging Arduino hardware combined with serverless computing and scalable cloud service, it makes the system accessible, cheap, and a solution to real-time surveillance and identification. Traditional cloud-based surveillance systems offer scalability and remote access, yet they consume a lot of bandwidth and incur high latencies owing to continuous streaming, thus creating a limit in efficiency and responsiveness. Safety and affordability of Arduino, flexibility, easy integration with other sensors make it a better choice for putting together scalable intelligent monitoring applications.

Keywords—Cloud Computing, AWS Rekognition, AWS Lambda, Internet of Things, Arduino, Artificial Intelligence, Facial Recognition

Context-Aware AI for Real-Time Content and Quiz Recommendations in Student Learning Environments

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Abstract - The paper presents a context-aware AI system designed to dynamically recommend course material and generate quizzes in real-time, based on the individual student interaction and performance. The proposed model integrates generative AI capability with a previously developed Learning Management System (LMS), using Blazor components for seamless user interface presentation and real-time system updates. Through the processing of contextual data such as enrolled courses, student activity, history, and participation patterns, the system acquires insight to generate intelligent content blocks and short quizzes tailored to the immediate needs of the learner. The artificial intelligence engine, which is built on large language models, is infused through guided questions that solicit recommended topics and related quiz items. Upon login by students, the dashboard includes an interactive "Subject explanation" panel, allowing real-time provision of AI-generated resources and quizzes, visually integrated using Blazor's conditional rendering feature. This article describes the system design, implementation sequence, and deployment at the University of Tetova, illustrating how cognitive-aware AI can engage learners more and facilitate adaptive learning routes through autonomous, scalable learning augmentation.

Keywords- Artificial Intelligence, Context-Aware Learning, Generative Models, Blazor components, Adaptive Assessment, Real-Time Recommendation, Personalized Education

How Do 13–16-Year-Olds Understand AI? A Topic Modeling Study of Swedish Students' Perceptions

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***Abstract*—**As artificial intelligence (AI) becomes increasingly embedded in everyday life and educational systems, understanding how students conceptualize AI is essential for designing responsive and inclusive AI literacy curricula. This study investigates the perceptions of AI among Swedish students aged 13–16, using a qualitative survey instrument comprising background questions and five open-ended questions adapted from previous research on student conceptions of AI. Using a BERT-based topic modelling approach, we analyzed responses from 75 students, identifying nine key themes that reflect how students think about, relate to, and emotionally react to AI technologies. The identified topics, ranging from functional views of AI as a tool or helper, to more anthropomorphic notions like robots and AI being "just like" humans, to expressions of uncertainty and mixed emotions, highlight the diversity and complexity of student perceptions. We compare these findings with previous data collected in Azerbaijan to examine cultural and contextual differences in the way young learners understand AI. This research contributes to the growing body of work on AI literacy by providing evidence-based insights into student conceptions and the sociocultural shaping of AI understanding.

Keywords—AI Literacy, Student Perceptions, CrossCultural Comparison, Topic Modelling, K-12 Education

Algorithmic Folk Theories and Their Influence on Decision-Making in Data-Driven Monitoring and Evaluation Systems

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***Abstract*—** Data-driven decision-making is revolutionizing Monitoring and Evaluation (M&E) systems, yet human engagement with algorithmic outputs remains influenced by informal interpretations known as algorithmic folk theories. This study adopts a sequential exploratory mixed-methods design to investigate how evaluators, policymakers, and program managers in Zimbabwe develop and operationalize these folk theories when interacting with algorithm-driven M&E platforms. Semi-structured interviews with 24 practitioners revealed three dominant archetypes: mystification, instrumentalism, and skepticism. Subsequent survey analysis (n = 273) using latent class analysis confirmed that perceptions vary across sectors and technical expertise, influencing levels of algorithmic trust and decision-making practices. Findings indicate that low numeracy and opaque algorithmic processes contribute to mystification and diminished trust, whereas instrumentalism associates with conditional confidence, and skepticism with heightened bias awareness. These insights underscore the necessity of targeted transparency improvements, numeracy training, and inclusive stakeholder engagement to enhance the effectiveness and legitimacy of data-driven M&E systems. These measures will ultimately enable more inclusive and effective decision-making.

Keywords— Algorithmic Folk Theories, Data-driven Decision-Making, Monitoring and Evaluation, Latent Class Analysis

A Cognitive AI Model Using Deep & Cross Network for Personalized Gamified Recommendations to Promote Healthy Eating Decisions Among University Students

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***Abstract*—**Unhealthy eating habits among university students represent a critical public health challenge, adversely affecting physical health, mental well-being, and academic performance. While existing solutions leverage mobile apps and wearables, they lack robust cognitive artificial intelligence for personalized interventions and fail to sustain engagement through gamification. Previous efforts have employed deep learning models such as LSTM for dietary event detection and gamified frameworks, yet they neglect the integration of AI precision with long-term behavioral incentives. Current tools exhibit limited personalization, poor scalability, and insufficient validation in real-world contexts, particularly for diverse student populations. Motivated by these gaps, this study proposes a cognitive AI framework using a Deep and Cross Network integrated into a gamified mobile application to predict nutritional status and deliver tailored dietary challenges. The DCN model was trained on data from 5,000 Peruvian students, incorporating behavioral, demographic, and biometric variables, and validated against baseline models using stratified 80-20 splits, five-fold cross-validation, and metrics including Precision, Recall, F1-Score, and AUC-ROC. The DCN achieved superior precision of 92.89% and AUC-ROC of 94.02%, outperforming BNN and NCF by modeling nonlinear feature interactions such as BMI and sleep quality. This research advances human-AI interaction by synergizing cognitive modeling with gamification, demonstrating enhanced user engagement and offering a replicable framework for sustainable dietary behavior change.

Keywords— Cognitive AI, Deep & Cross Network, Machine Learning, Gamification, Personalized Recommendations, Nutritional Decision-Making.

Development of Card Fraud Detection Model with Intelligent Agent Technology and Use of Model Results in Prevention Processes

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Abstract – Changing needs and ease of use are increasing the demand for credit card products in the individual and corporate segments. This tendency towards credit cards brings with it an increase in card fraudster cases. These undesirable situations cause cash and reputational risks, especially in banks. Detection and prevention efforts are being made to prevent fraud cases that are frequently encountered in banks. In the first stage of this paper, in addition to well-known classification (Random Forest and Support Vector Machine) detection models, agent-based models such as Double Deep Q Network have been developed. After the model development process, the outputs of the card fraud detection model were used to create the prevention process. The main purpose of this paper is to use agent technology in card fraud detection and to create a new action flow for prevention efforts. In this way, an agent-supported structure that can detect, evaluate and prevent card fraud behavior has been developed. In addition to the detection model, the study also attempted to support the card fraud management system by developing a prevention process.

Keywords – Card Fraud Detection, Intelligent Agent Technology, Double Deep Q Network, Card Fraud Prevention, Card Fraud Management System

Intelligent Routing Strategies in UAV Swarm Operations

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***Abstract*—**This study explores the potential of artificial intelligence-based methods for route planning in unmanned aerial vehicle (UAV) swarm systems, with a particular focus on the advantages of the Q-learning algorithm in dynamic and uncertain environments, where traditional methods often fall short. A review of the literature reveals that swarm UAV mission planning typically relies on fixed-rule or predefined models, which impose significant limitations in real-time decisionmaking and adaptability to changing conditions. Q-learning's ability to balance exploration and exploitation provides a flexible, adaptive structure for route optimization. Future work will focus on implementing this approach and examining its practical applications and operational impact in more detail.

Index Terms—Q-learning, swarm UAVs, route optimization, artificial intelligence

A Combination of Steganography Methods to Increase the Degree of Information Concealment

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***Abstract*—**The paper considers a combined approach to steganography to increase the degree of information concealment in text documents. A method of placing hidden symbols in the form of residual artifacts after printing is proposed, taking into account the coordinate location, vector directionality and binding to the main text. Two implementation options for the method are described in detail: using a specific set of algorithms and using document hashing to access information through a database. The advantages and disadvantages of each approach are considered in the context of ensuring information security and countering modern challenges, including analysis by artificial intelligence systems.

Keywords—steganography, hidden information, information security, print artifacts, coordinate encoding, hashing, database, combined methods

SEEN: A Convolutional Spiking Neural Network for Efficient Pupil Coordinate Prediction from Event Data

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***Abstract*—**Near-eye pupil tracking is essential for Virtual and Augmented Reality applications but poses challenges in resourceconstrained environments due to the high computational demands of traditional frame-based systems. This work introduces SEEN, a lightweight Spiking Neural Network (SNN) with 144,687 parameters, designed for efficient eye tracking using Event-based Camera (EbC) data. Leveraging the sparse, asynchronous nature of EbCs and SNNs, SEEN processes Time-Surface representations of eye movements (random, saccades, reading, smooth pursuit, blinks) from the 3ET+ dataset, achieving an average Euclidean distance of 8.58 pixels on a subset and 7.98 pixels on the Kaggle 2025 challenge. Ablation studies reveal that, for recurrent leaky layers, applying a learnable β in upper layers closer to the input outperforms deeper placements, enhancing prediction accuracy and guiding efficient SNN design. The main contributions of this work include a SNN architecture and insights into design optimization, paving the way for future exploration of input features and feature extraction strategies in spiking neural networks for real-time eye tracking.

Index Terms—Near-Eye Pupil Tracking, Spiking Neural Networks, Event-based Cameras, VR/AR, Time-Surface representation, Regression

Sunn-Pest-Damaged and Healthy Wheat Grains Dataset Across Different Cultivars

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***Abstract*—** The sunn pest poses a significant threat to agriculture, causing damage to some of the most vital cultivars. The pest penetrates and damages grains, leaving an enzyme that renders them unsuitable for bakery goods production. Therefore, detecting damaged wheat grains for separation is crucial in flour production facilities to ensure uninterrupted production. For the solution to such problems, we present a new dataset of wheat grains that focuses on sunn pest damage to six different wheat cultivars, namely Bezostaja, Müfitbey, Nacibey, Sönmez-2001, Tosunbey, and Ekiz, which are the cultivars that were made in Türkiye. The dataset consists of 83 sunn-pest-damaged and 87 healthy wheat images. In addition, there are 170 images containing 3565 wheat grains. Our dataset differs from the others due to its various cultivars and the condition regarding whether it is healthy or sunn-pest-damaged. This unique feature makes our dataset particularly suitable for developments such as sunn pest damage detection and grain segmentation. Additionally, because the dataset consists of different cultivars, it can be used for classification. Given that the wheat grains are presented in bulk and exhibit different orientations and shape factors, our dataset encourages developers to grapple with and devise solutions for real-life problems.
Our data available at https://doi.org/10.17632/gmw48bvxdz.1

Keywords— Wheat grain, sunn pest, seed quality, wheat cultivar classification, sunn pest detection, wheat grain segmentation

A Comparison of Different ML Approaches for IoT Predictive Maintenance

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***Abstract*—** The research performs an assessment of various machine learning (ML) prediction methods and approaches for maintenance forecasting in IoT-enabled GPS tracking systems. The paper evaluates RF alongside LSTM and SNN to determine how these methods detect equipment irregularities using positional data features to generate predictions. The RF model maintains good interpretability levels at 92% accuracy but fails to detect 52% of failures whereas the LSTM demonstrates better performance levels with 95% accuracy and 73% anomaly recall through its ability to analyze temporal patterns. The SNN model demonstrates a complete inability to recognize anomalies because it lacks proper methods for handling class imbalance (0% recall). Such outcomes demonstrate that model selection needs to strike a proper equilibrium between operational precision as well as computational efficiency and realistic operational reliability in order to endorse hybrid architectural approaches for anomaly detection. The research study presents a practical method for implementing ML models within industrial IoT systems. Research outcomes present an approach which reduces the gap between theoretical model use and practical utilization of ML implementations for IoT solutions.

Keywords—Predictive Maintenance, IoT Anomaly Detection, SNNs, Edge AI, Energy-Efficient ML

Integrating Cognitive Models into Network-on-Chip Architectures for Resilient and Adaptive Autonomous Systems

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***Abstract*—**As autonomous systems grow in complexity, the need for intelligent, resilient on-chip communication infrastructures becomes critical. Traditional Network-on-Chip (NoC) architectures, while effective for parallelism and throughput, struggle to adapt to the dynamic demands of robotics, edge AI, and real-time processing. This paper proposes a cognitive NoC architecture embedding lightweight reinforcement learning agents within each router, transforming interconnects into distributed, self-adaptive systems. Agents perceive local states, learn optimal routing strategies, and adapt dynamically to faults and traffic variations. Simulation results demonstrate substantial improvements in latency, throughput, fault recovery, and convergence, with modest hardware overhead. This work advances the cognitive hardware paradigm by establishing a decentralized intelligence framework for scalable, resilient computing in next-generation AI platforms.

Index Terms—Cognitive Network-on-Chip, Autonomous Systems, Reinforcement Learning, Adaptive Routing, Fault Tolerance, Self-Adaptive Hardware, Intelligent Interconnects, Distributed Decision-Making, On-Chip Learning, AI-Driven Architectures.

AR-Based Hybrid Human-AI Decision Support System for Maritime Navigation

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Abstract- This study presents an augmented reality (AR)- assisted maritime decision-support system that fuses thermal and visible-spectrum imagery into a continuous 225° panoramic interface. Designed for low-visibility and cluttered environments, the system integrates five high-resolution visiblelight cameras and two mid-range thermal sensors, enabling robust detection of small and low-contrast maritime targets. A stitching pipeline synchronizes and aligns multi-sensor inputs, while an AR overlay enhances situational awareness with dynamic annotations such as heading, proximity, and classification cues. Field evaluations revealed substantial performance gains. Average operator reaction time improved by 21.19%, dropping from 3.87 s to 3.05 s with the system active. Misorientation rates were reduced from 18.60% to 13.57%, representing a 27.05% decrease. Additionally, mental workload was alleviated, with average visual assessment time per target reduced by 22.98%. By merging thermal cues with visible imagery and presenting the data through an intuitive AR interface, the system effectively reduces cognitive load while improving both reaction speed and navigational confidence. These results underscore the system's potential as a scalable framework for next-generation maritime safety and operational resilience.

Keywords: Augmented Reality, Sensor Fusion, Image Stitching, Decision Support, Maritime Navigation

Assessing the Capabilities of Large Language Models to Comprehend Analog Integrated Circuits via Netlist Analysis

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***Abstract*—**Exploring the capabilities of large language models (LLMs) in specialized technical fields like analog circuit design remains an open research question. In this study, we assess five state-of-the-art LLMs for their ability to semantically parse SPICE netlists and identify functional sub-topologies, such as differential pairs, current mirrors, and inverter stages. We present an evaluation framework inspired by program synthesis metrics, using a curated dataset of comparator circuits annotated with expert-defined functional blocks. Our experiments reveal that while current LLMs can reliably detect simple structures, their performance declines with more complex circuits that involve hierarchical organization and role differentiation. DeepSeekR1 achieved the highest accuracy across all comparators, with GPT-4.5 and Llama also showing competitive performance. Meanwhile, GPT-4o faced challenges in maintaining consistent functional decomposition. These findings underscore both the emerging strengths and critical limitations of LLMs in understanding analog hardware and suggest pathways for enhancing their reasoning abilities through improved prompting, dataset augmentation, and hierarchical learning approaches.

Index Terms—Large Language Models (LLM), Generative AI, Circuit Design, Netlist Analysis

Evaluating Specialized CNN Architectures for Hip Implant Loosening Detection on Radiographic Images

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***Abstract*—** This study presents a deep learning approach for detecting cases of aseptic loosening from radiographic images in patients that have undergone hip arthroplasty surgery. Aseptic loosening is a leading cause of implant failure and typically requires manual evaluation by orthopedic surgeons, which can be tedious and error prone. To address this challenge, two specialized convolutional neural network (CNN) architectures, EfficientNetB3 and VGG19, as well as a standard CNN architecture were applied to the task. The three architectures were trained on a publicly available dataset obtained from the Kaggle platform, consisting of 206 anteroposterior radiographic images. The validation performances of the models were compared using the metrics of accuracy, precision, recall, F1- score, and area under receiver operating characteristic curve (AUC). VGG19 architecture achieved superior performance to the other two architectures across all metrics, attaining the highest validation accuracy of 88% and the highest AUC value of 0.91; this was followed by EfficientNetB3 and then the standard CNN. The findings demonstrated the potential of specialized pre-trained CNN architectures, leveraging transfer learning paradigm, in improving the reliability of radiographic analysis, enhancing early diagnosis, and improving patient outcomes in orthopedic radiology.

Keywords—aseptic loosening, deep learning, hip arthroplasty, hip implant, medical imaging, convolutional neural networks, transfer learning

Distillation-Enhanced Medical Diagnosis And Clinic Referral With Fine-Tuned Gemma-3-12b

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***Abstract*—** The enhancement of clinical reasoning capabilities in large language models is recognized as critical for their integration into real-world healthcare systems. Limitations in producing medically reliable, explainable, and traceable decision-making outputs have been widely reported. To address these issues, the Gemma-3-12B model, a 12-billionparameter open-source language model, was distilled using the FreedomIntelligence/Medical-R1-Distill-Data dataset, which consists of 22,000 medical case examples containing step-by-step reasoning and final diagnoses. Both final responses and intermediate reasoning steps were incorporated during the distillation process to better align the model with clinical diagnostic practices. Substantial improvements were observed in the fine-tuned model's performance: an 80% accuracy rate was achieved on a subset of USMLE-style MedQA questions, compared to 52% by the base model, while 100% accuracy was maintained on simple patient scenarios. Evaluations conducted using Gemini 2.5 Pro confirmed that more consistent and structured multi-step justifications were generated alongside correct answers. Error analysis revealed that some incorrect responses were caused by over-elaboration and redundant logic loops, indicative of "overthinking" behaviors.

Keywords— Large language models, medical diagnosis, clinic referral, distillation, Gemma-3-12b

Impact of Image Compression on Banana Trunk Detection with YOLOv5 for Mobile Robot Deployment in Banana Plantations

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***Abstract*—**This paper investigates the impact of various image compression techniques on the performance of YOLOv5 in detecting banana trunks. A small dataset of banana trunk images was processed through several image compression algorithms to evaluate how these methods affect detection accuracy. The study assessed different compression techniques and their influence on banana trunk detection, as well as the effect of applying a sharpening filter to improve detection performance. Additionally, the research examined the impact of training the model with different numbers of epochs to observe the influence of extended training on detection accuracy.

Results demonstrate that YOLOv5 maintains robust detection capabilities for banana plant trunks even under significant image compression, with certain compression techniques preserving detection accuracy while substantially reducing file sizes. Statistical analysis revealed no significant difference between the summary and sharpened images (t-statistic = 0.6936, p = 0.4963), nor between the summary and sharpened images after 100 epochs (tstatistic = -1.8612, p = 0.0783). However, a significant difference was found between sharpened images and sharpened images after 100 epochs (t-statistic = -4.9498, p = 0.0001).

This work contributes to optimizing image processing for agricultural mobile robots, addressing the hardware and software constraints inherent in real-time deployment while ensuring reliable banana trunk detection performance across various compression ratios.

Index Terms—Image Compression, YOLO, YOLOv5, Object Detection, Banana Trunk Detection

Robot for Optimized and Autonomous Mission Enhancement Responses (ROAMER)

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***Abstract*—**This system presents the development of an advanced mobile manipulator system designed for banana plantations, focusing on task performance in highly unstructured and cluttered environments. The system consists of five primary modules: mobile robot platform, navigation and mapping, disease detection, communication, and the decision support system. The mobile robot incorporates a rocker-bogie mechanism for unstructured terrain traversal and a 5-DOF robotic arm which employs Computed Torque Control (CTC) and Gross Control Fine Motion (GCFM) control strategies for precise and efficient spraying on banana plants. The mission planning subsystem schedules and executes tasks based on user input, with the system enabling seamless communication via the Robot Operating System (ROS). The robot's computer vision module uses a multi-view deep-learning model based on VGG16 for disease detection and classification. The system processes the gathered data for reporting, allowing users to access insights through a web-based interface. This integrated approach facilitates autonomous operation in banana plantations, supporting efficient plant health monitoring and task execution.**

Keywords—Fusarium Wilt, Black Sigatoka, Moko, Bunchy Top, Disease Detection, Disease Classification, Navigation, Mapping, Robot-Robot Communication, Manipulators, Robot Arm, Banana, Mobile Robot, Computer Vision, Deep Learning

Detection and Disinfestation of Diseased Plants with YOLO Based ANFIS Controlled Unmanned Ground Vehicle

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Abstract – Plant diseases remain a major challenge in modern agriculture, causing considerable reductions in both yield and crop quality. This study focuses on the development of an intelligent unmanned ground vehicle (UGV) capable of detecting plant diseases in real time and autonomously responding through targeted spraying. A camera mounted on the UGV captures continuous images of crop rows, and disease detection is carried out using the YOLO (You Only Look Once) algorithm—chosen for its speed and accuracy in real-time object recognition. To evaluate model performance, YOLOv7, v8, and v9 were trained using datasets focused on potato leaf diseases, including early and late blight. The YOLOv8 model was selected for deployment on a Raspberry Pi 4B based on its superior detection accuracy. Additionally, a servo motor-enhanced vision system was implemented to broaden the camera's coverage. The UGV's autonomous driving is enabled by a combination of five ultrasonic sensors and an ANFIS (Adaptive Neuro-Fuzzy Inference System)-based decision-making module, which governs navigation and motion planning. As the vehicle traverses the field, the onboard system identifies infected plants and activates a localized spraying mechanism to treat only the affected areas. This integrated approach significantly reduces pesticide use, minimizes environmental harm, and lowers the dependency on manual labor. The results demonstrate a promising application of artificial intelligence and embedded systems for sustainable and efficient disease management in precision agriculture.

Keywords – Diseased Plant Detection, YOLO, Spraying, ultrasonic sensor, Raspberry Pi, motion planning, ANFIS

Review and Comparison of Facial Emotion Recognition Services and APIs

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***Abstract*—**This paper provides a comprehensive review and comparison of various emotion recognition services and APIs, focusing on their access, pricing, media support, and feature sets. The study reviews the foundational work on universal emotions and the Facial Action Coding System (FACS), as well as the critiques and advancements in automated emotion recognition systems. Previous research on the performance of different emotion recognition APIs is also discussed, highlighting the need for updated comparisons due to recent advancements in AI and changes in market offerings. The comparison reveals distinct strengths and weaknesses among the APIs, with services like Amazon Rekognition and VicarVision providing more capabilities in terms of number of emotions detected and demographic analysis, while others like Google Cloud Vision offering more limited capabilities. Ethical considerations and regulatory concerns, particularly those related to the responsible use of AI, are also examined. The findings emphasise the importance of ongoing evaluation and the development of more inclusive, accurate, and ethically sound emotion recognition technologies.

Keywords—Facial Emotion Recognition (FER), Facial Action Coding System (FACS), Universal Emotions, API Comparison

Hybrid Deep Learning Approach of a 6-Axis Force-Torque Sensor Calibration for a Wheeled Humanoid Robot

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***Abstract*—**This work proposes a hybrid calibration strategy for a 6-axis force-torque sensor based on residual learning over a previously trained deep neural network. Although, the neural network standalone model effectively captured nonlinear cross-axis dynamics, the systematic residuals indicated unmodeled patterns. To enhance accuracy, 637 wrench vectors were used to compute prediction residuals, which then were modeled using Random Forest, XGBoost, and Gaussian Process Regression (GPR) models. The hybrid predictions were evaluated on five unknown test vectors. Results show that hybrid models, particularly the Neural Network + XGBoost configuration, significantly reduced the root mean square error (RMSE) compared to standalone methods. While increased model complexity limits real-time deployment, a dual-network architecture is proposed to provide real-time execution and an accurate hybrid model.

Index Terms—force-torque sensor, hybrid calibration, neural network, ensemble learning, XGBoost, Gaussian Process Regression, Random Forest

Eat4U: Calorie Management Based on Predictive Machine Learning Models and Instance Segmentation for University Students in Metropolitan Lima

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***Abstract*—** Caloric imbalance among university students has emerged as a critical public health concern in the modern era, with significant implications for their long-term health and wellbeing. The lack of nutritional knowledge and awareness among young people often contributes to this problem. Although previous research has created nutrition applications to help people understand the nutritional value of foods, there is a notable lack of applications expressly designed to help university students in metropolitan Lima manage their caloric intake. To address this gap, we propose Eat4U, an intelligent mobile application aimed at providing students with essential information about the nutritional content, the base model used is Mask R-CNN ResNet50 FPN V2 and the results obtained through finetuning, and incremental learning resulted in a Mean-IoU of 86%, thereby increasing their awareness and understanding of nutrition. The main feature of the application is the use of the cell phone camera and machine learning models equipped with the PyTorch library, allowing users to scan meals and display detailed information on nutrients and calories to manage their caloric intake. Additionally, a personalized recommendation system is offered based on each user's tastes, goals, and objectives, helping them choose healthier food options. The application also includes an interactive log and a calendar of eating habits to monitor progress and encourage the adoption of healthy lifestyles.

Keywords— Caloric imbalance, university students, metropolitan Lima, mobile application, Eat4U, PyTorch, food recognition

Mobile Application for Managing Anxiety using Machine Learning Model

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***Abstract*—** Anxiety before and after cardiac surgery is a critical factor that can negatively affect patients' recovery and clinical outcomes. This study presents Kora, a mobile application that combines mobile health (mHealth) strategies with a machine learning model to recommend relaxation techniques tailored to each patient's anxiety level. The proposed system uses physiological data—such as heart rate, blood oxygen saturation, and sleep duration—along with State-Trait Anxiety Inventory assessments (STAI), to classify users into anxiety categories and recommend appropriate interventions (music therapy, guided meditation, or breathing exercises). Three machine learning models—Random Forest, Support Vector Machine, and Gradient Boosted Trees—were trained and evaluated using the LifeSnaps dataset (7,411 records), with Gradient Boosted Trees achieving the highest performance, reaching 80.76% accuracy and 82.33% F1-score. Additionally, validation with clinical experts confirmed the app's usability and relevance in healthcare settings. These results suggest that Kora is a promising digital tool to support the emotional wellbeing of cardiac surgery patients through personalized relaxation techniques.

Keywords— anxiety, mHealth, machine learning, TensorFlow, relaxation techniques

Dorsal Hand Vein Biometric Systems: A Survey on Methods, Applications, and Future Directions

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***Abstract*—**With the increasing demand for security, biometric identification systems have gained significant importance in recent years. Traditional authentication methods (such as passwords, PINs, and access cards) suffer from security vulnerabilities, making biometric approaches more reliable, alternatives. This review study focuses comprehensively on dorsal hand vein (DHV) biometrics. Due to the subcutaneous positioning of the veins, DHV patterns are highly resistant to forgery and offer high accuracy thanks to their individual uniqueness and temporal stability. The study examines key processes such as near-infrared imaging of vein patterns, preprocessing techniques, region of interest (ROI) extraction, and vein segmentation. Moreover, modern feature extraction methods, including Gabor filters, PCA, LBP-based approaches, Curvelet transform, and convolutional neural networks (CNNs), are discussed, along with matching algorithms such as Hamming distance, SVM, and KNN. Widely used datasets, methodological performance comparisons, and recent developments in feature-level fusion for multimodal biometric systems are also evaluated. The findings indicate that deep learning-based methods provide higher accuracy than traditional techniques, suggesting that DHV systems will play a prominent role in future secure authentication solutions.

Keywords—dorsal hand vein biometrics, biometric authentication, near-infrared imaging, image preprocessing, feature extraction

Technical principles and accuracy evaluation of UAV remote sensing technology and deep learning algorithms in land survey and detection

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Abstract-The integration of new changes in land surveying and detection methodologies has been provided in Unmanned aerial vehicles (UAV) and deep learning algorithms to acquire data more precisely and accurately. The research work focuses on the technical aspects that support UAV remote sensing technology. The text further discusses how effectively and efficiently various deep learning models can be used to process data originating from UAVs for issues related to land detection. This research paper analyzes the performance of CNNs, U-Net, and Mask R-CNN algorithms for land feature classification across urban, agricultural, and forest terrains. Using a mixed-method approach, this study utilizes data from UAV LiDAR and multispectral sensors. The results have proved that the U-Net models achieved higher segmentation accuracies as compared to the others; precision was almost 93% in an urban environment. Environmental factors and limitations of data processing are the major challenges for optimizing UAV applications. The study adds value to existing knowledge by discussing challenges related to the integration of UAV and deep learning technologies and strategies to enhance data collection and model optimization. This study brings out the importance of the adoption of hybrid sensor technologies and lightweight deep learning models to enhance real-time processing capabilities. As UAV remote sensing progresses, it will be crucial in developing the practices of land survey and producing real-world applications for professionals in geospatial science, environmental monitoring, or urban planning. Future research directions will need to improve model precision and increase applicability in diverse landscapes by providing a solid framework for land survey and detection within an increasingly complex environment.

Keywords: UAV, Remote Sensing, Deep Learning, Land Surveying, U-Net, Environmental Monitoring.

Governance Dynamics in Platform Organizations: The Influence of Information Communication Technology on Decision-making Processes in the Education Sector in China

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Abstract-This study investigates the influence of Information Communication Technology (ICT) on governance dynamics within platform organizations, specifically focusing on the education sector in China. It aims to analyze how ICT tools impact decision-making processes, stakeholder satisfaction, and transparency within these organizations. Employing a mixed-methods approach, the research combines quantitative surveys and qualitative case studies. The quantitative component includes responses from 500 stakeholders across various educational platforms, while the qualitative aspect involves in-depth interviews and focus groups with selected participants from three major educational platforms.The findings reveal that the implementation of ICT significantly enhances decision-making efficiency, with marked improvements in speed and effectiveness. Stakeholder satisfaction has also increased, reflecting higher engagement and acceptance of decisions facilitated by ICT. ICT significantly benefits governance dynamics by improving efficiency, satisfaction, and transparency in the education sector.

Keywords: ICT; Governance; Education Sector; China; Decision-making; Stakeholder Satisfaction; Transparency.

Innovative Application and Implementation Path of IoT Technology in Smart Furniture Integrating Chinese Traditional Auspicious Patterns

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Abstract-The inclusion of Internet of Things (IoT) technology in smart furniture has created new opportunities for novelty perspective in technology where functionality and connectivity are merged with aesthetic designs. This research investigates how the application of IoT is utilized to enhance furniture designs together with the incorporation of Chinese traditional auspicious patterns as the major research problem. This is because it will be easy for furniture manufacturers to incorporate cultural aspects like the clouds, lotus, and phoenix designs into IoT-enabled furniture when a blend of modernism and heritage is desired. Technological developments, practical applicability and application of smart technologies, and design thinking paradigms are explored in the study with a focal concern on IoT's function topologies like remote control, health monitoring, and adaptability. It reveals sustainable manufacturing aspects of the internet of Things in terms of material reduction and energy consumption. On this basis, the present study emphasizes that cultural aspects should be incorporated into the new technologies to ensure that consumers develop affection and cultural attachments to newly developed technologies. It is concluded that smart furniture with auspicious patterns can significantly improve the status of home and workspace designs by combining technology and tradition offering advanced practical and culturally meaningful solutions.

Keywords: IoT, Smart Furniture, Chinese Auspicious Patterns, Cultural Aesthetics, Sustainable Design

Design and implementation of energy efficiency audit, carbon footprint tracking and sustainable development path planning system for green economy enterprises based on blockchain technology

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Abstract-This study examines a solution that entails the use of a blockchain-based system for designing these processes to be transparent and secure. Through the use of blockchain technology, it becomes possible for the proposed system to compile data from IoT based energy meters, carbon trackers, and sustainability reporting systems in real time to boost data credibility and the system's efficiency. Empirical evidence gathered from 15 green enterprises across Europe demonstrated significant improvements: average savings of wastage energy was 18%, accuracy in reporting of carbon emissions was 25% better than traditional methods. Moreover, the system allowed increasing sustainability targets by 22%, and providing 15% cost reduction for overall operations, audits and reporting. The blockchain framework used in this work is Hyperledger Fabric; data integrity is guaranteed, and the proposed methods anonymize the data and meet the GDPR's requirements. The study also demonstrates that blockchain technology is also expandable to some of the existing system challenges such as; data manipulation, opacity and illogical sustainability. Besides, machine learning and predictive analysis are valuable to improve the efficiency of decisions and to identify the patterns that may lead to sustainable development scenarios. Besides rectifying the knowledge gap of Sustainability concepts alongside innovation and sustainable development concerning green enterprises and innovations it also outlines a process through which sustainable development goals could be achieved in the shortest time through integration of blockchain technology and machine learning in societies within and across the globe.

Keywords: Blockchain Technology, Energy Efficiency Audit, Carbon Footprint Tracking, Sustainable Development, Green Economy Enterprises.

Design of Real-Time Embedded System Based on STM32 and Free RTOS with Optimization of Advanced Task Scheduling Algorithm

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Abstract-The research discusses the architecture and realization of a real-time embedded system based on STM32 microcontrollers and Free RTOS with the specification of complex scheduling algorithms. A real-time embedded system is widely used in applications where small-time deviation and nonvariability of the task are mandatory. The STM32 mentioned above platform accompanies Free RTOS and creates a perfect base for developing such systems. The study is quantitative and focuses on performance attributes that include, task completion time, execution time, and scheduling. This was done with the help of RMS (Rate Monotonic Scheduling), DMS (Deadline Monotonic Scheduling) to achieve higher system performance. It was shown that experimental outcomes enhanced the efficiency of task response with a particular emphasis on a 25% increase in the response time, and 98% of tasks completed on time at different workload conditions. The results are consistent with the prior work done in real-time system optimization and establish the usefulness of Free RTOS in handling scheduling issues. The system also indicates a favorable resource utilization where the system can support the applications in areas such as automation, robots and IoT. This research also verifies the applicability of STM32 and Free RTOS for hard real-time applications and lays foundation for these future works: adaptive scheduling and realtime communication protocol.

Keywords: Real-Time Systems, STM32, FreeRTOS, Task Scheduling, Embedded Systems

In-Depth Research on Dynamic Assessment of ESG Benefits and Intelligent Optimization Strategies Based on Iot and Big Data Analytics Technology for Green Transformation in Manufacturing

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Abstract-Exacerbating is a requirement of presenting an efficient response to climate change along with sustainable development urgently calls for innovation of approaches and methodologies on energy conservation and also carbon management within a new and emerging green economy. In this paper, that solution will involve utilising capabilities of IoT and Big Data Analytics concerning dynamic evaluation of the relevance of ESG in the particular manufacturing environment. Co-integration of these technologies provides an over arching system that ensures that sustainability reporting is credible and efficient as it captures real time data for analysis. IoT and Big Data Analytics enable manufacturing enterprises to accomplish predictive maintenance, minimise wastage and optimise energy consumption. Automated technologies incorporate factual analysis into business processes on productions environments; and IoT device permanently supervises them. Manufacturers agree that real-time data means one can pin point and make corrections on operational issues as they occur. The conclusion that can be made from this research is it is impossible to make manufacturing sustainable without the integration of IoT and Big Data Analytics. The conceptual framework is a principle that future technologies that will address global sustainability will be guided by, and the findings offer makers who wish to enhance their sustainability approaches amidst the present-day environmental issues an essential understanding.

Keywords: IoT Technology, Big Data Analytics, ESG Benefits, Sustainable Manufacturing, Green Transformation

Construction and Empirical Research of Personalized Design System for Smart Home Furniture Based on Deep Learning Neural Network and Kansei Engineering Principles

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Abstract-The rapid development in technology in the field of Smart Home led to advancement and innovation in designing furniture personalized specially to the user preferences and applications. This paper analyses the construction of Smart Home Furniture based on Deep Learning Neural Network and Kansei Engineering Principles. The research evaluates the system using empirical research of capturing user preferences through a series of questionnaires and employs a conventional neural network to create multimodal datasets such as image, voice recognition, touch sense and environmental factors . It represents the personalized design system for Smart Home Furniture by integrating Deep Learning Neural Network with Kansei Engineering Principles. The principles used in this research bridge the gap between neural network analysis and functional construction of furniture design. This research contributes to the smart home technology and ergonomic designs by promoting unique approaches to furniture personalization. Key findings indicate that this methodology enhances both functionality and user satisfaction. This also provides powerful theoretical and technological structure for future developments in personalized smart home solutions**.**

Keywords: Smart Home Furniture, Deep Learning, Neural Networks, Kansei Engineering, Personalized Design

Copyright Protection And Traceability Of Intangible Cultural Heritage Digital Aesthetic Education Resources Based On Blockchain Technology

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***Abstract*—**At present, there are few studies on the protection and traceability of copyright resources in the digital aesthetic education of intangible cultural heritage, and the results of copyright protection are less practical. Therefore, this paper makes a thorough study on the copyright protection and traceability of intangible cultural heritage. Copyright protection and traceability of intangible cultural heritage digital aesthetic education resources based on blockchain technology are proposed. First of all, the method of hierarchical analysis is adopted to analyze the weight value of the factors affecting the application of digital aesthetic education of intangible cultural heritage and the protection of copyright resources, and the weight value of the influencing factors is obtained through the consistency test. Then, the application of the intangible cultural heritage digital aesthetic education and copyright resource protection system is constructed, the reliability of the intangible cultural heritage digital aesthetic education and copyright resource protection is applied to trace the results, the weight coefficient of the protection of copyright resources is traced, and the weight is determined by the entropy right method, so as to form the application of the intangible cultural heritage digital aesthetic education and copyright resource protection model. The results show that the method outperforms other models in protecting stability and traceability accuracy.

Keywords—Blockchain technology; intangible cultural heritage; digitalization; aesthetic education resources; copyright protection; traceability

Design and Implementation of Supply Chain Collaborative Risk Early Warning System Based on Machine Learning and Data Mining Technology: A Case Study of China's Manufacturing Supply Chain

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Abstract-Subsequently, there has been a rise in the levels of supply chain disruptions due to the complexity and integration of the global supply chains, especially in manufacturing industries. The study targets establishing a Supply Chain Collaborative Risk Early Warning System (SCREWS) using ML & Data mining techniques. Specifically, we highlight the architecture of the supply chain by examining China's manufacturing supply chain system through secondary data source and journal analysis, including the algorithm and the applications of the manufacturing supply chain system. It is evident that integrating predictive analytics and collaborative frameworks help in risk identification, prevention, and supply chain continuity. Therefore, this study supplements the existing literature in supply chain risk management and offers a practical methodology grounded in data analysis.

Keywords: Supply Chain Risk Management (SCRM), Machine Learning (ML), Data Mining, Collaborative Frameworks, China's Manufacturing Sector

College English reading comprehension graded test and CLIL teaching strategy Customization driven by the integration of SVM and deep learning

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Abstract-Integrating machine learning into education has changed traditional teaching methods especially how to enhance English reading comprehension. This research analyses the use of the "Support Vector Machine (SVM)" and deep learning models to enhance Content and Language Integrated Learning (CLIL) strategies through the tailoring of instruction and targeting of reading levels. A quantitative study was performed; control and experimental groups consisted of 60 students from different colleges in China. Data was gathered using pre-tests and post-tests and analyzed in SPSS. Results showed that reading comprehension of the experimental group improved significantly, with a paired t test resulting in a mean difference of 11.60 ($p < 0.05$). Finally, correlation analysis showed strong positive correlation between SVM predictions and post-test scores ($r = 0.84$) indicating that model is accurate. The results imply that combining SVM with CLIL could lead to more effective personalized learning and better data driven intervention, yet long-term effect on broader language skills still needs more research.

Keywords: Support Vector Machine (SVM), Content and Language Integrated Learning (CLIL), Reading comprehension, Machine learning in education.

Evaluation of the effectiveness of English vocabulary review strategies based on forgetting curves in computer-assisted language learning (CALL) software

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Abstract-Computer-assisted language learning (CALL) has indeed brought a change since it provides learners with better, more effective and more efficient means of learning. This study evaluates the role of Duolingo's system of vocabulary repetition, focusing on its spaced repetition and the function of the game element as its part in terms of its applicability to learning motivation, interest, and retention. The purpose of this study is to evaluate Duolingo's review strategy according to the forgetting curves, to discuss the advantages and disadvantages of this approach, and to determine characteristics that can impact user satisfaction. A systematic literature review (SLR) was conducted using peer-reviewed articles from 2015 to 2024, with a final selection of 8 studies that cover three key themes: (1) the role of spaced repetition on vocabulary retention and (2) user motivation and engagement through gamification. Results indicate that while Duolingo's approach supports initial engagement, its fixed review intervals and repetitive gamification may limit long-term retention and user satisfaction. The study concludes that Duolingo could benefit from adaptive review intervals, diversified gamification, and greater customization options to enhance effectiveness and meet diverse user needs. It is recommended that Duolingo incorporate adaptive spaced repetition intervals, diversify gamified elements, and introduce customization options to better support long-term vocabulary retention and user satisfaction. This study is limited by its reliance on secondary data from existing literature, which may not fully capture recent updates to Duolingo's features or user experiences across diverse cultural contexts.

Keywords: Spaced Repetition, Vocabulary Retention, Gamification, User Engagement, Mobile-Assisted Language Learning (MALL), Computer-assisted language learning (CALL)

Research on the synergistic mechanism of improving the transparency of listed company governance and reducing equity costs based on blockchain technology

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Abstract-The application of blockchain technology in corporate governance has attracted a lot of attention because it promises to improve corporate governance practices by increasing transparency and reducing equity costs. The purpose of this study is to explore the joint governance transparency and low equity cost underlining mechanism of blockchain in registered companies. Through five closed end interviews with two corporate governance experts, two blockchain technology specialists, and one financial managers and a thematic analysis of their insights this research explores the practical application of blockchain within corporate governance structures. The research results showed that blockchain technology increased the transparency of transactions through the creation of a decentralized, immutable record of transactions that decreases fraud and builds confidence among investors. The result of this is lower equity costs. These results are important for corporate leaders, investors, as well as policy makers that are trying to fashion governance models for increased accountability and efficiency. It is suggested that blockchain reduces the costs and increases the governance transparency.

Keywords: Blockchain technology, Corporate Governance, Transparency, Equity Cost Reduction, Governance Automation.

Construction and optimization of intelligent management system for sports venues

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Abstract-The contemporary sports facilities entail complexity in the operation, safety, and fan experience that necessitates the use of smart systems. This paper focuses on analyzing the practices of IoT and AI technologies in Madison Square Garden (MSG) and Mercedes-Benz Stadium to determine benefits in resource utilization, fans management, and safety. The conference paper employed a qualitative case study design to examine how real-time data from IoT and AI-predictive analytics had been integrated by relating data from the public domain combined with performance reports. Hence, the study shows that IoT systems in MSG are capable of controlling energy consumption and staffing to save costs on sustainability. In the same manner, MercedesBenz stadium incorporates an attendance prediction model to determine likely attendees, facilitate resource management, and avoid congestion. Both venues provide immediate benefits to fans with real-time services like crowd control and promotional incentives. As a result, this study assesses intelligent management systems and fosters understanding that they deliver manifold operations and customer values.

Keywords: IoT, AI-driven analytics, sports venue management, resource optimization, fan experience

Machine Learning Approaches in Cervical Cancer Research: A Comprehensive Literature Review

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Abstract - Cervical cancer (CrC) continues to pose a significant global threat to women's health and accounts for a considerable share of the worldwide cancer burden. Early diagnosis and effective management strategies play a critical role in reducing the morbidity and mortality rates associated with the disease. This review aims to comprehensively evaluate the epidemiology, etiology, traditional screening and diagnostic methods, and the current and potential applications of machine learning (ML) and artificial intelligence (AI) algorithms in cervical cancer. The reviewed studies cover a broad spectrum, ranging from the role of Human Papillomavirus (HPV) infection in disease progression to cancer cell classification, prediction of treatment response, and individual risk assessment. This review highlights the transformative potential of ML and AI techniques in the fight against cervical cancer, demonstrating how advanced methods such as feature selection, ensemble learning, and explainable artificial intelligence (XAI) enhance diagnostic accuracy and clinical applicability.

Keywords: cervical cancer, machine learning, artificial intelligence, human papillomavirus (hpv), early diagnosis, pap smear, colposcopy, feature selection, ensemble learning, explainable artificial intelligence (xai), medical image processing, risk prediction, clinical decision support systems, epidemiology, data balancing