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[3] *Introducing SukukChain Architecture: The Role of Blockchain and Smart Contracts in the Digital Transformation of Islamic Financial Instruments*

Farhang M Hamzah (Mr).

Restructuring of traditional Sukuk system into a more robust and secure framework using the application of decentralised architecture called SukukChain. The main purpose of this paper is to develop and validate a blockchain based infrastructure that enables the issuance and management of Sukuk in alignment with Islamic economic principles. Further, the study settled on a mixed methods approach, combining experimental methods with data analysis to evaluate the performance, compliance, and scalability of smart contract enabled Sukuk Structure. Besides, Experimental simulation demonstrates how smart contracts automate the execution of agreements, ensuring Shariah compliance and reducing the potential for errors and disputes. Consequently, findings highlight the potential of decentralized Sukuk to support an inclusive and ethical financial system by reducing reliance on centralized intermediaries, enhancing trust through smart contracts, and promoting real economic activity. However, the research identifies critical limitations, including legal uncertainties, lack of standardized smart contract frameworks, and resistance from legacy financial institutions, all of which hinder the broader adoption of SukukChain in reviving the Islamic economic system. Despite these challenges, the paper contributes significant value by introducing a viable pathway toward a more autonomous, Shari'ah compliant, and digitally integrated financial future.

[4] *MedPredict: A Prototype System for Integrated Machine Learning–Based Disease Prediction*

Nur Athirah Mohd Abu Bakar (International Islamic University Malaysia), Hannah Kamillia Hamidi (International Islamic University Malaysia), Nurazlin Zainal Azmi (International Islamic University Malaysia).

The rise in chronic and non-communicable diseases (NCDs) such as diabetes, heart disease, kidney conditions, and breast cancer has underscored the need for early diagnosis and preventive strategies. Traditional diagnostic approaches often involve complex procedures and specialist interpretation, delaying timely intervention. This paper presents MedPredict, a prototype of an intelligent, web-based disease prediction system that leverages machine learning to assist in the early detection of multiple health conditions. Developed with an integrated architecture, the prototype includes modules for diabetes, heart disease, breast cancer, and kidney disease, each employing tailored ML algorithms trained on public datasets. Evaluation through functional, integration, and usability testing demonstrated positive outcomes, with prediction accuracies ranging from 76% to 98% and high user satisfaction in terms of interface usability and clarity of results. MedPredict aims to complement clinical decision-making and support public health efforts by providing an accessible, non-invasive tool for proactive healthcare.

[5] *Hikmah AI – A Spiritually Intelligent AI Assistant for Balancing Dīn and Dunyā Through Barakah-Centered Planning*

Sanam Habib (Hikmah AI).

Today's digital-driven society brings significant challenges for Muslims seeking to strike a harmonious balance between their dīn (religious duties) and their dunyā (worldly responsibilities). While an increasing number of AI applications cover various aspects of Islamic life, there remains a critical research gap in tools that holistically integrate Islamic psychology, particularly nafs (self) training, into a comprehensive framework for achieving this balance. This paper presents the conceptual development of Hikmah AI, a spiritually intelligent AI assistant, at an early stage. Hikmah AI aims to fill this identified gap by proposing a novel approach that combines the teachings of the Holy Quran and Sunnah with the principles of Islamic psychology, with a particular focus on nafs training to enable barakah- centred planning. This methodology is designed to build discipline, increase productivity and guide users towards a successful and balanced lifestyle by using AI to promote deeper spiritual and personal development.

[6] *Quantitative Imaging Biomarkers for Prognosis Prediction and Treatment Stratification in Lung Cancer Through a Multi-Stage Deep Learning Approach*

Nisa Nabilah Azaddin (International Islamic University of Malaysia (IIUM)), Akeem Olowolayemo (International Islamic University of Malaysia (IIUM)).

This paper proposes a multi-stage deep learning framework for non-small cell lung carcinoma (NSCLC) treatment planning. The framework includes convolutional neural network (CNN) integration for computed tomography (CT) classification to three different classes which are “normal”, “benign”, and “malignant”, histopathology biomarker quantification from hematoxylin and eosin (H&E) stained images, Random Forest and XG Boost prognosis prediction, and stratified treatment suggestions generated based on the predicted outcome and computed metrics. Experimental outcomes exhibit high accuracy for lung CT image classification, high potential in histopathology biomarkers quantification metrics, and support automated decision-making for lung cancer treatment.

[12] *Exploring organisational challenges and enablers in the implementation of the integrated personnel and payroll information system (IPPIS) in Nigeria*

Ayesha Adeleye Dupe (International Islamic University Malaysia, Gombak, Malaysia), Abd. Rahman Ahlan (International Islamic University Malaysia, Gombak, Malaysia), Najhan Muhamad Ibrahim (International Islamic University Malaysia, Gombak, Malaysia), Mahfooz Ahmed (Universiti Sultan Zainal Abidin Terengganu, Malaysia).

The Integrated Personnel and Payroll Information System (IPPIS) was introduced by the Nigerian government as a centralized digital platform to promote payroll transparency, reduce fraud, and improve administrative efficiency within the public sector. Despite its intended benefits, IPPIS implementation faces organizational, technical, and user-related challenges. This study investigates the barriers and enablers affecting its effective and sustained use, drawing on qualitative data from semi-structured interviews with key personnel at the Office of the Accountant-General of the Federation. Findings reveal that delayed data updates, limited ICT capacity, system rigidity, and resistance to change hinder adoption, while leadership commitment, training, perceived usefulness, and accountability act as enablers. Participants further proposed strategies for improving system design, stakeholder engagement, and long-term sustainability. The study contributes ministry-level insights to digital transformation literature and offers policy recommendations for strengthening payroll reforms in Nigeria’s public sector.

[14] *Hands-on Learning in Database Programming Education: Exploring Student Experiences Through Thematic Analysis of Project Reflections*

Nurhafizah Mahri (Department of Information Systems, International Islamic University Malaysia), Nur Leyni Nilam Puteri Junurham (Department of Library Information Systems, International Islamic University Malaysia).

This study explores the challenges and experiences of students undertaking a database programming project that integrates database systems with web applications, utilizing a project-based learning (PBL) approach. Through a thematic analysis of 80 student reflections, five key themes were identified: Web Application Development Challenges, Difficulty of SQL and PL/SQL Mastery, Time Management, Teamwork and Communication, and Technical Support and Resources. The findings reveal that students faced significant technical hurdles, particularly in integrating diverse technologies and mastering complex database languages. Many students had to self-learn web development technologies, indicating a gap in foundational knowledge. The study also highlights the importance of structured support, practical experience, and robust technical assistance in PBL environments. Students demonstrated resilience and adaptability, leveraging teamwork and communication to overcome technical challenges. The study underscores the need for enhanced scaffolding, mentorship programs, and curated learning resources to improve pedagogical approaches in database education. Addressing these challenges allows educators to cultivate a more nurturing and productive learning space, effectively preparing students to meet the demands of the technological world.

[16] *Scalable IoT Event Processing by Integrating EPCIS Standards with Blockchain Verification and NoSQL Storage*

Hannah Maisarah Mohamad Hassan (IIUM), Qurratu'Ain Iskandar Arash (IIUM), Saidatul Izyanie Kamarudin (IIUM), Siti Husna Abdul Rahman (IIUM), Mimi Liza Abdul Majid (IIUM), Ahmad Anwar Zainuddin (IIUM).

The Internet of Things (IoT) is expanding rapidly, connecting billions of devices that generate vast volumes of data in real time. However, a major problem facing IoT systems is the lack of scalability, especially when integrating technologies like blockchain, because while it offers trust, transparency, and immutability, it also creates a decentralization and computational overhead. Moreover, traditional IoT infrastructures struggle to manage increasing traffic, complex data types, and real-time processing demands. Hence, there is a need for smarter systems that can understand better and may evaluate trust in digital environments. To tackle this issue, this paper suggests an innovative solution that combines an EPCIS-based model with blockchain technology to enhance data flow and validation in IoT settings. The main concept involves utilizing a layered framework where data gathered through RFID is filtered and processed by multi-core application layers, verified and permanently logged via smart contracts on a blockchain, and saved within a cloud-based, NoSQL distributed database structure. An intelligent Scalability Manager actively modifies computing resources to sustain performance and lower expenses. In order to include trust and security into each stage of development, the methodology uses a Software Development Life Cycle (SDLC) structure and a methodical research approach with a thorough literature analysis. A thorough

analysis was conducted using peer-reviewed academic publications from 2019 to 2025 to uncover dominant challenges and innovative solutions related to blockchain scalability in IoT. This research is strengthened by a conceptual architectural design illustrating how integrating the EPCIS standard with blockchain technology can overcome current limitations. The primary product of this work is a high-level system architecture model that demonstrates secure and scalable IoT data handling. The study specifically examines how this EPCIS-blockchain combination can enhance real-time tracking for IoT applications, improve system scalability, and bolster data security. Its primary contribution is a thorough analysis of scalability challenges in existing IoT-blockchain systems, alongside the introduction of a novel integrated model designed for flexible, reliable, and efficient data management. This architecture provides a foundation for building more dependable and scalable future IoT systems.

[20] Challenges of Big Data Analytics Applications in Small and Medium Enterprises (SMEs)- A TOE Model Study

Najhan Muhamad Ibrahim (IIUM), Salman Bashir (IIUM).

This research investigates the adoption of Big Data Analytics (BDA) within Small and Medium-sized Enterprises (SMEs) in Malaysia, leveraging the Technology-Organization-Environment (TOE) model as a conceptual framework. A comprehensive review of global TOE factors SMEs face sets the stage for understanding the context of BDA adoption. The study employs a structured questionnaire survey, gathering responses from 155 SMES personnel to assess diverse TOE factors and the impact of BDA adoption. The findings reveal a positive correlation between BDA adoption and its Relative Advantages: cost reduction, improved work processes, elevated customer service, and enhanced work quality. Significant influencers in the adaptation of BDA within SMEs include compatibility and complexity. Organisational factors, such as preparedness and top-level management support, emerge as critical variables shaping BDA adoption. Furthermore, environmental factors, particularly competitive pressure, outweigh governmental regulation as a driver for BDA adoption among SMEs in Malaysia. Employing SPSS software and one-sample t-test analysis, the study establishes statistical significance for each identified TOE factor, providing robust evidence of their impact in the Malaysian SMEs context. This research contributes empirical insights into the nuanced dynamics of BDA adoption, offering valuable guidance for policymakers, practitioners, and researchers navigating the evolving landscape of digital transformation within SMEs.

[26] Performance Evaluation Metrics Comparison Between WEKA and Google Colab for Predicting Type1 and Type2 Diabetes using ML algorithms on Egyptian Dataset

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Diabetes is among the chronic disease that globally the number of deaths increases. While Egypt had carried the 8th position in diabetes and is approximated that the number is suggested to rise to 13.1 million by 2035. Additionally, the number of patients especially Type1 and Type2 has been high in Egypt. Early prediction of machine learning of Type1 and Type 2 is needed. Therefore, the main objective in this study is to compare the two software that are WEKA and Google Colaboratory in predicting Type1 and Type2 using machine learning algorithms and then comparing those algorithms of each software using Egyptian dataset that categorizing the dataset with the three groups such as Early Adulthood, Middle age and Geriatric. Six algorithms were used, which were Naïve Bayes, Random Forest, Decision Tree, Random Tree, AdaBoost and Bagging and as a performance metrics, the accuracy, precision, recall, F1 measure and ROC were used. In the experimental results it has been shown that, for the WEKA software, Random Forest had highest accuracy of 0.936 on the early adulthood group and the Decision Tree of accuracy 0.930 and 0.794 for middle age and Geriatric age groups respectively. As for the google Colab, Random Forest had highest accuracy for all age groups of 0.9742, 0.9491 and 0.9043. In conclusion, Google Colab had the better overall evaluation performance than WEKA.

[29] Model Accuracy in Enterprise Architecture: Validation and Verification of Business Process via Petri Nets and WoPeD

M Luthfi Ridhwan (Telkom University), Asti Amalia Nur Fajrillah (Telkom University), Muharman Lubis (Telkom University), Fadhil Rozi Hendrawan (Telkom University), Dini Oktarina Dwi Handayani (International Islamic University Malaysia).

Enterprise Architecture (EA) is a strategic approach aimed at aligning business functions and information systems/information technology within an organization. Despite its significant potential for improving business process efficiency, EA implementation often faces various challenges, including the failure of integration with Business Process Management (BPM). BPM, as a crucial component of Business Architecture, often encounters obstacles, particularly in the business process modeling phase. Standard modeling languages such as BPMN are commonly used, but do not provide explicit mechanisms for model validity analysis or verification. As a solution, a Petri Nets-based approach was introduced because it provides a more formal method for validating and verifying business processes through analysis of model notation and behavior (soundness).

In this study, validation and verification were conducted using the WoPeD tool, with the object of study being the EA design of a regional company engaged in natural resource management, particularly in logistics and general functions. The results obtained indicate that the validated and verified business process model can support the improvement of the overall success of Business Architecture design

[30] *Understanding Muslim Parents' Navigation of Online Safety through a Sensemaking Model*

Fadzlin Ahmadon (International Islamic University Malaysia (IIUM)), Muna Azuddin (International Islamic University Malaysia (IIUM)), Murni Mahmud (International Islamic University Malaysia (IIUM)).

This paper explores the ways Muslim parents make sense of online risks by mapping their experiences to Pirolli and Card's Sensemaking Model. Through semi-structured interviews with seven participants, the study examines both their foraging and sensemaking activities and uncovers how religious considerations shape each step of online safety navigation. The findings indicate that parents integrate Islamic values into their interpretation of online risks, adding on a faith-based dimension to conventional online safety guidelines. Although Pirolli and Card's model is frequently applied for HCI system design, these results demonstrate its values as a theoretical lens for understanding safety-centred sensemaking of online risks. Additionally, using this model highlights the potential opportunities for future design decisions and affordances that could better support Muslim parents in safeguarding their children's online experiences in all phases.

[32] *Leveraging Big Data Quality to Visualize Botnet Attacks Trends in Malaysia*

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Botnet attacks pose significant threats to the security of information systems and network infrastructures globally, including in Malaysia. Lack of public awareness regarding botnet threats, contributing to potential vulnerabilities among individuals and organizations. Understanding botnet attacks is essential to strengthening cyber defenses and enabling timely incident responses. This study combines data management processes, software development principles and user interface guidelines to produce data visualization. Datasets from various sources including network traffic logs, intrusion detection system (IDS) alerts, and malware repositories, are utilized in this study. The dashboard aims to uncover underlying patterns, temporal trends, and spatial anomalies within the Malaysian botnet threat landscape. The visualizations are designed to support policymakers by enabling the identification of peak botnet activity periods and commonly exploited attack pathways. These insights assist in shaping informed cybersecurity policies and national defense strategies.

[33] *Identifying Key Parameters for School Bus Monitoring System Using a Triangulation Method: A Study in Zanzibar*

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The design and development of school bus monitoring systems requires a clear understanding of the key parameters that ensure student safety, reliable communication and parental satisfaction. While various studies have proposed technological solutions to improve school bus transportation safety, they often do not clearly identify the key parameters required for school bus monitoring systems. This study aimed to identify the critical parameters for such systems by first conducting the literature review which revealed three frequently referenced parameters which are student identification, bus location tracking, and SMS notification alerts. To validate the importance of these parameters in real-world context, a triangulation method was applied, involving interview with school authorities, focus group discussion with school bus drivers and questionnaire with parents. Data were collected from the stakeholders in Zanzibar Urban West Region. The findings across all three methods confirmed that student identification, bus location tracking and SMS notification alerts are essential parameters for school bus monitoring systems. These validated parameters provide a strong foundation for designing and developing technological solutions for school bus monitoring.

[34] *Bridging Service Quality and Architecture in Digital Banking: A Usability Framework Based on TOGAF ADM and E-Servqual*

Muharman Lubis (Telkom University), Fadhil Rozi Hendrawan (Telkom University), Alif Noorachmad Muttaqin (Telkom University), Dini Oktarina Dwi Handayani (International Islamic University Malaysia).

PT. Bank PT XYZ is one of the top banks in Indonesia. Every business function in PT. PT XYZ must be integrated one another in order to achieve the bank's vision. There must be a good information technology implementation to support every line of business, especially in the IT applications and development area. There are some issues related to customer's satisfaction of Bank PT XYZ application called PT XYZ Online. Enterprise architecture (EA) can be used to fulfill the bank's requirement based on customer's feedback on Bank PT XYZ's services. EA can be used in designing system within a company. The method that is used is using TOGAF ADM. We customized TOGAF by using it with satisfaction matrix. Satisfaction matrix is used as an alternative that is equivalent to TOGAF ADM's business architecture, information architecture, and technology architecture phases. Before the satisfaction matrix is made, we did a quantitative research by distributing questionnaires to 100 customers of Bank PT XYZ. The method that is used to measure quality of Bank PT XYZ's electronic service is E-Servqual, which is primarily implement the mixed method while the qualitative research was done by observation and literature study

[35] Fortifying the Pipeline: WSN Security Challenges and Mitigation Strategies in Student-Driven IoT Innovation (A Case Study of IoTeams)

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In today's technological era, where the advancement of the Internet of Things (IoT) has become more widespread, especially in the field of education, particularly through student-led innovation platforms for example in university club that related to study of IoT or ICT like IoTeams Clubs in International Islamic University Malaysia (IIUM) who relies heavily on Wireless Sensor Networks (WSNs) for real-time data collection and communication. Still, WSNs are at risk from various security issues like data being intercepted, nodes getting compromised, and denial-of-service attacks because they are wireless and do not have plenty of resources [1], [2]. This paper aims to discuss these security-related problems from a wireless communication angle and their effect on IoTeams. The focus is to determine the security of WSNs in student-driven IoT work research and explore which current practices can be used to help them. The methodology involves a comprehensive literature review of WSNs security issues in education and a survey among IoTeams members about their perceptions, actions, and concerns regarding security in wireless communication. The study offers a clearer understanding of the vulnerabilities in the current security of IoT in academic environments and offers targeted ways to improve wireless security within student-driven IoT ecosystem.

[36] A Comparative Study of Deep Learning Models for Automated Detection of Lumpy Skin Disease in Cattle

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Lumpy Skin Disease (LSD) is a highly contagious viral illness affecting cattle, leading to significant economic losses in the livestock industry due to reduced milk yield, weight loss, infertility, and mortality. Early and accurate diagnosis is crucial for containment and treatment. Traditional diagnostic methods are time-consuming and require expert veterinarians, which may not be accessible in rural areas. This study proposes and evaluates a range of deep learning models for automated identification of LSD from cow images. We compare the performance of six deep learning architectures—CNN-TensorFlow, CNN-SqueezeNet, CNN-Inception, CNN-Xception, MobileNet, and PyTorch based CNN, alongside traditional machine learning classifiers such as SVM, MLP, Logistic Regression, J48, and an ensemble model. Using a dataset of 1,024 labeled images (split 80:20 for training and testing), our experiments show that Xception achieves the highest accuracy of 90.15%, followed by MobileNet (89.16%) and Inception (88.18%). The original CNN-TensorFlow model achieved 84.73%, outperforming SVM (81.28%) and MLP (67.49%). Notably, SqueezeNet failed to detect any positive cases (recall = 0), highlighting model sensitivity to architecture choice. The results demonstrate that deep learning, particularly transfer-learning-capable models like Xception and lightweight MobileNet, offers a robust solution for automated LSD detection. This work lays the foundation for developing realtime, mobile-based diagnostic tools for farmers and veterinarians, contributing to sustainable livestock management.

[38] Managing Information Technology in Health Facilities: A Systematic Review of a Decade

Abdul Hakim Satria Nusantara (Telkom University), Muharman Lubis (Telkom University), Mochamad Teguh Kurniawan (Telkom University), Dini Oktarina Dwi Handayani (International Islamic University Malaysia).

This study aims to explore the success factors and efforts of information technology governance in health facilities based on scientific literature from 2014 to 2024. Using a Systematic Literature Review (SLR) approach, 17 relevant studies were analyzed. Four themes emerged based on the results of the literature review: Information Technology and Business Value, IT Orchestration, Applications in the Healthcare Industry, and IT Architecture. This study identifies multiple success factors and mechanisms critical to the implementation of IT governance in healthcare facilities. It is suggested that a comprehensive framework can serve as a reference for IT governance implementation, particularly within healthcare environments.

[40] *Design Thinking for Disaster Response: Enhancing Volunteer Engagement via UI/UX Innovation in the Cawan Application*

Qadhli Jafar Adrian Adrian (Universitas Teknokrat), Nur Chayana Aminullah (Universitas Teknokrat), Imam Ahmad (Universitas Teknokrat), Fadhil Rozi Hendrawan (Telkom University Jakarta), Syakira Al-'Aafiyah (Telkom University Jakarta).

Natural disasters always have a surprising impact and cause a lot of loss of life and material. The role of volunteers in the initial response to disasters is very important so that these incidents can be minimized. However, currently, disaster management is still experiencing weaknesses, one of which is the slow pace of mitigation efforts and the lack of disaster emergency response so that the negative impact of the disaster is felt big. So the need for an innovation to improve skills and knowledge through learning experiences in achieving effective performance in various activities. Therefore, to achieve this goal, the Design Thinking method was chosen in designing a volunteer search application that focuses on the user's usability and satisfaction with the application. The Design Thinking method consists of five iterative stages that can be used to strengthen innovation, solve a problem and help understand user needs so as to provide an appropriate solution. The results obtained from user validation when using the prototype, it is concluded that the application design has met the benchmark criteria, by obtaining a user satisfaction level of 84 points, where these points have met the criteria for measuring the System Usability Scale so that the design.

[42] *Grant Access Protocol for Consortium Blockchain in Vehicle Maintenance System*

Hafizah Mansor (International Islamic University of Malaysia), Nur Shuhadah Mohd Ab Razak (International Islamic University Malaysia), Abdul Ghafar Jaafar (Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia).

A vehicle undergoes various lifecycles, spanning from the manufacturing process to its end-of-life phase. One of the essential life cycles is the ownership period, which involves maintaining the car. The services performed on a vehicle must be properly recorded to ensure that its maintenance and historical records are available and accurate, which is a challenge in the current practice. By leveraging decentralised ledger systems, specifically a consortium blockchain, we propose an innovative approach that addresses current challenges associated with traditional record-keeping methods, such as data silos, fraudulent or tampered entries, and a lack of interoperability between various stakeholders. All stakeholders are considered in the proposed framework to ensure secure and trusted operations. A secure protocol is introduced during the stakeholders' inception phase, specifically for the new vehicle owner. The protocol is formally analysed using the Scyther tool to ensure the security requirements (confidentiality, integrity, and authentication) are met. The security requirements, which include integrity, availability, and non-repudiation, are also analysed informally. The framework and protocols are verified to be secure and could be used in logging vehicle service maintenance based on the proposed framework.

[43] *Artificial Intelligence and Sentiment Analysis of X Platform Users: COVID-19 Tweets as a Case Study*

Mohammed Alhaweti (King Abdulaziz University), Yasamiyan Aljadani (King Abdulaziz University).

This study analyzes the sentiments of Saudi users toward the COVID-19 pandemic using posts from the X platform (formerly Twitter). We adopt a descriptive design and employ natural language processing (NLP) techniques—particularly machine learning (ML)—to build and evaluate a sentence-level sentiment classifier. After manually annotating posts with contextual, sentence-level labels (positive, negative, neutral) rather than relying on word-level lexicons, we detect emotional expressions such as anger, sadness, and disgust using a pre-trained Arabic emotion model partially aligned with Robert Plutchik's Wheel of Emotions. We implement two ML algorithms—Support Vector Machines (SVM) and Naïve Bayes (NB)—and assess their performance using accuracy and confusion matrices. Data analysis was conducted in Google Colab using Python. Results show that sentiment among Saudi users varied across the three polarity classes, with the largest share being positive (42.1%). The NB classifier achieved the best overall accuracy (78.1%) with balanced predictions across the three classes, indicating robust performance for sentence-level Arabic social-media sentiment classification.

[44] *Financial Technology and Financial Inclusion in Malaysia: An Analysis of Scientific production and Future research trends*

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Financial inclusion and sustainable development emerge as pivotal policy objectives across both developed and developing economies, with Malaysia particularly focused on utilizing digital innovations to address financial accessibility challenges. Financial technology (FinTech) represents a transformative technological paradigm that optimizes the provision of financial services via automation, digital interfaces, and data analytics. The swift evolution of Malaysia's digital economy, bolstered by

rapid technological advancements, has fostered an environment conducive to the proliferation and integration of FinTech across diverse sectors. This study investigates the role of FinTech in enhancing financial inclusion in Malaysia through a detailed analysis of scientific output, thematic focus areas, and emerging research trajectories within this domain. Utilizing a Systematic Literature Review (SLR) combined with bibliometric analysis, the research delineates the progression of academic discourse, identifies key thematic clusters, and recognizes influential publications, authors, and pivotal keywords that shape the narrative. The results underscore a robust, positive correlation between FinTech innovations and financial inclusion, evidencing that Malaysia's FinTech ecosystem not only broadens access to financial services but also synchronizes with sustainable development goals. The study concludes with a delineation of prospective research avenues, providing valuable insights for policymakers, industry leaders, and scholars keen on leveraging FinTech as a driver for inclusive and sustainable economic progress.

[45] *Predictive Analytics and Machine Learning Approaches for Supply Chain Demand Forecasting: Concepts, Applications, and Trends*

Rehab Ibrahim Ahmed Omer (International Islamic University Malaysia), Raini Hassan (International Islamic University Malaysia), Madiah Sheikh Abdul Aziz (International Islamic University Malaysia).

Accurate demand forecasting is vital for effective supply chain optimization, influencing inventory management, production planning, and customer satisfaction. This paper presents a structured overview of traditional forecasting models, predictive analytics techniques, and machine learning approaches in supply chain demand forecasting. The discussion highlights key methods, including statistical time-series models, supervised and unsupervised learning algorithms, ensemble techniques, and deep learning architectures. Real-world application examples illustrate how these methods are used across retail, manufacturing, healthcare, and food industries. The paper also examines persistent challenges such as data quality, model interpretability, and integration complexity and outlines emerging trends, including real-time adaptability, hybrid modelling, and explainable AI. By synthesizing selected research insights and practical experiences, this work aims to provide supply chain professionals and researchers with a clearer understanding of current capabilities, limitations, and opportunities in demand forecasting.

[46] *A Mapping Study of Artificial Intelligence Application for Assisting Dyslexia Children in Education*

Siti Husna Mohd Zubair (International Islamic University Malaysia), Farhana Sukiman (International Islamic University Malaysia), Norsaremah Salleh (International Islamic University Malaysia), Siti Noorjannah Ibrahim (International Islamic University Malaysia), Samer Zein (Birzeit University).

Artificial Intelligence (AI) is becoming more and more a part of our everyday lives. It facilitates us in decision making, work planning, learning new skills and many other tasks. One of the applications of AI is to assist children with Dyslexia to learn better. Dyslexia is a learning disability that affects reading, writing, and speaking ability. This study aims to discover the learning tools that have utilized AI in helping Dyslexia children to learn. We used the systematic mapping study approach to provide evidence about the use of AI-based tools and characterize the studies based on the learning difficulties. Based on the 20 included studies, we found that most of the studies focused on implementing AI features but lack in addressing the limitations that Dyslexia children are facing. We discussed the findings on this topic and highlight the future direction of this work.

[47] *Ethical Use of AI to Preserve Money: A Maqasid-Based Approach*

Yasser Tarshany (Al-Madinah International University), Akram Zeki (International Islamic University Malaysia).

We currently live in a time of digital transformation, and because of the many ethical issues that arise in the digital realm, there is a lot of interest in artificial intelligence applications and their ethics to Achieve Maqasid of Digital Business Sustainability. One such issue is figuring out who should bear responsibility for damages caused by AI technologies to achieve Maqasid of Preserving the Money? Thus, the purpose of this research was to examine how crucial it is to enable artificial intelligence's ethics by holding people accountable and taking responsibility in a way that advances the Maqasid of money Business Sustainability. This issue was studied using an analytical inductive approach in the research, which emphasizes the need for frameworks that improve responsible innovation, accountability systems, and ethical governance to achieve Maqasid of Preserving the Money.

[48] *MYSENTIMENTH: Affective Norms for Malay Sentiment Word Derived from Mental Health Context*

Hafizuddin Adnan (International Islamic University Malaysia), Hamwira Yaacob (International Islamic University Malaysia), Normi Sham Abu Bakar (International Islamic University Malaysia), Abdul Wahab Abdul Rahman (International Islamic University Malaysia).

Recent research trends in sentiment analysis increasingly focus on understanding and extracting emotions from social media comments and user-generated content. These studies aim to identify emotional cues within language to better understand public sentiment and social dynamics. Word-level sentiment analysis, in particular, plays a crucial role in interpreting human emotions, offering valuable insights for anticipating and responding to societal issues. Despite the growing interest in sentiment analysis, there is a noticeable lack of research on emotion-labeled corpora in the Malay language. To date, no comprehensive studies or publicly available datasets have been published that focus on the development of a Malay emotional corpus. Furthermore, methodologies for annotating Malay words with emotional labels are still underdeveloped. To address this gap, the present study aims to develop MySentiMentH, a lexicon of affective norms for Malay sentiment words within the context of mental health. The primary objective of this research is to review existing techniques and methodologies used in the creation of emotional corpora and adapt these approaches to the development of MySentiMentH. Focusing on the mental health domain allows for a more targeted analysis of emotional language, particularly as it appears in responses to major societal events. The methodology of this study includes detailed discussions on data sampling, the design of the MySentiMentH lexicon, and the materials and procedures employed in its development. The findings of this study demonstrate the feasibility of constructing a Malay sentiment lexicon with emotional labels. MySentiMentH is shown to be a valuable resource for future research and applications, providing a foundational dataset for the continued development of a comprehensive Malay emotional corpus

[49] *Data Stories and Cognitive Load A Systematic Review of the Picture Superiority Effect.*

Mohammed Rakibul Hassan (International Islamic University Malaysia), Madiah Sheikh Abdul Aziz (International Islamic University Malaysia), Raini Hassan (International Islamic University Malaysia).

This study investigates the Picture Superiority Effect (PSE) as a mechanism for enhancing data storytelling and reducing cognitive load. A systematic literature review (SLR) of 16 peer-reviewed studies published between January 2022 and June 2025 was conducted following PRISMA 2020 and CASP guidelines. Results show that visual formats such as infographics, dashboards, and data comics outperform text-only approaches, particularly when tailored to audience expertise and domain context. Relevant, well-integrated visuals improve memory retention, engagement, and comprehension, whereas irrelevant or overly complex visuals can increase cognitive load. The synthesis draws on Dual Coding Theory, Cognitive Load Theory, and Cognitive Semiotics to explain these effects. Despite growing adoption of PSE-based approaches, challenges persist in developing standardized design guidelines, accurately measuring cognitive load, and adapting visuals for diverse audiences. This review consolidates empirical evidence, identifies key research gaps, and offers design recommendations for adaptive, user-centered visual storytelling applicable to domains including education, healthcare, and governance.

[50] *A Conceptual Framework for Information Technology Adoption in Healthcare During Disease Outbreaks*

Hiba Osman (IIUM), Lili Marziana Bt. Abdullah (IIUM), Nurazlin Bt. Zainal Azmi (IIUM), Noor Azizah Bt. Mohamed Ali (IIUM).

Recent disease outbreaks, such as COVID-19, have led to the adoption of IT solutions, such as mobile apps for contact tracing and telemedicine services, to support public health measures. Despite their potential, adoption rates remain low, highlighting the need to investigate the technological and threat-related factors influencing their use. This conceptual paper integrates the Unified Theory of Acceptance and Use of Technology (UTAUT) and Protection Motivation Theory (PMT) to examine technological acceptance and psychological motivational factors affecting IT adoption in healthcare during outbreaks. Based on a systematic literature review of publications, eight independent variables influencing the intention to adopt IT were identified. The proposed framework addresses gaps in previous studies and offers guidance for policymakers, healthcare providers, and IT professionals to enhance IT adoption, with future validation planned through an exploratory sequential mixed-methods approach.

[51] *Implementing Cloud-Based Security Solutions for Cryptocurrency Wallets*

Sohel Rana (KICT,IIUM), Rizal Mohd Nor (KICT,IIUM), Mohamamd Enayet Hossain (IIUM Institute of Islamic Banking and Finance), Md Amiruzzaman (Dept. of Computer Science, West Chester University), Md Redwan Laskar (Trine University), Norlia Md Yusof (International Islamic University Malaysia).

The rising use of cryptocurrency has created a vital need for robust security measures to safeguard digital assets in cryptocurrency wallets. Traditional security approaches often struggle to keep up with evolving digital threats. Cloud-based security solutions have become a promising option, offering scalability, flexibility, and advanced security features inherent in cloud computing. This research investigates the challenges of securing cryptocurrency wallets and how cloud solutions can mitigate these issues. It outlines key features and benefits like multi-factor authentication, real-time monitoring, encryption, and secure backup and recovery. The study also considers the regulatory and privacy implications of adopting cloud security within cryptocurrency ecosystems. By reviewing current trends and case studies, this paper aims to evaluate the effectiveness, practicality, and cost benefits of cloud security solutions for protecting digital wallet assets. Additionally, it

presents a cost-efficient approach, combining cloud scalability, advanced security, regulatory compliance, and optimized ownership costs.

[52] *Fast Flux Attack Engine for Benchmarking AI-Based DNS Security Systems*

Rizal Mohd Nor (International Islamic University, Malaysia), Aizuddin Ishqal Abdullah (International Islamic University, Malaysia), Ahmad Afiq Syamsul Akram (International Islamic University, Malaysia), Andi Fitriani Abdul Kadir (International Islamic University, Malaysia), Md Amiruzzaman (West Chester University).

Fast flux is a DNS-based cyberattack technique that rapidly changes the IP addresses associated with a single domain to evade detection. While AI-based detection methods have been increasingly proposed, limitations persist due to the dynamic and evasive nature of fast flux networks. This study presents a benchmarking framework using multiple machine learning classifiers—Decision Tree, Random Forest, Gradient Boosting, and Support Vector Machine—trained on real DNS data. The system evaluates performance against key features such as TTL values, IP churn rate, and number of name servers. This work provides a foundational dataset and comparative performance metrics to support future research in AI-driven DNS security.

[54] *Towards a Smart University through the Development of an AI-Integrated Examination Management ecoSystem (SEMS)*

Mohd Khairul Azmi Hassan (International Islamic University Malaysia), Amir Aatieff Amir Hussin (International Islamic University Malaysia), Nurazlin Zainal Azmi (International Islamic University Malaysia), Ahmad Anwar Zainuddin (International Islamic University Malaysia), Adlin Hafidz (International Islamic University Malaysia), Adam Othman (International Islamic University Malaysia).

Smart university transition makes way for incorporating sophisticated technologies into optimizing educational administration. In presenting the conceptualization and deployment of the Smart Examination Management System (SEMS), an AI-empowered, web-centric platform to automate and enrich the end-to-end examination management lifecycle of higher learning campuses, the research draws upon iterative and incremental software engineering philosophies. SEMS bundles together question construction, reviewing, and approval life cycles into a single, unified digital realm. The system leverages role-based security, template standardization, and entrenched data treatment protocols to enhance the quality, consistency, and security of examination materials. A comparison of SEMS against currently prevalent platforms such as Moodle, Canvas LMS, and Questionmark illustrates the former's superiority in collaboration features, workflow insight, and intelligent guidance. The incorporation of AI features ensures automated comments, clarity of contents, and originality verification, thus enriching academic rigor. The platform promotes green practice through eliminating dependency on papers and administrative duplication. Through structural modeling (UML, ER, and sequence diagrams), prototype creation, and usability testing, SEMS illustrates its capability to revolutionize institutional assessment regimes and lend itself to the larger mission of intelligent academic administration.

[55] *Towards Safe and Smart Campus Living: A Cost-Effective Dual-Factor Dorm Access System*

Rizal Mohd Nor (International Islamic University, Malaysia), Umar Fauzan (International Islamic University, Malaysia), Fatin Nabila Abdul Karim (International Islamic University, Malaysia), Ahmad Anwar Zainuddin (International Islamic University, Malaysia), Md Amiruzzaman (West Chester University), Nurul Nadhrah Kamaruzaman (International Islamic University Malaysia).

This paper presents a dual-factor access control prototype designed to enhance security in university housing through the integration of RFID-based matriculation cards and facial recognition technology. Traditional methods using physical keys and standalone card readers are commonly lost, duplicated or shared by students. To address these issues, our prototype enforces dual authentication by requiring both possession of a valid matric card and biometric verification. The system was implemented with Python-based OpenCV and the main focus was to increase effectiveness while reducing cost. A user survey was conducted, and the results validates our initiative for multi-factor authentication. Our experimental results demonstrated acceptable accuracy and acceptable authentication times despite hardware constraints.

[57] *Feasibility of Quantum Cryptography with AES for Secure Communication*

Nurul Muzfirah Binti Mustaffa (International Islamic University Malaysia), Nurulain Balqis Binti Mat Daud (International Islamic University Malaysia), Takumi Sase (International Islamic University Malaysia).

Traditional encryption techniques face serious threats from the fast developing field of quantum computing, which could soon be vulnerable to attacks. New quantum-resistant security methods are therefore desperately needed to safeguard private data and communications. This paper proposes a hybrid encryption technique that uses a smaller 3x3 matrix to simplify the Advanced Encryption Standard (AES) algorithm and Quantum Key Distribution (QKD), a secure quantum-based

key exchange method. The objective is to provide a safe and effective encryption system that can function well on gadgets with constrained processing power, like mobile platforms and Internet of Things (IoT) devices. In order to protect data security and confidentiality in upcoming digital systems, the research intends to explore this integration and offer workable solutions for secure communication in the developing era of quantum computing

[58] SMOTE-Driven Optimization of AI-Based Halal Classification for Japanese Snack Ingredients

Amir Aatieff Amir Hussin (International Islamic University Malaysia), Galeya Herman Gallego (International Islamic University Malaysia), Nur Syafika Bahrudin (International Islamic University Malaysia), Ahmad Anwar Zainuddin (International Islamic University Malaysia), Amelia Ritahani Ismail (International Islamic University Malaysia), Nurazlin Zainal Azmi (International Islamic University Malaysia).

Japanese snack imports to Malaysia and the number of Muslims traveling to Japan are increasing, which has prompted the importance of providing automated halal verification tools. This research investigates an Artificial Intelligence (AI)-based classification that uses Optical Character Recognition (OCR) and Natural Language Processing (NLP) to identify non-halal ingredients from Japanese snack labels. The dataset represents a challenge due to significant class imbalance between halal and non-halal ingredient data, which compromises model sensitivity to detect critical minority cases. This research examines the value of using the Synthetic Minority Over-sampling Technique (SMOTE) for increasing classification performance for algorithms such as Random Forest and Support Vector Machines. Evaluation found that linear models, like Logistic Regression and SVM, exhibited similar accuracy at 90% with better balanced precision and recall across both classes. This balance is particularly critical in halal verification contexts, where false negatives carry greater ethical and religious consequences. The project shows the scalability of AI-assisted halal verification for foreign-language food products, as well as applications in dietary compliance and consumer transparency.

[59] Enhancing Quran Memorization with AI: Efficiency and Engagement in the Tarteel App

Abdulaziz Aaborujilah (DU), Suad Said Ali Aldaghaishi (DU), Elham Yahya Al-Alawi (DU), Hanan Khalfan Zayid Alsubhi (DU).

This study investigates the effectiveness of the Tarteel application in enhancing Quran memorization and learning outcomes. A structured survey was administered to users, and non-parametric tests were applied to examine differences across grouped constructs. For Using the App Helps in Enhancing Memorization, results indicated no significant difference between perceived improvement in memorization speed and ease of recall ($p = .081$). In Using the App Helps in Enhancing Self-Learning, a significant difference was found ($p = .014$), where ease of navigation was rated higher than focus during memorization. Within Error Detection, results showed strong significance ($p < .001$), with major error detection outperforming fine articulation detection. For Feedback Helps on Mistakes Correction, significant differences emerged ($p = .007$), with feedback usefulness rated higher than multimodal correction speed. No significant differences were observed for Usability ($p = .248$), indicating similar perceptions of ease of use and interface design. Finally, for Learning Outcomes, significant variation was found ($p = .008$), with increased motivation rated higher than goal setting and achievement. Overall, the findings demonstrate that the application significantly enhances memorization, self-learning, error detection, and motivation, with usability remaining consistently strong.

[60] Designing for Anonymity in Social Networking Platform for Student Mental Health and Well-Being

Hazwani Mohd Mohadis (International Islamic University Malaysia), Muhammad Hadwan Mohd Hisham (International Islamic University Malaysia), Muhammad Danial Mohd Zahri (International Islamic University Malaysia), Mohamad Hidir Mhd Salim (Universiti Kebangsaan Malaysia), Zulfikar Ahmed Maher (Sindh Agriculture University).

The rise of digital communication has transformed how students seek support for mental health and well-being, yet stigma and fear of judgment continue to hinder open self-expression. This study presents the design and development of BeyondWords, a mobile application that functions as an anonymous social networking platform, providing university students with a safe space to share personal confessions, emotional expressions, life experiences, challenges, and vulnerabilities. The platform was developed based on a user requirements analysis through interviews and questionnaires, which revealed that 80% of respondents consider anonymity crucial for self-expression, while 90% believe it protects privacy and reduces fear of judgment. Students emphasized that anonymity enables them to express burdens and emotions freely, fostering a sense of relief and emotional support. To support this, BeyondWords incorporates features such as anonymous posting, interactive feedback, content moderation, and community engagement. This work underscores the pivotal role of anonymity in digital social platforms for creating safe spaces that effectively support student mental health and well-being.

[61] Building Sustainable Muslim-Friendly Tourism: A Conceptual Framework of Obedient Values and Service Quality

Lianna Wijaya (BINUS Online Learning, Bina Nusantara University), Athea Sarastiani (Service Management, Trisakti University), Tiurida Lily Anita (Hotel Management Department, Faculty of Digital Communication and Hotel and Tourism, Binus University).

Indonesia, recognized as the world's largest Muslim-majority country possesses significant prospects for establishing itself as a forerunner in the domain of Muslim-Friendly Tourism (MFT). Given its profound cultural heritage, stunning natural landscapes, and the integration of Islamic principles within its societal framework, Indonesia is committed to advancing MFT alongside promoting sustainable tourism practices. This study analyzes the influence of obedient value and service quality on the intention to visit and the sustainability of MFT destinations in Indonesia. A total of 273 valid respondents were used in this research. The data was comprehensively assessed utilizing the PLS-SEM methodology. A cross-sectional investigation employing a self-reported and self-administered survey instrument is used. Finally, the implications and constraints of the results derived from the present study and several recommendations for future research endeavors are considered. Obedient values and service quality significantly affect the intention to visit. However, have no significant effect on sustainable MFT in Indonesia. Behavior intention shaping the sustainable MFT.

[62] *Structural Factors and AI-Generated Content Trust Influencing Educator Acceptance of Generative AI Tools: Extending the Technology Acceptance Model*

Pathaya Ruangroengkulrit (Songkhla Rajabhat University), Sasalak Tongkaw (Songkhla Rajabhat University).

The rapid advancement of Generative Artificial Intelligence (GenAI) tools has created both opportunities and challenges in educational settings. This study examines the factors influencing educators' acceptance of GenAI tools by extending the Technology Acceptance Model (TAM) with additional constructs of external factors and trust in AI-generated content. Data were collected from 137 educators using a comprehensive questionnaire measuring six key constructs: external factors, perceived usefulness, perceived ease of use, attitude towards use, behavioral intention, and trust in content. The results show that perceived usefulness (Mean=3.984, SD=0.778) and attitude towards use (Mean=3.876, SD=0.812) are the strongest predictors of behavioral intention to use GenAI tools. Trust in AI-generated content demonstrates a significant influence on both perceived usefulness ($B=0.445$) and attitude towards use ($B=0.412$), while external factors such as technical support and infrastructure show moderate influence on perceived usefulness ($B=0.421$) and perceived ease of use ($B=0.389$). The strongest relationship was found between attitude towards use and behavioral intention ($B=0.512$). These findings suggest that while educators generally show positive intentions to adopt GenAI tools, their acceptance is significantly influenced by trust in AI-generated content and institutional support structures. The study provides theoretical implications for extending the TAM in educational technology contexts and practical recommendations for implementing GenAI tools in educational settings.

[64] *Exploring the impact of human factors in Information Security in light of PMT and TPB theories*

Abdulaziz Aborujilah (Dhofar University).

Human error and intentional misconduct alike create serious weak points in a firm's overall digital defense. Protecting systems therefore requires more than firewalls—it calls for insight into the attitudes and pressures that drive risky choices. This paper investigates such human motives through two established frameworks: Protection Motivation Theory (PMT) and the Theory of Planned Behavior (TPB). Its goal is to see how blending the two helps shape clearer, more targeted programs for safer conduct and stronger rule-following. To ground the work, the authors carried out a semi-systematic review guided by both models, sifting evidence across diverse settings. Findings show that PMT elements mainly steer an individual's sense of need and self-efficacy toward protective tasks, while TPB traits outline the social norms and perceived control that either enable or block them. Used together, the frameworks paint a fuller picture of why staff behave securely—or fail to do so. From this view, practical advice emerges: training, feedback, and peer support must line up with personal motivation to close human-made gaps. The study thus highlights the need for finely tailored, dual-track interventions that link head-level awareness with community-level encouragement so organizations can raise compliance and lower risk.

[65] *EEG Signal Quality Analysis of Resting States Using the MUSE 2 Headband for Brain-Computer Interface*

Hamwira Yaacob (International Islamic University Malaysia), Normi Sham Awang Abu Bakar (International Islamic University Malaysia), Abdul Wahab Abdul Rahman (International Islamic University Malaysia), Dini Handayani (International Islamic University Malaysia).

Recent advances in brain-computer interface (BCI) technology have enabled a growing range of real-world applications. Due to its non-invasive nature, affordability, portability, and ease of use, electroencephalography (EEG) remains a widely adopted neuroimaging method for BCI. However, because EEG signals are inherently delicate, and consumer-grade devices are

particularly susceptible to noise, inexperienced operators are at heightened risk of recording poor-quality data. This study aims to analyze EEG data collected by inexperienced novice operators using the MUSE 2 headband. The primary objectives are: (1) to evaluate the reliability of MUSE 2 for capturing EEG signals, and (2) to determine whether operators with no prior EEG experience can acquire data of acceptable quality. To assess EEG signal quality during resting-state recordings, several quality metrics are employed, including signal shape statistics (mean, standard deviation, skewness, and kurtosis), artifact rate, signal-to-noise ratio (SNR), and line noise power. The results demonstrate that Muse 2 can yield usable EEG data, even when operated by novices.

[66] *Design and Implementation of a Gesture-Controlled Smart Room Using Computer Vision*

Wahju Sediono (International Islamic University Malaysia), Helfy Susilawati (Universitas Garut), Nurul A'Aisyah Shahlan (International Islamic University Malaysia).

This paper presents the design and implementation of a gesture-controlled smart room system that leverages computer vision to enhance home automation and user interaction. The system enables users to control key appliances—specifically lighting, a fan, and curtain—using predefined hand gestures, addressing limitations of conventional manual or remote-based controls that may be inaccessible or inconvenient. By eliminating the need for physical contact, the gesture-based interface provides an intuitive and hygienic solution, particularly advantageous for individuals with mobility impairments or in contact-sensitive environments. The core of the system integrates MediaPipe and OpenCV for real-time hand gesture recognition, translating detected gestures into discrete control commands. These commands are transmitted via serial communication to an Arduino microcontroller, which activates the corresponding actuators. The control logic follows a modular structure, allowing continuous gesture recognition with dedicated mappings for each appliance and a termination gesture to exit the loop. Experimental validation demonstrates reliable, mostly seamless contactless control within the constraints of current hardware and lighting conditions. The system currently supports a limited but expandable set of gestures, highlighting its potential for future integration into hygiene-sensitive and accessibility-focused environments.

[67] *The Role of Islamic Mobile Apps in Enhancing Religious Practices among Gen Z in Jakarta*

Tiurida Lily Anita (Binus University), Athea Sarastiani (Trisakti University), Lianna Wijaya (BINUS Online Learning, Bina Nusantara University), Muhammad Zilal Hamzah (Trisakti University), Hainnuraqma Rahim (Universiti Teknologi Melaka).

The rapid growth of digital technology has transformed religious practices among Generation Z (Gen Z), particularly in Muslim-majority contexts such as Indonesia. This study investigates the role of Islamic mobile applications in enhancing religious engagement among Gen Z Muslims in Jakarta. Utilizing a framework based on the Unified Theory of Acceptance and Use of Technology (UTAUT/UTAUT2) and an extended Technology Acceptance Model (TAM), the study investigates how attitudes, behavioral intentions, and actual usage of Islamic apps are influenced by perceived utility, perceived ease of use, trust, privacy concerns, social influence, and habit, as well as how these elements affect religious engagement. An online survey was used to gather data from 210 Gen Z respondents, and Structural Equation Modeling with Partial Least Squares (SEM-PLS) was used to analyze the model. The results show that attitudes are considerably shaped by perceived ease of use, while attitudes and intentions are not much impacted by perceived usefulness. Actual usage is a powerful indicator of religious engagement, while social influence and habit are important determinants of behavioral intention. It's interesting to see that attitudes are positively impacted by privacy worries, indicating a privacy paradox among Gen Z consumers. By expanding technology acceptance models into the field of digital religion, this study advances both theory and practice by providing guidance to developers, educators, and legislators on how Islamic apps can encourage young people to engage in faith-based activities.

[69] *The Role of Strategic Entrepreneurship To Develop Sustainable Competitive Advantage (A case study on Umrah and Hajj Travel agencies)*

Rianto Nurcahyo (Bina Nusantara University), Richael Alfasha (Bina Nusantara University), Matthew Avrellio Avrellio (Bina Nusantara University), Damar Aji Irawan (Bina Nusantara University).

This study aims to analyses the marketing strategies implemented by PT. Hajj/Umrah Travel Agency “X” Bekasi Branch in enhancing its competitiveness as a specialized Hajj travel agency. The focus of this study is on the application of the 7P marketing mix (Product, Price, Place, Promotion, Process, People, Physical Evidence) and the effectiveness of each strategy in attracting pilgrims. Using a qualitative approach, data was collected through in-depth interviews, participatory observation, and documentation studies. The results of the study show that promotional strategies through social media and collaboration with religious leaders are the most effective marketing tools. However, the company also faces challenges such as intense industry competition and limited use of digital technology. This study provides recommendations for strengthening digital marketing strategies and improving service quality so that PT. Hajj/Umrah Travel Agency “X” Bekasi Branch can compete sustainably.

[71] Muslim University Student Experience with Islamic DTx for Mental Health Support: A Qualitative Analysis

Nahreen Zannat (International Islamic University Malaysia), Murni Mahmud (IIUM), Suhaila Samsuri (International Islamic University Malaysia).

University students from Muslim backgrounds face unique challenges when it comes to stress, and they seek mental health care that is culturally appropriate to them. Islamic DTx (Digital Therapeutics) blend Islamic practices with psychological interventions, but there is a dearth of study concerning their user experience. The purpose of this study was to observe how students interact with three well known Islamic mental health apps — MyRuh, Sabr, and Muslim Moodfit. Thirteen students from Bangladesh and Malaysia tested the apps and later engaged in semi-structured interviews. Through thematic analysis, it became evident that the applications delivered both psychological and spiritual comfort, notably through dhikr, du'a, and Qur'anic reflection. Dhikr, du'a, and Qur'anic reflection. The minimalist design coupled with reminders fostered motivation, and trust was further developed through Islamic content and professional credentials. Students advocated for enhanced customization and richer religious features. Sabr and MyRuh stood out as favorites, whereas Muslim Moodfit appeared to be out of touch with other cultures. Students benefit from the Islamic DTx as they provide complementary resources that are in line with the students' religious values and embed empirically supported interventions.

[72] A Retrieval-Augmented Generation Model for Multimodal Medical Question-Answering System

Amelia Ritahani Ismail (International Islamic University Malaysia), Farhan Haikal Hishamuddin (International Islamic University Malaysia), Aisar Nasrun Ramjee (International Islamic University Malaysia), Amir'Aatieff Amir Hussin (International Islamic University Malaysia), Nurul Afifa (International Islamic University Malaysia).

This paper addresses the limitations of existing medical question-answering systems, which are often unimodal and lack retrieval-augmented capabilities or expert-guided learning. To overcome these challenges, a Retrieval-Augmented Generation (RAG) framework was developed to handle multimodal medical data by integrating GPT-2 for text generation and BLIP for visual understanding. The system was fine-tuned using the MedQuAD and VQA-RAD datasets, and a FAISS-based retriever was used to supply relevant external context. Additionally, reinforcement learning from human feedback (RLHF) was applied to align responses with expert knowledge. Experimental results showed that the GPT-2 model achieved a BERTScore F1 of 0.8115, while the multimodal RAG-enhanced GPT-2 model improved slightly to 0.8169, demonstrating the slight effectiveness of combining retrieval and multimodal learning in enhancing medical answer quality. For RAG-enhanced BLIP, the model shows 0.9831 BERTScore with sample question and image.

[75] AI-Powered Neurofeedback Systems for Bipolar Disorder

Zainatul Shima Abdullah (International Islamic University Malaysia, Kuala Lumpur, Malaysia), Muhammad Danial Mutalib Mohd Shah (International Islamic University Malaysia, Kuala Lumpur, Malaysia).

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Abstract—Bipolar disorder (BD) frequently erupts during late adolescence, precisely when the brain's structural scaffolding is being remodelled through synaptic pruning, myelination and reward circuit fine tuning. Conventional clinical tools—mood charts, rating scales and episodic interviews—capture only the visible tip of a much deeper neuro developmental iceberg. Recent strides in artificial intelligence (AI) and high throughput computing raise the prospect of monitoring that iceberg in real time by fusing multi scale neuro data (MRI, diffusion MRI, EEG), behavioural exhaust (keyboard metadata, actigraphy, speech prosody) and longitudinal developmental markers. This paper delivers a 360 degree review of state of the art pipelines, then proposes Brain DEV BD, an end to end, student friendly blueprint that (i) aligns data acquisition with critical neuro developmental windows, (ii) deploys explainable transformer ensembles for multimodal fusion, and (iii) outputs a dual report—developmental risk trajectory and 30 day episode onset probability. A prospective validation plan on 200 Malaysian and international youths (14–24 years) is laid out, together with ethical guard rails around privacy, bias and participatory design. By zooming out from static diagnosis to dynamic brain growth, Brain DEV BD seeks to convert BD care from reactive firefighting to proactive, just in time intervention.

[77] Exploring Machine Learning Approach for Attention Detection Using Public EEG Datasets

Dini Handayani (International Islamic University Malaysia), Hamwira Yaacob (International Islamic University Malaysia), Atikah Balqis (International Islamic University Malaysia), Heni Sulistiani (Universitas Teknokrat Indonesia), Dedi Darwis (Universitas

Teknokrat Indonesia), Megat Arif Ilham (International Islamic University Malaysia), Mas Azlan Hafiz (International Islamic University Malaysia).

Brain Computer Interface (BCI) technology provides new opportunities for objectively assessing cognitive states such as attention, which plays a critical role in effective learning. In today's digital and hybrid classrooms, students often encounter distractions that hinder their engagement and performance. Meanwhile, conventional assessment methods rely heavily on subjective observations or self-reports, which limit real-time accuracy. This preliminary study examines the feasibility of predicting attention levels using electroencephalography (EEG) signals and machine learning techniques. A publicly available Kaggle EEG dataset, recorded from four electrodes (AF7, AF8, TP9, TP10), was preprocessed through feature extraction, normalisation, and partitioning into training and testing sets. An XGBoost regression model was trained to predict continuous concentration scores from multichannel EEG features. The model achieved a high performance with a Root Mean Squared Error (MSE) of 0.0559 and a coefficient of determination (R^2) of 0.9764. These results demonstrate the potential of regression-based EEG analysis for real-time, continuous attention monitoring, offering finer granularity compared to traditional categorical approaches. The findings serve as an initial step toward developing TARKEEZ, a real-time EEG-based brainwave monitoring system designed to enhance student engagement and learning efficiency.

[81] EEG-based Machine Learning Model for Personalized Power Nap Identification in Brain-Computer Interface

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Electroencephalography (EEG) based Brain Computer Interface (BCI) systems provide a non-invasive means for monitoring sleep and cognitive states. Power naps, typically lasting between 10 and 30 minutes, are known to enhance alertness, memory, and cognitive recovery; however, their effectiveness varies widely across individuals due to differences in neural activity patterns. Current nap detection approaches often rely on generalized sleep staging or subjective reports, limiting their reliability and personalization. This study proposes a machine learning framework for personalized power nap identification using EEG signals from the Sleep-EDF Expanded Database. Two bipolar EEG channels (Fpz–Cz and Pz–Oz) sampled at 100 Hz were preprocessed with bandpass filtering (0.5–49 Hz), segmented into 30-second epochs, and transformed into feature vectors combining statistical descriptors (mean, standard deviation, skewness, kurtosis, RMS) and spectral powers (total PSD and band-specific δ , θ , α , β , γ). The features were standardized and used to train a Multi-Layer Perceptron (MLP) model with class-weighted loss to address label imbalance. Experimental results demonstrated an overall accuracy of 94% on test data, with strong precision, recall, and F1-scores across Wakefulness, Light Sleep (N1+N2), Deep Sleep (N3+N4), and Rapid Eye Movement (REM). The confusion matrix revealed occasional misclassifications between light sleep and wakefulness, reflecting their overlapping EEG patterns. Training and validation curves confirmed stable convergence without overfitting. The model required <15 ms per segment for inference, indicating feasibility for real-time deployment on modest hardware. In summary, the proposed MLP framework demonstrates high accuracy, strong generalization, and low computational cost, making it a promising foundation for adaptive, real-time power nap detection. Future work will focus on integrating this system into a closed-loop BCI capable of detecting light sleep onset and optimizing nap timing to maximize recovery while avoiding sleep inertia.

[82] Analyzing the Role of Mobile Applications and Loyalty Programs in Enhancing Customer Loyalty

Sharron Widarto (Entrepreneurship Department, BINUS Business School Undergraduate Program, Bina Nusantara University), Iston Utama (Entrepreneurship Department, BINUS Business School Undergraduate Program, Bina Nusantara University).

Due to the digitalization that has occurred during the past few years, a lot of businesses are now focusing on developing new marketing, service, and distribution methods to maintain business sustainability. This study employs a quantitative approach to investigate the impact of Starbucks' mobile applications, loyalty programs, and brand image on customer loyalty. All data was acquired from 355 valid respondents and then used SEM-PLS for further examination. The findings demonstrate that loyalty programs have a significant influence on customer loyalty, whereas brand image does not have a significant influence on customer loyalty. Mobile applications have a significant impact on brand image and also customer loyalty, indicating its important role. These results underscore the importance of technological innovation and business strategy when running a coffee shop business in the digital era. This suggests that coffee shops might enhance customer loyalty by utilizing mobile applications, providing excellent service, and implementing loyalty programs to maintain business sustainability. This study offers valuable insights for businesses in the coffee industry to develop effective business strategies and encourage the implementation of practices that can enhance the company's competitive advantage and improve overall business outcomes.

[84] Optimizing Transaction Classification through Hybrid Feature Engineering and Advanced Machine Learning Algorithms

Adel Rajab (Department of Computer Science, College of Computer Science and Information Systems Najran University).

The rapid rise of Bitcoin and other cryptocurrencies has enabled fast, decentralized financial transactions but has also created opportunities for illicit activities such as money laundering, fraud detection, and terrorist financing. Detecting such illicit behavior is challenging due to the pseudonymous and high-dimensional nature of blockchain data, which demands advanced machine Learning (ML) techniques for accurate classification. This study presents a comparative evaluation of ML classifiers for detecting illicit activity in cryptocurrency transactions using the publicly available Elliptic Bitcoin Transaction dataset. The data processing involved normalization to standard features, while a two-stage feature strategy was employed; a variance threshold was employed to eliminate low-variance attributes, followed by random forest-based feature importance ranking to retain the most informative predictors. Six ML classifiers, such as Random Forest (RF), K-Nearest Neighbor (KNN), Logistic Regression (LR), Support Vector Classifier (SVC), Gradient Boosting (GB), and Multilayer Perceptron (MLP), were selected and evaluated on a stratified train-test split using accuracy, precision, recall, f1 score, confusion matrix, and ROCU-AUC score. The results demonstrate that RF, GB, and the other methods consistently achieved the highest accuracy rate of 98% with nearly perfect classification scores of (0.997, 0.994, and 0.982, respectively). In contrast, the KNN attained an AUC score of 0.963, and the margin-based SVC attained an AUC of 0.981. These findings confirm the robustness of ensemble approaches for cryptocurrency-based intrusion detection, highlighting their ability to capture complex blockchain transaction patterns and offering practical implications for enhancing cybersecurity and transparency of Bitcoin networks.

[86] *Deep Learning for Classifying Service Priorities in Gmail Network Traffic*

Muhammad A. Aldhahery (College of Computing and Information Technology, Shaqra University, Dawadmi, Saudi Arabia).

Ensuring accurate packet classification based on Differentiated Services Code Point (DSCP) is vital for maintaining quality of service (QoS) in network transmission. This study addresses the challenge of DSCP misclassification and manipulation by developing a deep learning model to classify network packets using metadata features. The dataset was derived from real-world PCAP files of Gmail. Key attributes "Protocol", "Length", and "DSCP" were selected and preprocessed for model training using RapidMiner. The model achieved high performance during training with 98.67% accuracy, 98.70% precision, 98.65% recall, and 98.68% F1-score. On testing data, it sustained strong results: 94.84% accuracy, 95.12% precision, 94.50% recall, and 94.80% F1-score. The combined model evaluation reported 96.90% accuracy, 96.85% precision, 96.60% recall, and 96.70% F1-score. These results confirm the model's effectiveness in accurately classifying DSCP values, enhancing fairness and performance in traffic prioritization. The approach supports real-time traffic analysis for intelligent network management. Future work may explore temporal data integration and performance across larger datasets to broaden the applicability in dynamic and heterogeneous network environments.

[87] *Enhancing Cybersecurity with Deep Learning: A Comparative Study of CNN and RMM for IDS*

Mana Saleh Al Reshan (Najran University).

Abstract—Machine learning approaches are widely being deployed in the world of cybersecurity for the design and development of intrusion detection systems (IDS). In this paper, we explore the application of deep learning techniques in the development of network-based IDS. We investigate traditional IDS approaches and their limitations in handling complex and dynamic network traffic while exploring convolutional neural networks (CNN) and recurrent neural networks (RNN) for employing enhanced detection and accuracy to the IDS. We leverage SoftMax-based multi-class classification and propose a framework assisted by the NSL-KDD dataset. The pre-processing entity of the adopted methodology deals with redundancy removal, null value elimination, and one-hot encoding to improve data quality and training effectiveness. We evaluate the CNN architectures with additional hidden layers and dropout mechanisms, which demonstrate superior performance in detecting abnormal traffic. Moreover, we compare and contrast RNN architectures with CNN in the context of capturing temporal patterns. The experimental results show that CNN-Focal and CNN-Cross models achieved higher accuracy, which sets a strong foundation for future IDS adapted with deep learning techniques in real-world network environments

[88] *OncoChat: LLM-driven Patient Support and Healthcare Communication*

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The deployment of large language models (LLMs) is significantly transforming healthcare communication, particularly in oncology use cases where precision and timeliness are critical. In this study, we introduce OncoChat, which refers to the finely-tuned LLM developed on the foundational large language model Meta AI (LLaMA) for oncology-specific dialogues. We integrate a distinctive feature of the sentence similarity model, which filters out irrelevant inquiries, ensuring that only oncology-related questions are processed. This functionality not only enhances the accuracy but also the reliability of the

provided information. The effectiveness of the proposed framework is presented through comparative performance metrics with the benchmark models. The results show that the OncoChat achieves a precision of 82%, recall of 86% and an F1-score of 84%, outperforming OncoGPT and ChatDoctor. These results highlight the OncoChat's potential to assist healthcare professionals by providing accurate information, supporting patient understanding, and timely communication with the healthcare providers.

[89] *An Integrated and Centralized Umrah and Hajj Management System*

Azlin Nordin (Kulliyyah of Information and Communication Technology(KICT), IIUM), Elyas Asmad (Kulliyyah of Information and Communication Technology(KICT), IIUM), Fikri Hisham-Muddin (Kulliyyah of Information and Communication Technology(KICT), IIUM).

The annual Umrah and Hajj pilgrimages entail highly complex logistical arrangements to accommodate millions of pilgrims (jemaah) from diverse backgrounds. Due to limited familiarity with the environment and the overwhelming scale of the spiritual journey, many pilgrims become disoriented or lost, resulting in considerable distress and additional challenges for the travel agencies. Many pilgrims, unfamiliar with the terrain and overwhelmed by the magnitude of the journey, often get lost, leading to unnecessary stress and overburdening of travel agencies. To address these challenges, the Umroo project proposes a comprehensive system designed to address real-time location tracking, emergency communication, and streamlined pilgrimage management, enhancing the overall experience for all stakeholders involved. Using the Agile software development methodology, the system integrates all the requirements into two different platforms, which are (1) web-based application, and (2) mobile application. Umroo solution, which covers both mobile app and web-based app aims to enhance safety, communication, and the overall management of pilgrimage activities for pilgrims, mutawwifs, and travel agencies, while addressing challenges posed by network limitations.

[93] *A Usability Test of Halal Food Classification of Machine Learning and Lexical Mapping*

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The halal food market is expanding rapidly worldwide, owing to increased Muslim populations and growing consumer concern about food safety, ethical sourcing, and religious conformity. However, identifying the halal status of modern food products remains difficult due to multilingual labelling, unclear ingredient names, and differing regional nomenclature. This paper describes a novel multilingual classification system that uses machine learning (ML) and Malay-Arabic lexical mapping to automate halal food recognition. A Support Vector Machine (SVM) model trained on a curated dataset of 3,000 labelled food items outperformed other classifiers, with an F1-score of 0.91. To reduce semantic ambiguity and improve interpretability, a lexical mapping module was created that connects local Malay food phrases to Arabic ideas obtained from Quranic and fiqh sources. A mobile-friendly prototype was developed and tested using 10 Muslim participants. The results show high user satisfaction (SUS score: 84.5), high task success rates (96%), and improved user confidence through transparent classification explanations. This study presents a hybrid AI framework that integrates linguistic, cultural, and religious domains, yielding a scalable and interpretable solution for halal food classification. The method has potential for use in consumer applications, certification systems, and Islamic informatics research.

[95] *E-Invoicing Implementation in a Malaysian Bank: A Case Study Using SWOT Analysis*

Siti'Aisyah Binti Abd Rahim (KICT IIUM), Noor Azura Zakaria (KICT IIUM), Muhammad Haziq Bin Hayazi (KICT IIUM).

Electronic invoicing (e-invoicing) is a key part of Malaysia's digital transformation to modernize tax systems, improve efficiency, and promote transparency. While the benefits of e-invoicing are clear, Malaysian banks face challenges in implementation such as compliance requirements, high initial costs and staff resistance to change. This paper presents a case study of a Malaysian bank implementing e-invoicing, analyzed using the SWOT analysis. Data was collected through interviews with three staff members directly involved in the e-invoicing. Findings show that while e-invoicing improves efficiency and compliance [1], challenges remain in system integration, training and change management [2]. Practical strategies are suggested to support smoother adoption [3][5].

[97] *Preliminary Study on the Development of Decision based 3D Game for Anxiety Disorder Screening*

Suhaila Samsuri (International Islamic University Malaysia), Zakaria Mohiuddin Khandaker (International Islamic University Malaysia), Syamil Rosli (International Islamic University Malaysia), Al-Alif Mohd. Zaini (International Islamic University Malaysia).

Traditional anxiety screening methods face challenges including stigma, low engagement, and cultural irrelevance among Malaysian university students. This preliminary study investigated the feasibility of decision-based 3D interactive fiction games for anxiety screening through expert consultation. Semi-structured interviews with academic experts, clinical psychologists, and student representatives assessed gaming medium suitability, cultural design requirements, and GAD-7 integration appropriateness. Thematic analysis revealed expert consensus validating digital gaming approaches over traditional methods and confirming GAD-7 feasibility within gaming environments. Key findings identified Malaysian cultural adaptation requirements and anxiety-sensitive design principles. The study's primary contribution is an adapted SERES framework for anxiety screening applications, incorporating psychometric validation protocols, ethical boundaries, and cultural considerations. These findings establish a foundation for future prototype development, demonstrating the feasibility of culturally appropriate game-based anxiety screening tools for Malaysian university populations.

[98] *Chatbot Personalities in Digital Learning: Investigating Their Relationship with Student Motivation, Engagement and Learning Effectiveness*

Elin Eliana Abdul Rahim (International Islamic University Malaysia), Ahsiah Ismail (International Islamic University Malaysia).

Educational chatbots are increasingly integrated into learning environments, yet their effectiveness depends largely on design characteristics that shape learner experiences. Previous studies have highlighted the importance of empathy, humor, authoritativeness, peer-like collaboration, and adaptive flexibility, but most have examined these traits in isolation. This paper reviews existing research on these five characteristics and identifies a gap in understanding their combined impact on student learning. To address this, a quasi-experimental study is proposed in which an integrated chatbot, designed with all five characteristics, will be compared with a baseline chatbot lacking these features. The investigation will focus on three key outcomes: learner engagement, learner motivation, and the overall quality of learning experiences. The planned study aims to generate both theoretical and practical contributions by advancing knowledge on holistic chatbot design and providing guidance for the development of more humanized, supportive, and effective digital learning environments.

[99] *Evaluating Retrieval-Augmented Generation in Scholarly Domains: A Contextual and Semantic Assessment*

Roslina Othman (Kulliyah of Information and Communication Technology, International Islamic University Malaysia), Akram M Zeki (Kulliyah of Information and Communication Technology, International Islamic University Malaysia), Tengku Mohd Tengku Sembok (Kulliyah of Information and Communication Technology, International Islamic University Malaysia), Amelia Ritahani Ismail (Kulliyah of Information and Communication Technology, International Islamic University Malaysia), Nur Adib Maspo (Kulliyah of Information and Communication Technology, International Islamic University Malaysia).

Retrieval-Augmented Generation (RAG) has emerged as a promising approach to enhance large language models (LLMs) by grounding outputs in external knowledge sources. This paper evaluates the effectiveness of RAG in scholarly domains through a dual assessment combining automated metrics and human expert validation. BLEU score analysis showed that the system achieved high accuracy in structured, ontology-based queries, with the strongest performance observed in ontology-driven counselling applications, while responses to abstract queries were less precise. Expert evaluation, conducted across six criteria—Correctness, Faithfulness, Completeness, Relevance, Error Categorization, and Overall Judgment—revealed that despite partial correctness and incomplete coverage, the generated outputs were highly relevant and received an overall Excellent rating. These findings demonstrate that RAG can provide contextually meaningful and useful responses in academic applications, while highlighting the need for improvements in retrieval accuracy, evidence grounding, and completeness. Future work will focus on refining retrieval strategies, applying domain-specific fine-tuning, and integrating human-in-the-loop feedback to further strengthen the reliability and scholarly utility of RAG systems.

[100] *Digital Strategies for Preventing Impostor Syndrome: An Exploratory Pilot Study in Malaysia*

Zeynep Tuncer (Faculty of Business – Digital Media Baden-Wuerttemberg Cooperative State University Mannheim (DHBW Mannheim)), Elin Eliana Abdul Rahim (Kulliyah of Information and Communication Technology (KICT) International Islamic University Malaysia (IIUM)), Murni Mahmud (IIUM).

Impostor Syndrome marked by persistent self-doubt and the inability to internalise achievements remains a prevalent challenge, particularly in high-performance and academic settings. This study investigates its prevalence, intensity, and potential digital prevention strategies through a structured online survey. The survey comprises three sections: (1) demographic and contextual data to map the prevalence and perception of impostor-related experiences; (2) a standardised diagnostic questionnaire to assess the presence and severity of the syndrome; and (3) participant evaluations of potential digital interventions, such as apps, online mentoring platforms, and interactive learning tools. By integrating psychological

insights with user-informed design, the study aims to identify targeted, scalable digital concepts to mitigate impostor feelings. The findings will provide actionable guidance for developing interventions that empower individuals and foster well-being in increasingly digitalised learning and work environments.

[101] *Sentiment Dynamics of the Israel-Palestine Conflict in Reddit Discussions*

Sharyar Wani (International Islamic University Malaysia), Muhammad Nazrin Jamil (International Islamic University Malaysia), Wan Ahmad Hafizuddin Wan Hussin (International Islamic University Malaysia), Muhammad Luqman Bisthamy (International Islamic University Malaysia), Zobayer Md Ahsanul Mahbub (International Islamic University Malaysia), Tengku Mohd. Tengku Sembok (International Islamic University Malaysia).

Reddit has become a key space for global discussions, especially during geopolitical crises like the Israel-Palestine conflict. This study examines over 600,000 Reddit posts and comments to understand user engagement, sentiment, and divisiveness in politically charged conversations. The findings suggest that user credibility plays a major role in engagement, with verified users attracting more attention. Controversial posts often receive fewer upvotes compared to non-controversial ones, challenging common assumptions about polarizing content. Subreddit dynamics also shape the discussion, with certain subreddits driving higher engagement. The study used machine learning models to predict upvotes and controversy but found average performance. This indicates that basic metrics like karma and sentiment are not enough to understand online discourse in conflict situations. Linear regression models showed weak correlations, while random forest classifiers achieved average performance in predicting upvotes ($R^2 = 0.0387$) and controversy (ROC-AUC = 0.69). These results indicate that factors like post score, karma, and sentiment alone are insufficient for accurate predictions. The observations reveal the need for more complex models that account for linguistic nuances, sarcasm, and contextual shifts in politically sensitive conversations. The study offers valuable insights for content moderation and communication strategies paving a path for future research focusing on improving predictions and understanding online discourse in politically sensitive contexts.

[102] *Conceptual Framework for the Development of AI-enhanced Electronic Training System (AI-TaS)*

Aizal Yusrina Idris (Kulliyyah of Information and Communication Technology, International Islamic University Malaysia), Shakiroh Khamis (Kulliyyah of Information and Communication Technology, International Islamic University Malaysia), Rafiza Abdul Razak (Faculty of Education, University Malaya), Khadijah Rajallah Alreafai (Computer Science & Engineering Department, Yanbu Industrial College).

The advancement of educational technology has transformed the professional development landscape, highlighting the need for more adaptive, accessible and effective training for educators. This paper proposes a conceptual framework for an AI-enhanced Electronic Training System (AI-TaS) that integrates Artificial Intelligence (AI) into professional development to address limitations of conventional e-training systems, such as lack of personalization and real-time adaptability. AI-TaS leverages adaptive learning, intelligent content recommendation, and data-driven feedback to provide educators with flexible and personalized training opportunities. The framework is grounded in three theoretical foundations: Design-Based Research (DBR), which ensures iterative design, implementation, and refinement in authentic contexts; Technological Pedagogical Content Knowledge (TPACK), which emphasizes the integration of pedagogy, content, and technology for effective AI use; and the Unified Theory of Acceptance and Use of Technology (UTAUT), which informs strategies to foster user adoption and sustainability. By aligning technological innovation with pedagogical soundness and user-centered adoption, the AI-TaS framework offers a structured pathway for designing and implementing AI-driven professional development systems in higher education. The model contributes both as a theoretical foundation and as a practical roadmap for enhancing educators' competencies, supporting institutional innovation, and ensuring continuous professional growth in the digital era.

[104] *Privacy-Preserving Protocols for Health Data Transmission in IoT-Based Wearable Ecosystems*

Hamad Hussain M Almansour (NAJRAN UNIVERSITY).

The use of Internet of Things (IoT)-supported wearable health devices has revamped the capture, monitoring, and transmission of personal health data. From fitness monitors to sophisticated medical wearables, these units produce streams of sensitive biometric information on a real-time basis, enabling real-time patient monitoring, early detection, and tailored treatment. The widespread nature of data capture and transmission across the ecosystems, however, raises important privacy issues. Unauthorized intrusions, data breaches, and abuse of health data pose tremendous threats to patient privacy and trust within digital health systems. This work discusses the privacy-preserving protocols particularly for the transmission of health data in IoT-based wearable systems. It first conducts a systematic review of the current methods, ranging from cryptographic solutions, anonymization, decentralized systems, to secure machine learning. Drawing from the security risks and shortcomings of existing solutions, we introduce a lightweight, privacy-preserving protocol for use on resource-limited wearable devices. Our protocol combines end-to-end encryption, secure key agreement, and edge-supported privacy-preserving computation, promoting strong security without sacrificing usability or performance. For comparison purposes, we compare our suggested method against cutting-edge protocols and consider them based on privacy assurances,

computational complexity, and communication effectiveness. The outcome shows that our protocol attains an optimal trade-off between security and resource usage, which makes it scalable for real-world implementation on health care IoT systems. We close the paper by discussing practical implementation issues and avenues for further research.

[105] *Evaluating the Impact of Augmented Reality on Physics Learning*

Devi Afriyanti Puspa Putri (Universitas Muhammadiyah Surakarta), Cheetara Novatriyanti Surya Adi (Universitas Muhammadiyah Surakarta), Endah Sudarmilah (Universitas Muhammadiyah Surakarta).

Indonesia's declining performance in science education, as evidenced by the latest OECD assessments, underscores the urgent need for more effective and engaging learning methods. Augmented Reality (AR), as an interactive and immersive technology, has shown promise in enhancing students' conceptual understanding and motivation. This study examines the impact of AR-based learning on junior high school students' comprehension of physics, specifically on the topic of electricity. A four-step methodology was employed: pre-test, AR-based learning session, post-test, and statistical analysis. Due to the violation of normality assumptions, the Wilcoxon Signed-Rank Test was used to analyze the difference in scores. The results revealed a significant improvement in student performance, with a mean score increase of 12.5 points ($p = 0.004$). Furthermore, the Mann-Whitney U Test showed no significant gender-based differences in learning outcomes ($p > 0.05$), indicating that AR benefits both male and female students equally. These findings support the integration of AR as a viable educational tool to enhance science learning outcomes regardless of gender.

[106] *Virtual Reality-Based Learning Media to Introduce Gamelan, Traditional Javanese Musical Instruments*

Endah Sudarmilah (Informatics Department, Universitas Muhammadiyah Surakarta), Syukur Ridodo Saputro (Universitas Muhammadiyah Surakarta), Devi Afriyanti Puspa Putri (Universitas Muhammadiyah Surakarta).

This study was conducted aiming to develop gamelan traditional musical instrument-virtual reality based as an interactive and innovative learning media. The method applied was Research and Development (R&D) having 4D development model. It was performed based on 4 steps, they were defined, design, develop, and disseminate. It was performed toward junior high school students in Surakarta (Central Java). The application trial was conducted with black box application functional test and eligibility test by media expert, material expert, and user. Based on the result, it could be concluded that learning media-virtual reality based (gamelan VR application) is eligible to use in school learning. The calculation result of interpretation percentage to media expert was 85%, in which it's categorized as 'very eligible'; 83% to material expert (very eligible), and 76% to users (eligible).

[107] *Artificial Intelligence in Higher Education: A Study of Benefits, Challenges, and Academic Integrity Concerns*

Hamed Alsalmi (University of Nizwa), Mahmood Al-Waaili (University of Nizwa), Akram Zeki (International Islamic University Malaysia).

Artificial intelligence (AI) has rapidly entered higher education, offering new opportunities for enhancing learning while raising concerns about academic integrity. This study investigates university students' utilization of AI tools in academic assignments, focusing on perceived benefits, challenges, and ethical implications. A survey was conducted among undergraduate and postgraduate students across diverse disciplines. The findings reveal that students recognize clear benefits of AI, including improved efficiency, enhanced quality of work, and access to creative ideas. However, challenges were also identified, such as accuracy issues, overdependence, subscription costs, and privacy concerns. Ethical issues, particularly the risk of plagiarism and its impact on academic honesty, emerged as critical considerations. The results highlight the dual role of AI in academia supporting learning while challenging traditional notions of integrity. This study contributes to the ongoing debate on AI in higher education by providing empirical insights and suggesting the need for clear institutional guidelines, training, and policies to promote responsible AI use.

[110] *Rule-based to Intelligent Chatbots: Understanding Librarian Insights in Library Reference Services*

Sharifah Nur Amirah Sarif Abdullah (International Islamic University Malaysia), Nor Saadah Md. Nor (International Islamic University Malaysia), Muhammad Al Faateh Muhammad Nubli (Universiti Malaysia Pahang Al Sultan Abdullah), Mira Kartiwi (International Islamic University Malaysia), Akram M Zeki (International Islamic University Malaysia), Titin Winarti (Universitas Semarang).

Deployment of an artificial intelligence chatbot in the library has existed to support reference-oriented and short conversation tasks. An observation from 20 Malaysian Public Institution of Higher Learning Libraries Websites revealed that most libraries utilized rule-based chatbots from service providers like Tawk.to, LiveChat, onWebChat, and Springshare in their reference services while the remaining do not offer information about chatbot services. The absence of responsive 24 hours chatbot services utilizing artificial intelligence was noted as a limitation in these libraries' reference operations. The era of

digital transformation needs a reinvented chatbot that can perform more natural conversations without human intervention. This study aimed to explore librarian' insights on readiness, opportunities, and challenges towards the implementation of artificial intelligence chatbots in the reference services. Qualitative research design was employed in this study by using semi-structured interview to gain an in-depth insight from the librarians. The responses have been gathered and analyzed using Nvivo 14 software to organize data into structural findings. The findings showed a favorable indicator of the implementation of artificial intelligence chatbots based on sufficient budget, staff competency, and adequate training. Issues of privacy, relevancy, excessive cost, and human dependency were paramount challenges in the development of artificial intelligence chatbots. Collaborative development between libraries, chatbot service providers, and users will determine the extent of this technology's ability while maintaining the best practice of reference services in the future.

[111] *A Persuasive Design Framework for Waste Management Application based on Maqasid al-Shari'ah : A Fuzzy Delphi Study*

Zohora Azmin Shompa (International Islamic University Malaysia), Hazwani Mohd Mohadis (International Islamic University Malaysia), Aznan Zuhid Saidin (International Islamic University Malaysia), Evi Indriasari Mansor (Abu Dhabi School of Management).

Municipal Solid Waste (MSW) management poses a significant challenge to environmental sustainability and public health. However, current waste management interventions often lack comprehensive frameworks that integrate Shariah-compliant principles and practices. Islamic principles specifically Maqasid al-Shari'ah offer a strong foundation for environmental ethics and sustainable living. Building on this foundation, this study proposes a Persuasive Design Framework for a waste management application grounded in the principles of Maqasid al-Shari'ah, with the aim of fostering sustainable waste management behaviors within Muslim communities. To validate the persuasive elements of the framework, the Fuzzy Delphi Method (FDM) was employed, involving twelve experts from relevant domains, including Maqasid al-Shari'ah, Islamic economics, Islamic jurisprudence, ICT and Islam, Human-Computer Interaction (HCI), Solid Waste Engineering and Waste Management Corporations including KDEBWM and SWCorp. The validation was conducted in two iterative rounds to ensure expert consensus and result stability. The initial framework included 25 persuasive design principles derived from a prior user-centered study. Through expert review, 12 core components were confirmed as most relevant and impactful such as reduction, tunnelling, tailoring, personalization, self-monitoring, simulation, rewards, reminders, suggestion, authority, and verifiability principles. The findings led to the development of a new integrated framework grounded in Maqasid al-Shari'ah, which was further validated in the second round of expert review using FDM. The results indicate that embedding Maqasid al-Shari'ah into persuasive system design can significantly promote responsible waste disposal behavior. The proposed framework provides practical guidance for developing effective, Shariah-aligned waste management applications targeting at Muslim community.

[114] *Al Quran as technological lens for new discoveries of digital technologies*

Noor Hasrul Nizan Mohammad Noor (IIUM).

The paper examines the Quran as a living epistemological lens through which new breakthroughs in digital technology can be achieved based on its rich heritage of diverse modes of thinking. Beyond religious and moral teachings, the Quran offers a cognitive framework that fosters intellectual searching, critical examination, and innovative integration as well as attributes necessary for technological breakthroughs. By recognizing and employing eleven various Quranic styles of thought-inquisitive, argumentation, analogical, empathetic, rational, hypothetical, introspective, visual, metaphorical, instinctive, and scientific, this study proposes an approach to incorporating Islamic thought in the future of digital technology development. Each style is a different form of reasoning employed in the Quran, from challenging assumptions and constructing logical arguments to observing abstract truths in imagination and introspection about the world around them. From this view, the Quran is not merely a source of theological understanding but an impetus to intellectually moral, meaningful, motivated and technological innovation. The article attempts to bridge classical revelation innovation, offering and contemporary Muslim scholars, technologists, and educators a revolutionizing paradigm of digital imagination grounded in divine wisdom.

[116] *Guiding Principles for Shariah-Based AI Adoption in Islamic Public Services*

Nor Faizal Paiman (Faculty of Artificial Intelligence, Universiti Teknologi Malaysia), Hazlifah Mohd Rusli (Faculty of Artificial Intelligence, Universiti Teknologi Malaysia), Haslina Md. Sarkan (Faculty of Artificial Intelligence, Universiti Teknologi Malaysia), Yazriwati Yahya (Faculty of Artificial Intelligence, Universiti Teknologi Malaysia), Faizura Haneem Mohamed Ali (Faculty of Artificial Intelligence, Universiti Teknologi Malaysia), Mohd Nazri Kama (Faculty of Artificial Intelligence, Universiti Teknologi Malaysia).

Islamic public services manage essential functions such as zakat, waqf, halal certification, and fatwa issuance, where service delivery must balance administrative efficiency with adherence to Shariah principles. Despite national initiatives such as the Malaysia AI Roadmap, AI adoption in public sector remains limited. This paper identifies adoption determinants from the

Technology–Organization–Environment (TOE) and Diffusion of Innovation (DOI) frameworks and contextualizes them for Islamic public service settings. Preliminary findings from seven State-Islamic agencies reveal low levels of AI readiness, limited governance mechanisms, and significant concerns over Shariah alignment. Based on these insights, guiding principles rooted in Maqasid Shariah are proposed to support ethical AI adoption. The paper provides a conceptual foundation and an initial roadmap for aligning digital transformation with Islamic governance values. Future research will empirically validate these principles and develop a Shariah-based AI adoption model for trustworthy and ethical implementation

[117] *Personality Trait Mapping based on Regression-Based Emotional Space Model*

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Emotion is an individual's psychological state in a specific situation. Personality traits are stable psychological tendencies that develop gradually over the long term and have a significant impact on an individual's emotional expression. In order to explore the relationship between emotional states and personality traits, this study collects valid emotional state data and personality trait data from 100 volunteers. During the data collection process, this study uses the Self-Assessment-Mannequin (SAM) scale to record volunteers' emotional states after viewing different emotional stimuli pictures (happiness, fear, sadness, and calmness) and uses the personality questionnaire based on the Five-Factor Model to collect personality traits data from volunteers. After obtaining the data, this study uses the polynomial regression model to explore the correlation between emotional states and personality traits. The comparative experiment results show that the polynomial regression model R^2 value ranging from 0.4723 to 0.5719, which is significantly higher than that of Lasso, Ridge, and linear regression models with R^2 value ranging from 0.0062 to 0.2178. The polynomial regression model accuracy value ranging from 0.7680 to 0.8230, which is significantly higher than that of the Lasso, Ridge, and linear regression models with accuracy value ranging from 0.5020 to 0.6350. Compared to linear regression models, the polynomial regression model improves the R^2 by 1.63 to 75.18 times and accuracy by 1.3 to 1.53 times. In summary, this study demonstrates that polynomial regression models are more suitable for capturing the correlation between emotional states and personality traits.

[118] *Mitigating LLM Hallucinations in Quranic Content: An Agentic Approach Using Deployable Language Models*

Muhammad Fahreza Alghifari (International Islamic University Malaysia), Mira Kartiwi (International Islamic University Malaysia), Muntaha Artalim Zaim (International Islamic University Malaysia), Dini Oktarina Dwi Handayani (International Islamic University Malaysia).

Large Language Models (LLMs) suffer from hallucinations - fabricating false information with high confidence - which poses critical risks in religious contexts where accuracy is paramount. When applied to Quranic content, these hallucinations can manifest as fabricated verses, incorrect diacritical marks, or misattributed sources, potentially leading to unacceptable distortion of sacred text. This paper addresses LLM hallucinations in Quranic text retrieval through an agentic framework that leverages external knowledge tools rather than relying on potentially flawed model memorization. We present two primary contributions: First, a benchmark quantifying hallucination rates across various LLMs on Quranic verse generation, revealing exact match rates below 1% for most open-source small language models and up to 69% for the best commercial models. Second, the preliminary result of our novel Islamic agentic approach that enables smaller, deployable models to achieve over 95% accuracy through SQL-based retrieval tools, providing a cost-effective, transparent, and locally deployable solution for accurate Islamic text retrieval.

[119] *Ethical Governance of Emerging Technologies: An Islamic Perspective*

Rio Erismen Armen (Universiti Malaysia Sabah), Ali Sophian (International Islamic University Malaysia), Zuraida Ahmad (International Islamic University Malaysia), Asmarani Ahmad Puji (International Islamic University Malaysia).

Rapid advancements in emerging technologies, such as artificial intelligence (AI), blockchain, and the internet of things (IoT), are generating major ethical dilemmas that necessitate the establishment of robust and context-specific governance systems. Despite the laudable normative frameworks provided by international initiatives UNESCO's guidelines, the integration of religious ethical traditions, particularly Islamic ethics, remains notably insufficient in these conversations. This study examines the ethical governance of emerging technologies using Islamic thought. It portrays it from sources of Islamic law such as the Qur'an, Sunnah, Maqāṣid al-Sharī'ah (higher objectives of Islamic law), and the principles of Ijtihād (independent reasoning) and Maslahah (public interest). The study uses a normative-ethical methodology based on textual interpretation (hermeneutics) and comparative ethics to create a framework that includes key ethical virtues, spiritual accountability, and legal maxims (qawā'id fihiyyah). The study also investigates the compatibility and uniqueness of Islamic ethics in comparison to global secular perspectives. The study concludes with policy recommendations for employing Islamic ethical frameworks in governance, highlighting the challenges and potential of developing ethical innovation in accordance with

Islamic standards. The study seeks to improve the worldwide discourse on responsible technology by centering a comprehensive Islamic ethical approach.

[121] *Adaptive Federated Learning with Unsupervised Autoencoder-based Reconstruction for Imbalanced Medical Image Classification*

Nadzurah Zainal Abidin (IIUM), Amelia Ritahani Ismail (IIUM).

Medical image classification has benefited greatly from deep learning techniques, yet performance remains limited by class imbalance and data silos across medical institutions. These challenges are especially critical in healthcare, where minority class samples typically correspond to rare but clinically significant conditions. Federated Learning (FL) enables collaborative training across decentralised medical institutions without requiring raw data sharing, but its performance degrades under imbalanced and non-independent and identically distributed (non-IID) data distributions, as commonly observed in medical imaging scenarios. To address these limitations, this thesis proposes an enhancement to the federated learning framework by integrating two key strategies: unsupervised autoencoder-based reconstruction, which identify and prioritizes rare cases, and adaptive tuning, which dynamically adjusts aggregation behavior to balance contributions under imbalanced data conditions. These strategies strengthen the model's sensitivity for underrepresented classes while maintaining stability under non-IID scenarios. The proposed model was experimentally evaluated on benchmark imbalanced medical image datasets under three imbalance ratios of 1 to 10, 1 to 5, and 1 to 2) in federated settings, and compared against baseline methods, including standard FL, FL with GAN-based augmentation, and FL with standalone autoencoder-based reconstruction. Results demonstrate that under severe imbalance (1 to 10), the proposed model improved minority-class recall by 59.6 percent, F1-score by 33.9 percent, and AUC-ROC by 13.3 percent compared to standard FL. Under moderate imbalance (1 to 5), it achieved a 41.3 percent increase in recall, 26.5 percent improvement in F1-score, and 13.7 percent gain in AUC-ROC, alongside consistent accuracy gains of up to 6.0 percent. Under low imbalance (1 to 2), the model maintained its advantage, with a 26.4 percent recall improvement and 18.9 percent increase in F1-score. These findings highlight the effectiveness of the proposed method as a scalable, coordination-free, and algorithm-level enhancement for federated medical image classification under real-world data imbalance conditions.

[122] *MOSQUE INTEGRATED ENTERPRISE RISK MANAGEMENT: ASSESSING AND TREATING RISKS IN THE POST-PANDEMIC & DIGITAL ERA*

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This research investigates the governance and risk management practices of mosques in Selangor, with a particular focus on the integration of Enterprise Risk Management (ERM) in the post-pandemic and digital era. The COVID-19 crisis disrupted religious activities, community outreach, and zakat distribution, exposing the absence of continuity planning and structured governance in many mosques. A mixed-methods design was adopted, combining literature review, observation, semi-structured interviews, and congregational surveys. Data were analyzed using the Kawakita Jiro (KJ) Method, allowing responses to be clustered into thematic categories. The findings reveal several weaknesses: the absence of formal risk management frameworks, uneven digital adoption between urban and rural mosques, and limited stakeholder participation. Governance was found to be hierarchical and exclusionary, with minimal engagement of youth and women, despite their active roles in mosque activities. The lack of cybersecurity policies raised concerns about digital vulnerabilities, while reliance on undocumented practices weakened institutional memory. At the same time, model mosques such as Masjid Tengku Ampuan Jemaah demonstrated that structured financial reporting, digital platforms, and inclusive governance can be successfully embedded within an Islamic framework. Comparative insights from churches further highlight the importance of standardized governance, financial transparency, and community engagement. Building on these findings, the study develops a Business Model Canvas (BMC) for mosque governance in Selangor, emphasizing Integrated Enterprise Risk Management (IERM) grounded in Islamic principles of amanah (trust), shura (consultation), and maslahah (public interest). The study contributes to scholarship on religious governance and provides practical recommendations for policymakers, mosque committees, and stakeholders, positioning Selangor's mosques as potential models of resilient and inclusive religious institutions.

[123] *Artificial Intelligence Literacy Framework for Libraries: A Competency-Based Approach*

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Artificial Intelligence (AI) is rapidly reshaping higher education and information ecosystems. Academic libraries, as key facilitators of knowledge access, face the challenge of equipping staff and patrons with AI literacy to ensure responsible and effective adoption. This paper synthesizes recent frameworks [5]–[8], examines library-specific AI readiness studies [1]–[4], [9]–[12], and proposes a competency-based AI Literacy Framework tailored for libraries. The framework highlights five dimensions—knowledge, skills, ethics and policy, metacognition, and community service—supported by tiered competency

levels (novice, practitioner, leader). The contribution lies in contextualizing AI literacy for librarianship, offering both theoretical grounding and practical pathways for implementation.

[125] *Web Content Analysis of Malaysia's Public Library Websites: An Evaluative Study*

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In the digital era, public libraries are expected to strengthen their online presence to support access, literacy, and community engagement. This study evaluates the websites of 14 Malaysian state public libraries using a checklist-based Web Content Analysis (WCA) under seven categories: accessibility, navigation and links, authority and currency, general information, user support and resource discovery tools, services, and Web 2.0 tools. The results show that overall performance is moderate, with Kuala Lumpur, Selangor, and Sabah achieving the highest compliance, while Perlis, Perak, Pulau Pinang, and Johor lag behind. Strengths include universal WebOPAC adoption, integration of social media platforms such as Facebook and Instagram, and consistent copyright/domain authority. Weaknesses include poor update practices, limited disability features, absence of fair use policies, and minimal adoption of interactive tools such as live chat and feedback systems. The findings highlight that while Malaysian public library websites provide basic access and visibility, they underutilize features essential for inclusivity, interactivity, and user education. This study recommends standardizing website development, enhancing accessibility, and integrating user-centered policies to optimize digital platforms and improve remote library services.

[128] *Integrating Computer Vision and GIS for Waste Identification and Recycling Location Recommendation*

Syahrial Jeremia Sinaga (Nusa Putra University), Teddy Mantoro (Nusa Putra University), Media Anugerah Ayu (Nusa Putra University), Rahmadya Trias Handayanto (Nusa Putra University).

The increasing volume of urban waste demands public participation in recycling, however, this process is often hindered by difficulties in identifying waste types and finding appropriate recycling locations. This Study designs and builds an integrated intelligent system to address these problems. The system utilizes a You Only Look Once version 8 (YOLOv12) object detection model for visual waste identification and a Geographic Information System (GIS) to recommend nearby recycling facilities through a Flask-based web application. Evaluation results show that the object detection model achieves an F1-score up to 0.91 for well-structured waste classes like cardboard, although it faces challenges with irregularly shaped objects. Testing of the overall system demonstrates an interactive response time of approximately 420 milliseconds and successfully showcases an end-to-end workflow from identification to location recommendation. This integrated system proves to be a viable and potential solution as a practical tool for the public as well as a data-driven decision support instrument for urban waste management.

[129] *Spatiotemporal Rainfall Aggregation and Machine Learning for Flood Prediction: A Case Study of Kelantan*

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Flood prediction and prevention present a significant challenge for disaster risk management, particularly in monsoon-prone regions such as Kelantan, Malaysia. The researchers, in this study, formulated and tested a district-wise machine learning framework for detecting floods using Random Forest for Kelantan. The radar-derived high-resolution rainfall data provided by MET Malaysia were used to engineer a comprehensive set of temporal features, namely cumulative rainfall statistics and lagged variables. Stratified random sampling and Synthetic Minority Over-sampling Technique (SMOTE) were used at the district level when training the model. Model performance was rigorously assessed for each district using Accuracy, precision, recall, F1-score, and AUCROC curve. Additionally, confusion matrix and precision recall curves were also analyzed. The findings have shown great predictive performance where accuracy stayed above 95%, F1scores were more than 80% and AUC-ROC above 95% in most of the districts. Remarkably, Kota Bharu showed the best results with the high recall and precision when the confusion matrix was demonstrated, whereas Jeli revealed a lower predictive accuracy. The analysis of the feature importances showed that 12-hour and 24-hour medians and sums of the rain were the most influential predictors of flood events. The given framework exhibits interpretable and robust flood forecasting at the district scale and delivers applicable information to shape the early warning systems and manage flood risks in Kelantan.

[131] *An Investigation into the Determinants of Bank Fraud Victimization*

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Bank account fraud is a serious problem that causes significant financial losses and affects millions of people worldwide. It includes crimes like unauthorized account access, identity theft, and fraudulent money transfers. While strict laws exist to punish offenders, preventing fraud remains challenging, and individuals must take steps to protect themselves. Fraud detection systems that use real-time monitoring and analytics are commonly used to identify unusual activity and predict fraud using machine learning. These systems help assess risk, save time, and enhance security for both customers and financial institutions. This study explores the factors that make people more vulnerable to bank fraud, identifies the easiest targets, and evaluates machine learning models for fraud detection. The study examines a range of demographic, behavioral, and technological factors, to understand the significance of these elements risk of fraud using data exploration and machine learning models such as decision trees, SVM, and XGBoost to highlight fraud patterns. The research aims to help individuals and banks reduce the risk of fraud by identifying high-risk behaviors and vulnerabilities leading to more effective fraud prevention strategies. The findings will potentially help banks improve their fraud detection systems, offering better protection for customers and strengthening trust in the banking system.

[134] *Trends and Developments in Virtual Laboratory Research in Indonesian Secondary Schools (A Bibliometric Study Based on Text Mining)*

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This study aims to map the trends and development of research on virtual laboratories at the secondary school level in Indonesia over the past ten years. The method used in this study is a combination of bibliometrics, text mining, and machine learning algorithms in the form of K-means clustering. Data were taken from four main databases, namely Scopus, Semantic Scholar, Google Scholar, and Crossref, with a total of 1522 articles analyzed. The analysis process includes data extraction of publication year, author, and abstract, which are then processed to identify dominant keywords and thematic clustering patterns based on content similarity. The results showed that articles related to virtual laboratories had increased significantly in the last five years, with Google Scholar and Crossref being the largest contributors in terms of the number of publications. Word clouds from each database revealed a major focus on science learning, educational technology, and teacher-student interaction. K-Means clustering analysis showed that articles could be classified into three to four clusters, representing different levels of influence, ranging from popular articles with high citations to contextual articles with limited influence. The findings show that despite the growing adoption of virtual laboratories, there is a gap between innovation and academic recognition. This study contributes to building a data-driven literature map of virtual laboratory research in Indonesian secondary schools and provides a basis for decision-making for future research planning, education policy, and strengthening scientific publications.

[135] *Development of a Transfer Learning-Based NMT Framework using mBART and mT5 for Indonesian and Local Languages in Low-Resource Settings*

Frans Panjaitan (Nusa Putra University), Teddy Mantoro (Nusa Putra University), Media Anugerah Ayu (Nusa Putra University), Rahmadya Trias Handayanto (Nusa Putra University).

Indonesia is among the most linguistically diverse countries in the world, with over 700 local languages, the majority of which are considered low-resource due to the limited availability of digital corpora. This scarcity presents significant challenges for the development of Natural Language Processing (NLP) applications and heightens the risk of language endangerment. To address these issues, this paper proposes a Neural Machine Translation (NMT) framework aimed at facilitating translation between Indonesian and its local languages under low-resource conditions. The framework employs transfer learning in conjunction with state-of-the-art multilingual pre-trained models, specifically mBART and mT5, to overcome data limitations. Its core components encompass dataset collection and augmentation, preprocessing via subword tokenization, a Transformer-based encoder-decoder architecture augmented with attention mechanisms, and evaluation through both automated and human-centered metrics. This proposed approach seeks to enhance translation quality while preserving linguistic diversity, providing a scalable solution for inclusive NLP applications targeting Indonesia's local languages.