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Homepage

The 4th International Conference on Intelligent Cybernetics Technology & Applications 2024 (ICICyTA 2024) is scheduled to be held on December 17-19, 2024, in Ubud, Bali, Indonesia. This event will be conducted in a hybrid format, accommodating both onsite and virtual participants, and is jointly hosted by Human Centric (HUMIC) Engineering at Telkom University (Tel-U) and Bali International University, Indonesia.

Fig. 1. Example documentation photos taken during the conference onsite.

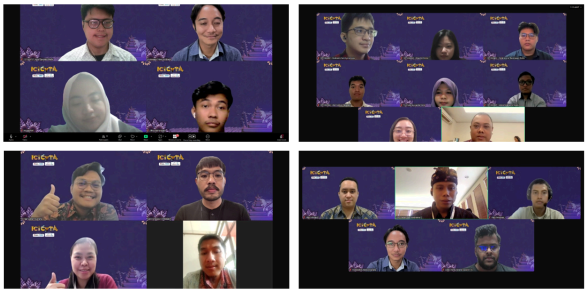

Fig. 2. Example documentation photos taken during the conference online.

This year's conference focuses on the theme *"From Data to Decisions: Cybernetics and Intelligent Systems in Healthcare, IoT, and Business."* Papers accepted through the rigorous review process will be considered for publication in IEEE Xplore, subject to compliance with its scope and quality standards. We encourage submissions of original and innovative research in fields such as cybernetics, computational intelligence, IoT, biomedical engineering, and related disciplines.

ICICyTA 2024 aims to foster meaningful discussions and collaborations among researchers and practitioners. The selection process for this conference has been highly competitive, resulting in the acceptance of 236 research papers from a broad pool of submissions, with an overall acceptance rate of 49.9%. This stringent process underscores our commitment to maintaining a high standard of quality. We deeply appreciate the dedication of authors and the meticulous reviews provided by experts, which have ensured the integrity of the program.

In closing, we extend our sincere gratitude to all contributors and participants for their support and active engagement in ICICyTA 2024. Your efforts are integral to the success of this conference.

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Program

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Tuesday, December 17	
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10:40-11:40	2A: Cybernetics and Information Management in Business 2B: Cybernetics and Biomedical Engineering 2C: Cybernetics and Information Management in Business 2D: Cybernetics and Information Management in Business
12:40-13:15	3A: Cybernetics and Information Management in Business 3B: Cybernetics and Data Science 3C: Cybernetics and Internet-of-Things (IoTs) 3D: Cybernetics and Data Science 3E: Cybernetics and Information Management in Business
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Time (Kuala Lumpur)	Elsewhere
10:15-11:15	7A: Cybernetics and Biomedical Engineering 7B: Cybernetics and Information Management in Business 7C: Cybernetics and Data Science
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Tuesday, December 17 9:30 - 10:30

1A: Cybernetics and Internet-of-Things (IoTs)

9:30 ***Augmented Reality Technology for Park Planning: An Innovative Approach to Landscape Design***

Irfan Armawan (Institut Teknologi Sepuluh Nopember (ITS), Indonesia); Hadziq Fabroyir, Muhammad Iskandar Java and Ilyas Mahfud (Institut Teknologi Sepuluh Nopember, Indonesia)

Technology is crucial in improving various aspects of modern life. An innovative approach is introduced in this work by combining Augmented Reality (AR) technology with garden planning, resulting in a more interactive, creative, and efficient design experience. The regular mobile app for garden planning often relies on 2D/3D drawings or blueprints, which are limited in providing a comprehensive visualization. In contrast, AR technology has rapidly evolved, offering new possibilities across industries, including landscape design. This article examines the ease of use and viability of Increased Reality (AR) innovation in scene and plant arranging compared to conventional portable applications. The essential objective is to survey AR's potential to supply a more intelligently, imaginative, and productive client encounter. The subordinate factors incorporate assignment completion time, client fulfillment, and workload, as measured by the NASA Errand Stack Record (NASA TLX) over six measurements: Mental request, physical request, worldly request, execution, exertion, and disappointment. Eight members, aged between 20 and 30, were relegated to total plant plan errands utilizing AR and conventional apps. Whereas the AR app took longer in errand completion time, it advertised higher client fulfilment and lower seen workload. The Wilcoxon Signed-Rank test uncovered a critical inclination for AR regarding ease of route ($p=0.023$). Despite the longer assignment term, AR was found to be more solid and locked in, stamping it as a promising apparatus for future scene plan hones.

9:45 ***Hybrid Multi-hop Data Transfer Modelling in Wireless Sensor Network for Bridge Structural Health Monitoring System***

Naufal Sayyid Furqoon, Seno Adi Putra, SSi MT and Setyorini Setyorini (Telkom University, Indonesia)

Static itinerary planning is a commonly employed multi-hop itinerary planning method in wireless sensor networks (WSN) due to its commendable energy efficiency and ability to minimize overhead. However, this approach lacks reliability due to the possibility of inactive sensor nodes in the WSN throughout the multi-hop process. This research presents a hybrid multi-hop strategy that combines static itinerary planning with dynamic adjustment. In the event of a malfunctioning sensor during the multi-hop procedure, data transfer can persist until it reaches the sink node. Our model integrates the benefits of utilizing a genetic algorithm for static route planning and making dynamic adjustments to ensure network functionality, even in the case of node failures during data transmission. This hybrid strategy provides reliable and robust data collection by overcoming the constraints of conventional static methods, which are vulnerable to disruptions when nodes are not reachable. Furthermore, a peak detection technique is employed to specifically process the incoming vibration data produced by the bridge, thus ensuring the collection of accurate and unambiguous data for FFT analysis. The

experimental results demonstrated that, despite the hybrid model's somewhat longer processing time compared to the static method, it significantly improves the network's ability to rapidly recover and maintain consistent performance. This effectively ensures uninterrupted data transmission and processing even in the event of node failures.

10:00 ***Forensic Analysis Model On Fintech E-Wallet Using Digital Evidence Generalization***

Irfan Achmad Firmansyah (Telkom University & PT. Anugrah Rekatama Cipta Solusi, Indonesia); Niken Cahyani and Farah Afianti (Telkom University, Indonesia)

Fintech is a service currently in great demand by the broader community in Indonesia. One fintech service that is currently widely used is Electronic Wallet (E-Walet). Apart from these available services, some parties commit criminal acts for personal gain. This needs the support of digital evidence obtained from acquisition results to inform analysis results in digital forensics. A forensic analysis model is required to support the analysis process of fintech services, which have varying characteristics across applications. This research analyses data and features in each fintech application and uses the Resource Description Framework ontology to help manage appropriate digital evidence in fintech applications. This model focuses on User, Transaction, and Merchant entities. This research can provide information about an incident involving a fintech e-wallet application and to what extent the data acquired can help by classification and analysis by generalizing digital evidence. This data that has been successfully acquired is grouped in a more general form to facilitate an understanding of what data plays an essential role in digital forensic activities and how an investigative question can be answered based on this data. The generalization of this data will be shown in model visualization to inform if the data is available and the known relationships between the data. The research contributes to digital forensics by providing a structured approach to analyzing fintech data. It offers insights into the future direction of data analysis in this domain.

10:15 ***SMART CRP USING PEGA ROBOTICS: Enhancing Customer Relationship Platforms with Robotics Process Automation***

Gokul Pandy (IEEE Senior Member, USA); Amey Ram Banarse (YugabyteDB, USA); Vivekananda Jayaram (Florida International University, USA); Koushik K Ganeeb (Salesforce, USA); Pankaj Gupta (Discover Financial Services, USA); Manjunatha Sughaturu Krishnappa (Oracle, USA)

In today's competitive business landscape, organizations are under pressure to improve operational efficiency and enhance customer satisfaction. This paper introduces SMART CRP, a model that integrates Pega Robotics Process Automation (RPA) with Customer Relationship Platforms (CRP) to streamline processes and address inefficiencies. SMART CRP leverages Pega Robotics to automate repetitive tasks within CRP systems, achieving a 30% reduction in query processing time, a 15% decrease in data entry errors, and a 20% reduction in operational costs. The paper outlines the architecture and deployment strategy of SMART CRP, focusing on key automation areas such as data validation, query resolution, and feedback management. Through a phased implementation approach, including pilot testing and full-scale deployment, the model demonstrates how integrating RPA with CRP systems can significantly improve both operational metrics and customer satisfaction. The paper also addresses the challenges of integrating RPA with legacy CRP systems, proposing solutions such

as API development and phased data migration to ensure seamless adoption. The findings underscore the potential of SMART CRP to transform CRP systems, offering insights for organizations looking to enhance efficiency and customer retention through automation. Future research avenues include expanding the model's application across industries and incorporating machine learning for predictive customer engagement.

1B: Cybernetics and Information Management in Business

9:30 ***Development of Scheduling and Room Mapping Application: A Case Study of Practical Room in Higher Education***

Muhammad Ramadhan Muttaqien, Ekky Novriza Alam and Sinung Suakanto (Telkom University, Indonesia)

Scheduling and mapping practical session rooms is a common challenge for higher education institutions, requiring the coordination of schedules and alignment of room availability with practical session needs, often leading to misalignments and inefficient room utilization. The Faculty of Industrial Engineering at Telkom University faces similar challenges, affecting the efficiency and effectiveness of practical session room management. This study presents the development of a web application designed to assist in scheduling and room mapping by utilizing iterative incremental methods within an agile framework. The core of the application is a genetic algorithm, implemented and optimized iteratively to generate optimal scheduling and room mapping solutions. The algorithm considers various constraints and preferences, such as room availability, shift times, and specific practical requirements, to ensure an efficient and effective solution. The user-friendly interface features clear information display and mechanisms for handling statuses, enhancing user experience and laboratory management efficiency. The implementation of this application is expected to significantly enhance laboratory management efficiency, reduce scheduling conflicts, and improve user satisfaction within the FRI environment. Rigorous testing, including unit testing, was conducted to ensure functionality and reliability. Extensive user acceptance testing demonstrated a 100% pass rate, confirming the application's success in meeting its functional requirements and achieving high user satisfaction.

9:45 ***Development of a Room Mapping Backend System: A Case Study of Practical Classroom Allocation***

Afif Zaky Muhana, Ekky Novriza Alam and Sinung Suakanto (Telkom University, Indonesia)

This study aims to develop a robust backend system for optimizing practical course scheduling in educational institutions, specifically addressing the challenges faced by the Faculty of Industrial Engineering at Telkom University. The primary objective is to streamline the allocation of classrooms to ensure efficient use of resources and minimize scheduling conflicts. Efficient management of practical course scheduling is a critical challenge for educational institutions aiming to optimize resource utilization and ensure seamless academic operations. This case study at Telkom University's Faculty of Industrial Engineering (FRI) highlights the demand for a robust system due to the growing student population. This paper introduces SIMETA FRI, a backend system designed to streamline practical course scheduling. The system includes modules for user, room, shift, and practical course

requirement management. By integrating a Genetic Algorithm (GA) for optimization, the system balances various constraints to minimize conflicts and maximize room utilization. Rigorous testing verified the flawless operation of all system features. Load testing demonstrated resilience, efficiently managing up to 800 concurrent users without performance degradation. The backend system facilitates easy management of scheduling data, ensuring data integrity and accessibility. The GA implementation reduced scheduling conflicts to zero and enhanced room utilization to 85%, showcasing the system's capability to tackle complex scheduling demands and optimize educational resources. Furthermore, the system's flexibility allows for future expansions and integration with other institutional systems. This research demonstrates the significant potential of a well-designed backend system, supported by advanced computational techniques, in improving academic scheduling and overall educational efficiency, highlighting its potential impact in the educational sector.

10:00 ***Advancing Transformer Asset Management with Geographic Information Systems***

Sinung Suakanto (Telkom University, Indonesia); Chandra Wiharya (State Polytechnic of Malang, Indonesia); Hilda Nuraliza, Mifta Ardianti, Riska Yanu Fa'rifah and Taufik Adi (Telkom University, Indonesia)

The increasing demand for electricity supply due to population growth necessitates not only an optimal quantity but also high-quality electrical distribution. The vulnerability of electrical distribution systems to disturbances underscores the critical need for effective monitoring and maintenance of transformers to prevent failures and premature performance degradation. This research aims to develop a comprehensive Geographic Information System (GIS) for monitoring electrical transformer assets using the Design Science Research Methodology (DSRM). The proposed system involves equipping transformers with advanced IoT devices that continuously transmit data to a centralized server, enabling real-time monitoring of transformer location, condition, and health. This data is then presented interactively on a digital map, providing comprehensive visual insights for maintenance and operational decision-making. The GIS integrates both spatial and non-spatial data, allowing for a detailed analysis of transformer performance across large geographical areas. The implementation of this GIS-based system is expected to significantly enhance operational efficiency, enable proactive and preventive maintenance strategies, and reduce the risk of sudden failures within the electrical distribution network. By facilitating timely detection and resolution of potential issues, this system aims to ensure the reliability and stability of the electricity supply, ultimately contributing to improved service quality, reduced maintenance costs, and extended transformer lifespan. Furthermore, the system supports data-driven planning for future network expansions and upgrades, promoting a more resilient and robust power distribution infrastructure.

10:15 ***Exploring Methodologies in ICT-enabled Community Development: Bibliometrix Analysis***

Mega Fitri Yani, Luthfi Ramadani and Iqbal Yulizar Mukti (Telkom University, Indonesia)

This study is dedicated to examining methodologies that enhance the implementation of Information and Communication Technology (ICT) in community development. The integration of ICT into community development initiatives has the potential to significantly advance the progress of communities. Despite the promising opportunities that ICT offers, its accessibility and utilization are

often obstructed by a range of challenges. Consequently, this research seeks to analyze studies related to ICT-based community development by categorizing them according to trends and methodologies employed. The research methodology utilized is bibliometric analysis, performed with the assistance of Biblioshiny software from the R-Package. An initial search in the Scopus database yielded 158 documents suitable for analysis. The outcomes of this research are presented through various metrics, including annual scientific output, identification of the most relevant sources, authors, affiliations, and countries. Additionally, the study examines the most frequently used keywords, trending topics, and thematic maps. By providing a detailed analysis of these elements, the research contributes to a deeper understanding of how ICT can be effectively harnessed for community development. It aims to identify the most effective methodologies for ensuring that technological advancements are accessible and beneficial to society. The insights garnered from this study are intended to support efforts to enhance the role of ICT in fostering community development, helping to overcome barriers to technology access, and ultimately improving societal outcomes.

1C: Cybernetics and Data Science

9:30 ***Multilabel Classification Abusive Language and Hate Speech on Indonesian Twitter Using Transformer Model: IndoBERTweet & IndoRoBERTa***

Muhammad Ridha, Dade Nurjanah and Muhammad Rakha (Telkom University, Indonesia)

Recently, the rampant hate speech and abusive language on Indonesian Twitter has become a concern. The overlap between the two makes it difficult to distinguish clearly. Legal action can be taken against those who spread hate speech because of its serious impact. Thus, multi-label classification using text classification in NLP is very important, utilizing models that understand context. This study proposes the use of transformer models such as IndoBERTweet, RoBERTa Base Indonesia, and IndoRoBERTa Small. Various data balancing methods such as SMOTE, Random Oversampling, and Random Undersampling are applied to evaluate their impact on the model. The results show that IndoBERTweet, with random oversampling and optimal hyperparameters (learning rate 1e-4, batch size 64, 3 epochs), outperforms other models with an accuracy of 0.86, an average precision of 0.85, a recall of 0.86, and an F1 score of 0.85. This shows that IndoBERTweet with random oversampling excels in identifying and categorizing multi-label hate speech and profanity on Indonesian Twitter. In addition, data balancing can be useful in improving accuracy in some scenarios such as random oversampling in the IndoBERTweet model, but its effectiveness is not consistent across models and configurations. Therefore, it is important to carefully consider the choice of data balancing technique and its impact on model performance in the context of a particular task and dataset.

9:45 ***Anomaly Detection in Gas Pipes with an Ensemble Learning Approach: Combination of Random Forest and GBoost***

Novaldi Ramadhan Waluyo, Widi Astuti and Aditya Firman Ihsan (Telkom University, Indonesia)

This research focuses on developing a robust anomaly detection method for gas pipeline networks using an ensemble-based machine learning approach, specifically through random forest and

gradient boosting algorithms. The study highlights the critical importance of early detection of gas leaks in pipeline infrastructure to prevent catastrophic consequences, including fires, explosions, and environmental damage. Leveraging extensive operational pipeline datasets from oil and gas companies, the research begins with a comprehensive data preprocessing phase designed to ensure the highest level of data quality and integrity. Both random forest and gradient boost models are rigorously implemented and trained on this dataset, with a focus on clustering data into decision trees or groups to effectively identify anomalies. The primary objective is to compare the accuracy of the random forest and gradient boost models while also exploring the potential for enhanced performance by combining these two powerful methods. The effectiveness of the anomaly detection system is meticulously evaluated using F1-score and accuracy metrics, which provide a clear measure of model performance. This research aims to significantly improve the safety and reliability of gas distribution systems by delivering a cutting-edge machine learning approach for anomaly detection in gas pipelines. The study's results, demonstrating an accuracy of 0.90 and an F1-score of 0.90, indicate strong and reliable performance.

10:00 ***Hybrid Data Mining Based on Student Grade Clustering for Major Concentration Classification (Case Study: University Xyz in Serang, Banten)***

Mia Miskiatul Atiroh (Telkom University, Indonesia); Lukman Abdurrahman (Gedung Karang Lt. 2 Fakultas Rekayasa Industri & Telkom University, Indonesia); Oktariani Nurul Pratiwi (Telkom University, Indonesia)

The development of data mining is currently very much helping decision makers to determine the right decision for the problem at hand. Data mining is a technique used to analyze data by combining statistics, mathematics, and machine learning. In hybrid data mining, an important influencing factor is the process of generating different classifiers to form a general model. This study proposes to combine two data mining methods, clustering and classification. Thiscombination of data mining methods is called hybrid data mining. By utilizing the technique of grouping data based on similarities and differences, data errors can be minimized, thereby improving the accuracy of the classification model. Using hybrid data mining methods, where the is data clustered using k-medoid model and then classified, shows that 3 out of 5 models can be effectively applied. Based on the student learning data used as the test data, Hybrid data mining methods demonstrate higher accuracy rates, such as an increase from 74% to 92% for Naive Bayes, 86% to 88% for Support Vector Machine, and 78% to 84% for K-Nearest Neighbor. so that concentration selection using hybrid data mining methods is more accurate.

10:15 ***Transmission Rate Estimation of COVID-19 in Bandung Using SIR Model and Runge-Kutta Fourth-order***

Diva Annisa Febecca and Putu Harry Gunawan (Telkom University, Indonesia); Didit Adytia (School of Computing, Telkom University, Indonesia)

The global outbreak of COVID-19, initially detected in Wuhan, China, at the end of 2019, has rapidly escalated into a pandemic, affecting numerous countries worldwide, including Indonesia. Among the impacted regions in Indonesia, Bandung, a significant city in West Java, has experienced a notable

spread of the virus. This research focuses on predicting the transmission of COVID-19 in Bandung using the Susceptible, Infected, Recovered (SIR) model, a foundational framework in epidemiology. The SIR model in this research is solved using the Runge-Kutta 4th Order (RK4) method, a numerical approach known for its high accuracy in solving differential equations. The model was applied to a dataset of COVID-19 cases in Bandung obtained from the Bandung COVID-19 Information Center from February 2021 to June 2023. The data was processed to handle missing values. Missing values are handled using the LOCF approach and then used to simulate the spread of the virus. This research aims to evaluate the effectiveness and accuracy of the SIR model when combined with the RK4 method in predicting COVID-19 transmission dynamics in Bandung. The findings reveal that this approach is effective, as demonstrated by the low RMSE values of 0.15 for infected and 0.7 for recovered cases. This close agreement between the model's predictions and actual data underscores the importance of accurately calibrating the transmission rate within the model, as it significantly influences the model's predictive accuracy. This research highlights the SIR model's potential, enhanced by the RK4 method, as a reliable tool for forecasting pandemic trends in Bandung.

1D: Cybernetics and Data Science

9:30 ***AI Nail Art Customization: Enhancing User Experience Through Skin Tone and Nail Disease Detection Using Self-Supervised Learning***

Princess Jane M Nerida and Alexa M Tan (Pamantasan ng Lungsod ng Maynila, Philippines);
Criselle J Centeno, Vivien A. Agustin, Mark Anthony S. Mercado and Joseph Darwin C Co
(University of the City of Manila, Philippines)

The lack of advanced technology in nail care and disease detection limits the ability to achieve personalized nail aesthetics and maintain healthy nails, as many individuals are unable to detect and address underlying conditions. In this paper, the proponents developed a mobile app to bridge this gap. The app personalizes nail art by detecting user skin tones and analyzing nail health with self-supervised learning (SSL) techniques. This innovative approach provides tailored nail art recommendations that enhance the user's natural appearance and promotes nail health through a built-in diagnostic tool for detecting nail diseases and offering medical advice. Evaluated under ISO Standard 25010, the app received high ratings for functionality, performance efficiency, compatibility, reliability, and usability, with means of 3.34, 3.38, 3.63, 3.29, and 3.47, respectively. The developed AI mobile application integrated with self-supervised machine learning has 86.5% overall accuracy rate. Thus, these results underscore the app's effectiveness in delivering an intuitive, user-centered experience that prioritizes both aesthetics and nail health. Future improvements are recommended, such as expanding the algorithm for a broader range of skin tones, enhancing nail disease detection capabilities, simplifying the interface, and increasing device compatibility. This application not only aims to provide users with visually pleasing and personalized nail art but also promotes healthier nail care practices through advanced AI-driven features. With its dual focus on aesthetics and health, this mobile app represents a significant step forward in personalized, data-driven nail care solutions.

9:45 ***Lung Cancer Classification Based on Ensembling EfficientNet Using Histopathology Images***

Akif Rachmat Hidayah and Untari N. Wisesty (Telkom University, Indonesia)

Lung cancer is a leading cause of cancer-related deaths, and accurate, early diagnosis is critical for effective treatment. Histopathological analysis is a standard diagnostic approach but requires significant expertise and time. This study aims to improve lung cancer classification through an ensemble of EfficientNetV2 models (B0-B3) applied to histopathological images. EfficientNetV2 was chosen for its scalability and strong performance in image classification tasks. Data augmentation was used to enhance robustness, simulating variability in histopathological slides, while transfer learning from ImageNet pre-trained models enabled faster convergence with limited data. The models were trained on the LC25000 dataset, containing augmented images, and evaluated individually and in ensemble configurations. Grad-CAM provided interpretability, generating heatmaps that highlight model focus, aiding in understanding decision-making. Results showed that individual EfficientNetV2 models achieved near-perfect accuracy, with the ensemble approach further improving performance. Ensemble models, particularly those using hard voting, achieved up to 100% accuracy, precision, and recall, underscoring the effectiveness of combined predictions. However, the high accuracy may be partially due to the dataset's limited unique images, as repeated patterns in augmented data might inflate performance. Future work will test the ensemble on larger, more diverse datasets to validate generalizability. These findings demonstrate the potential of EfficientNetV2 ensembles in lung cancer diagnostics, paving the way for reliable, interpretable AI-based pathology tools in clinical settings.

10:00 ***Optimizing 4Ps Beneficiary Identification: A Web-Based Analysis Using Forecasting and Multiple Linear Regression to Improve Socioeconomic Outcomes***

Raven Lorenz D. Cagsawa and Andrei Pocholo A Pinauin (Pamantasan ng Lungsod ng Maynila, Philippines); Raymund M Dioses, Criselle J Centeno, Marilou B. Mangrobang and Mark Anthony S. Mercado (University of the City of Manila, Philippines)

The limited application of advanced analytics in social welfare programs hinders effective beneficiary identification and reduces the potential for optimizing socioeconomic outcomes. Addressing this gap, our paper introduces a web-based application designed to enhance the Pantawid Pamilyang Pilipino Program (4Ps) by utilizing multiple regression and forecasting techniques to improve decision-making in identifying program beneficiaries. By analyzing key socioeconomic data, the application generates actionable insights that support program administrators and policymakers, thereby enabling more accurate, data-driven decision-making. The application has been developed and is designed with a user-friendly interface that allows clients and stakeholders to easily navigate the system while accessing essential information. To ensure its robustness and reliability, the application was evaluated according to the ISO/IEC 25010 software quality model, receiving high scores across several dimensions, including functionality, performance efficiency, compatibility, reliability, usability, and security. Such evaluations underscore the application's capability to meet diverse user needs effectively. The findings suggest that this tool not only supports efficient beneficiary identification but also offers a scalable solution for broader social welfare programs. Future recommendations include the integration of more advanced analytics, enhancements in data visualization for better interpretability, and expansion of the platform's scalability to accommodate a growing user base and larger datasets, ensuring the system's adaptability and long-term viability in socioeconomic planning initiatives.

10:15 ***Sentiment Analysis of Steam Video Game Reviews for Disco Elysium Using the Random***

Forest Tuning Method with Chi-Square Features

Dendy Hadinata, Mahendra Dwifebri Purbolaksono and Utami Kusuma Dewi (Telkom University, Indonesia)

Video games have emerged as one of the most popular forms of entertainment worldwide, particularly through digital distribution platforms like Steam, which provides access to over 30,000 games. User reviews on Steam are crucial for game developers to understand consumer needs and improve product quality. This study aims to conduct sentiment analysis on user reviews for the game Disco Elysium on Steam using the Random Forest classification method, optimized through Chi-Square feature selection. The dataset comprises 5,000 manually labeled reviews categorized as positive or negative. Preprocess-ing steps include punctuation and number removal, lowercasing, stopword elimination, stemming, and tokenization. The TF-IDF method is then applied for word weighting, followed by Chi-Square for feature selection to reduce irrelevant features. The Random Forest model is subsequently applied with hyperparameter tuning via GridSearchCV and RandomizedSearchCV. Evaluation metrics, including accuracy, precision, recall, and F1-score, are calculated using a confusion matrix. Results indicate that stemming and hyperparameter tuning enhance model accuracy, while Chi-Square feature selection does not al- ways significantly improve performance. RandomizedSearchCV outperforms GridSearchCV in terms of computational efficiency and optimal parameter exploration, proving more effective for this study's requirements. This research highlights the potential for further optimization in preprocessing techniques and feature selection to enhance text-based sentiment analysis. Findings from this study can guide game developers in efficiently un- derstanding user sentiment from digital platform reviews, thus aiding in more informed product improvement and decision- making.

Tuesday, December 17 10:40 - 11:40

2A: Cybernetics and Information Management in Business

10:40 ***Enhancing Community Development with Information and Communication Technology: An In-Depth Analysis of Successful Strategies and Approaches***

Mega Fitri Yani, Luthfi Ramadani and Iqbal Yulizar Mukti (Telkom University, Indonesia)

This study explores methodologies that support the implementation of Information and Communication Technology (ICT) in community development, aiming to enhance community building and engagement. The integration of ICT can significantly open up new opportunities for communities, fostering development and improving quality of life. However, the potential benefits of ICT are often constrained by various challenges, including limited access, technological literacy, and infrastructural deficits. To address these issues, this research provides a comprehensive examination of how ICT can be utilized effectively within community development initiatives. We employed a systematic literature review approach to address three primary research questions related to ICT application, challenges, and methodologies for effective implementation. Our review led to the selection of 20 relevant articles, which were analyzed to identify key themes, best practices, and methodologies that facilitate ICT integration in community development. The findings highlight both the potential of ICT to drive community progress and the barriers that need to be addressed to optimize its impact. By

elucidating effective methodologies and offering insights into overcoming common obstacles, this research contributes significantly to the understanding of ICT's role in community development. It provides valuable guidance for policymakers, practitioners, and researchers interested in leveraging technology to promote sustainable and inclusive community growth.

10:55 ***Development of a Pedagogical Agent Utilizing ChatGPT as a Response Mechanism and Scaffolding Method for CSS Learning***

Alvito Baihaqie Yosobumi, Ati Suci Dian Martha and Kusuma Ayu Laksitowening (Telkom University, Indonesia)

Cascading Style Sheets (CSS) are fundamental to modern web development, yet many learners encounter significant challenges with its intricate syntax and extensive styling capabilities. Approximately 85.7% of students report difficulties in mastering CSS concepts, which are often compounded by motivational issues that hinder the learning process. To tackle these challenges, this paper introduces a web-based educational application designed to enhance CSS learning through the integration of an innovative pedagogical agent that employs advanced scaffolding methods. The application utilizes a dual-phase scaffolding approach, including procedural scaffolding, which offers structured guidance through pre-designed dialogues, and strategic scaffolding, which employs ChatGPT to deliver personalized, adaptive feedback tailored to individual learning needs. The implementation of these scaffolding techniques has led to significant improvements in both user engagement and learning outcomes. Thematic analysis revealed that 80% of participants found the learning style provided by the pedagogical agent aligned with their personal preferences, compared to only 40% with conventional methods. Additionally, 90% of participants experienced increased motivation using the application with the pedagogical agent, versus 40% with the conventional approach. These findings highlight the effectiveness of the pedagogical agent in fostering a personalized and engaging learning experience, enhancing both motivation and learning. This research lays the chance for future advancements in interactive and adaptive learning systems, demonstrating the potential of combining pedagogical agents with sophisticated language models like ChatGPT to address educational and motivational challenges.

11:10 ***Design and Implementation of a Data Warehouse for Satu Data at Telkom University***

Alfito Febriansyah and Kusuma Ayu Laksitowening (Telkom University, Indonesia)

In today's digital era, effective and efficient data management is very important for higher education institutions. Telkom University, as one of the leading universities in Indonesia, faces challenges in managing complex academic data spread across various units. To overcome these challenges and support the Satu Data Indonesia initiative, this research focuses on the design and implementation of a Data Warehouse at Telkom University. Through a combination approach of Kimball's Nine-Step Method and the SDLC Waterfall development model, this research aims to create an efficient data integration system, addressing issues such as redundancy, lack of data transparency, and integration difficulties that have previously been obstacles at Telkom University. This Data Warehouse implementation includes managing data from various sources including student information, curriculum, and other academic activities, with the aim of improving data consistency and reliability.

The results of the testing show that the designed Data Warehouse is able to handle increasing data volumes efficiently, with processing time stability remaining within reasonable limits. In addition, the system achieved a 100% success rate in data validation without data loss or rejection during storage and processing. Overall, this research successfully developed a Data Warehouse that meets the needs of academic data integration at Telkom University, thus supporting more effective and efficient data management in accordance with the Satu Data Indonesia framework.

11:25 ***Development of Tracking Features and Recommendation for Mother's Nutrition in the Genting Mobile Application to Prevent Stunting using Vision Transformer (Case Study: PKK Bandung City)***

Azka Tsawaab Dhafin, Rahmat Fauzi and Zalina Fatima Azzahra (Telkom University, Indonesia)

Stunting is a chronic nutritional problem that has a serious impact on child growth and development in Indonesia. It not only affects physical stature but also impairs cognitive development and increases the risk of long-term socio-economic issues. Although several applications have been developed for stunting prevention, many do not provide efficient nutrition tracking features and personalized nutrition recommendations, which are crucial for early prevention of stunting. This research introduces the development of an Android mobile application called "Genting" that leverages the Vision Transformer (ViT) machine learning model for food image classification and Google Generative AI for providing tailored nutrition recommendations. The ViT model achieved an accuracy of 82.12% on the validation dataset after 20 epochs, with a loss value of 0.6725. To ensure model robustness, K-fold cross-validation with 5 folds was employed, resulting in an average accuracy of 95.93 Further testing demonstrated the model's ability to recognize various types of food with the highest probability reaching 99.99%, reflecting high confidence in its predictions. This high accuracy ensures more reliable food classification and improving efficiency in nutrition tracking. Although not publicly released, the Genting application underwent thorough testing in a restricted environment with Posyandu cadres to verify its functionality. This application is designed to provide innovative solutions in nutrition monitoring through advanced machine learning technology, offering more personalized and efficient nutrition recommendations. By doing so, it aims to support early stunting prevention efforts, addressing a significant public health challenge in Indonesia by improving the precision and effectiveness of nutritional interventions at a critical stage in child development.

2B: Cybernetics and Biomedical Engineering

10:40 ***Designing a Test Case Catalog Based on Software Requirements Documents Using Text Mining***

Jahfal Mudrik Ramadhan, Dana Sulistyo Kusumo and Rosa Reska Riskiana (Telkom University, Indonesia)

Software development projects involve a number of companies and individuals with diverse knowledge and expertise. This Failure of software development projects is generally caused by weaknesses in the testing process. Fixing and detecting bugs is a costly and time-consuming activity. Bugs can be addressed through the testing process, which utilizes test cases. However, creating test

cases manually is expensive and time-intensive. This study presents a Test Case Catalog design that reuses existing test cases, focusing on XYZ campus system applications. Test cases are organized based on existing software requirements documents as a basis for testing. By utilizing a repository containing similar and relevant test cases, the Test Case Catalog offers a systematic tool for application testing of the XYZ project. The catalog is designed using Text Mining, including Bag of Words, to extract and analyze similar and relevant functions or features from the software requirements documents. Based on the threshold results with a percentile value of 70 not only relevant feature selection to generate test cases but also improves the testing process, as evidenced by the better success rate compared to the pretest phase, manual testing without using the Test Case Catalog. Thus, this catalog emerged as an effective and efficient tool in software testing.

10:55 ***Development of Pattern-Based Test Case Catalog to Increase Reuse and Variety in Software Testing***

Alwan Kemal, Dana Sulistyo Kusumo and Rosa Reska Riskiana (Telkom University, Indonesia)

In software development, the quality control process is a critical element that aims to oversee and verify product quality. Poor quality control processes are frequently a key factor in software project failures. Software testing is key to identifying defects, but designing an effective test suite requires a huge effort that can affect cost, effectiveness, maintenance time, and development schedules. The Directorate of the Center for Excellence in Information Technology (PUTI) as one of the IT support units within Telkom University, is currently facing the same challenges in managing the BaSO application, which is an application for making official letters online. This application requires further testing to ensure that each function runs properly in various browser and device environments. In this case, the reuse and pattern approach was proposed as a solution, and based on this approach, a test case catalog was created. To assess the design system's impact and effectiveness, an experimental study was conducted for the PUTI QA team to test the BaSO application. The experimental results show that the use of a test case catalog during the test case development process can increase the reusability of test cases, with an average precision value of about 50%. In addition, the obtained test case variation value also increased by 35.5%. The findings highlight the significant impact of using a test case catalog, thus contributing to a more effective software testing process.

11:10 ***Robust Reversible Watermarking Application via User Interface***

Afi Athallah Syamsulhadi Putra, Ledya Novamizanti and Gelar Budiman (Telkom University, Indonesia)

In the digital era, particularly in medical applications, ensuring the originality and security of digital images has become a critical concern due to the ease with which digital content can be duplicated and altered without authorization. The main objective of this study is to produce a desktop-based application named Wmarks, which ensures the integrity and authenticity of medical images while providing copyright protection. Wmarks employs the adaptive spread spectrum method to implement a robust, reversible image watermarking technique, prioritizing both security and ease of use. The focus of Wmarks is to ensure the security of digital images, particularly in medical contexts, while offering a reliable user-friendly interface that simplifies the process of embedding and retrieving

watermarks without compromising image quality. Functionality testing was conducted on two devices, a laptop and a PC, to evaluate performance. The results indicate excellent latency responsiveness, with an average response time difference of 58.079 ms between the devices. Black box testing further confirmed that Wmarks performs efficiently across all features. In terms of resource consumption, the application demonstrated optimal performance, with CPU usage ranging from 0-4% during idle conditions. Usability testing was conducted with 30 respondents using the System Usability Scale (SUS), resulting in a score of 80.35, reflecting positive feedback and high user satisfaction. These results indicate that Wmarks effectively secures sensitive digital content, particularly in medical fields, while being easy to use and implement in professional settings.

11:25 ***CNN Architectures Exploration and Analysis for Multiclass Skin Diseases Identification***

Nur Afny Catur Andryani (Bina Nusantara University, Indonesia); Yonathan Chandra (BINUS, Indonesia); Maulida Mazaya (National Research and Innovation Agency (BRIN), Indonesia); Mohammad Rosyidi (BRIN, Indonesia); Srie Prihianti Gondokaryono (Indonesian Society of Dermatology & Venereology, Indonesia)

Skin diseases have become one of the most common ailments, particularly in rural areas. Misdiagnosis, however, can lead to an even worse quality of life and inefficient treatments. Furthermore, countries with archipelagos, like Indonesia, are particularly impacted by an imbalance in the distribution of dermatological care. Here, general practitioners with less experience in the field typically provide most dermatological care in this area. Thus, misdiagnosis is virtually inevitable and leads to problems for the patient, even impacting the doctor's and dermatology organization's reputation. To solve this problem, it has recently been shown that general practitioners can identify skin disorders using artificial intelligence (AI). Unfortunately, not all AI implemented has considered dermatologists' knowledge in their systems, and specifically, most Indonesian dermatologists are not familiar with this AI thing. Thus, this work was purposed to help them predict skin disease classification through CNN-based Deep Learning Architecture methodologies for autonomous skin disease identification using mobile photos and dermoscopy. Here, the Fitzpatrick 17k and ISIC 2018 datasets with several deep learning methods, including ensemble techniques were used. The results showed that for mobile-based skin disease photos, the deep learning architecture offers a notable improvement over the handcrafted-based approach. The accuracy using an ensemble for the Fitzpatrick dataset was 55% and ISIC was higher, 80%. Although not all methods are improving slowly, further employment and refinement of ensemble techniques promise to automate further medical diagnostics which can enhance patient outcomes in dermatology. Finally, additional images will increase accuracy; specifically with the more intricate the photographs and sizes. Thus, this preliminary research showed the importance of the deep learning method in identifying skin disease classification.

2C: Cybernetics and Information Management in Business

10:40 ***Smart Ambulance: Mobile Solutions for Emergency Booking and Real-Time Tracking***

Moch Faizal Fahmi, Sinung Suakanto and Ilham Perdana (Telkom University, Indonesia); Edi Triono Nuryatno (The University of Western Australia, Australia & Harry Perkins Institute of Medical Research, Australia)

In emergencies, vehicles play a crucial role in managing critical situations, and ambulances are essential assets for mitigating the risk of worsening conditions. Given their importance, effective ambulance booking mechanisms are vital. Efficiency in ambulance booking can be improved through real-time tracking of ambulances by both requesters and hospitals. This research aims to develop a booking application system to assist patients in emergencies and aid medical personnel in managing emergency service requests. The iterative incremental method is a methodology that combines elements of the waterfall method in an iterative approach. The system is created using this approach, starting with data collection and analysis to understand business processes and define system requirements, followed by system development based on these insights. The result is a mobile-based ambulance booking and tracking application with two types of users: requesters and drivers. Requesters have features for registration, login, booking an ambulance, tracking its location, viewing available ambulances and their details, checking booking history, managing profiles, and updating information. Drivers have access to features such as login, a dashboard with booking information assigned to them, and tracking of patient pickup locations. The testing results using System Usability Scale indicate that from the three testing respondents, the system received an overall grade of A with an average score of 88.3. This application aims to enhance the quality of emergency medical services and save lives by improving response times.

10:55 ***Analysis of Factors Influencing the Intention-to-Use Child-monitoring Health Applications with Technology Acceptance Model 3 (TAM 3) (Study Case: Sukabumi Regency)***

Abrar Zuhdi Aqil Amrullah, Rahmat Fauzi and Widia Febriyani (Telkom University, Indonesia)

In Indonesia, stunting which is caused by persistent malnutrition is a serious problem, particularly in areas with high rates of poverty. The Indonesian Central Statistics Agency reports that the growth retardation rate remains elevated, reaching 24.40 percent in 2021 (SSGI), especially in high-poverty rural and urban areas. The government wants to lower stunting rates by transforming the healthcare industry digitally in order to solve this problem. Nonetheless, there is still insufficient knowledge in the study field about the application of child-monitoring health applications. Using a survey method and a quantitative methodology, this study is theoretically underpinned by the Technology Acceptance Model 3 (TAM 3). The study population consists of parents, particularly pregnant mothers and mothers of toddlers, in Ciheulang Village, Cibadak District, Sukabumi, West Java, totaling 759 individuals, with a sample size of 262. The findings indicate that variables such as Experience, Image, and Perceived Usefulness significantly influence the plan to utilize the child-monitoring health application. For instance, Experience (H4) has a path coefficient of 0.422 and a t-statistic of 5.441. Conversely, Subjective Norm (H1) does not significantly impact Perceived Usefulness, also path coefficient of 0.049 and a t-statistic of 0.785. This research highlights the importance of enhancing user experience and perceived benefits to encourage application usage. The findings are expected to assist application developers in providing more effective services for stunting monitoring.

11:10 ***Enhancing Laravel Filament Security Through Owasp-based Secure Code Practices***

Teguh Rijanandi and Niken Cahyani (Telkom University, Indonesia); Funny Farady Coastera (University of Bengkulu, Indonesia)

The Academic Information System (SIAKAD) is a digital platform utilized by Bengkulu University to oversee a range of academic activities, including student enrolment and attendance. Given the considerable number of parties that utilize SIAKAD within the university context, it is of great importance to enhance the security of this system, in order to mitigate the risk of future cyber-attacks. The objective of this research is to provide recommendations regarding the implementation of more secure code by the development team. The methodology employed in this research comprises three stages: data collection, security analysis and the formulation of recommendations for the implementation of secure code. In terms of standardizing the security analysis, this research adheres to the OWASP Application Security Verification Standard (ASVS), while the system testing is based on the OWASP Testing Guide. The outcome of this research is a more secure code recommendation, to be implemented in order to enhance the security of SIAKAD. The application was subjected to security testing using both black-box and white-box methods, which revealed a number of vulnerabilities, including code injection and errors in the configuration of security settings. Based on these findings, recommendations were formulated to enhance the authentication architecture, input and output validation, and file upload mechanism. It is anticipated that the implementation of these recommendations will lead to a notable enhancement in the security of SIAKAD, thereby protecting academic data and processes from potential threats.

11:25 ***B-GIS: Modernizing Local Governance Through a Web-Based Barangay Information System With (GIS) Geographic Information System for Efficient Resident Management in Barangay 99, Tondo, Manila***

Carlo Gabriel E Del Pilar, Sean Gabriel R Nale and Angelo L Jinio (University of City of Manila, Philippines); Diony S. Abando (Pamantasan ng Lungsod ng Maynila, Philippines); Mark Christopher R Blanco (University of the City of Manila, Philippines); Ariel Antwaun Rolando Sison (PLM, Philippines)

In the Philippines, governance begins with Local Government Units, extending down to barangays as the smallest administrative division, responsible for managing small neighborhoods. Paper-based management has historically been the backbone of many industries, a practice still prevalent today. Previous research mentioned that a digital divide persists, particularly in urban barangays lacking adequate ICT infrastructure and centralized systems. Without tailored system applications for barangay functions, local governance management may not achieve its full potential in efficiency. To address these challenges, B-GIS (Barangay Geographic Information System) will be developed. B-GIS is a digital platform aimed at modernizing and optimizing local governance. Its functionalities include management information systems, documentation, request processing, information dissemination, and geographic information systems to improve planning and governance leveraging ICT. Using the Agile Scrum Software Development Life Cycle, B-GIS was evaluated by 410 respondents using a 4-point Likert scale survey based on ISO 25010 standards. Evaluations revealed high user satisfaction to all key metrics specifically for the functional suitability with a 3.59 overall mean, performance efficiency with a 3.57 overall mean, usability with a 3.58 overall mean, reliability of the system with an overall mean of 3.55, and the overall respondent satisfaction with a 3.44 overall mean. These results suggest BGIS meets user needs and expectations, effectively addressing challenges with seamless communication and decision-making. Positive feedback underscores its potential for greater

community engagement, improved planning, and enhanced service delivery, positioning B-GIS as a valuable tool for local government units. Enhancing GIS features and data handling is recommended.

2D: Cybernetics and Information Management in Business

10:40 ***Developing a Startup Company Strategy in Energy Sector Using Five Diamond Method***

Lexy Akbar (Institute Technology of Sepuluh Nopember, Indonesia); Mahendrawathi ER (Institut Teknologi Sepuluh Nopember, Indonesia)

Indonesia, through its Electricity Supply Business Plan (RUPTL), mandates an increase in the use of renewable energy, including solar power plants, to reduce carbon emissions. Positive responses from energy sector entrepreneurs have driven the emergence of startups focused on providing solar-powered electricity solutions. However, startups in Indonesia face significant challenges in managing their business processes efficiently and effectively, particularly in penetrating the market and increasing sales due to market uncertainties. This research aims to fill gaps in the literature by offering an approach can provide strategic guidance for startups to improve sales and competitiveness in the market. Five Diamond Method (FDM) approach is used to design innovation strategies, emphasizing the exploration of innovation potential in market penetration. Data collection methods include research through scientific articles, news, relevant books, Focus Group Discussions (FGD). Based on FDM implementation that ABC Company can leverage the momentum of global megatrends such as SDGs, climate change and the blue economy to expand the market and increase sales. Technological trends such as digitalization, renewable energy, and energy storage technology (batteries) give significant opportunities for companies to provide more sophisticated, efficient, and easily accessible energy services to consumers.

10:55 ***Designing a Marketplace Platform for MSMEs: A Strategic Approach to Digitalization within the Smart City Concept in Pringsewu Regency***

Imam Samsudin (Universitas Gadjah Mada, Indonesia); Rudy Hartanto (Gadjah Mada University & Electrical Engineering and Information Technology Departmen, Faculty of Engineering Gadjah Mada University, Indonesia); Wing W. Winarno (Universitas Gadjah Mada, Indonesia)

The digital era presents significant opportunities for Micro, Small, and Medium Enterprises (MSMEs) to adopt digital technologies, enhancing market access, business efficiency, and economic growth. The Indonesian government aims to integrate 30 million MSMEs into the digital ecosystem by 2024. However, many MSMEs in Pringsewu Regency face challenges, particularly due to the complexity of government-introduced platforms and difficulties in monitoring MSME data across fragmented systems. This research aims to design a user-centric marketplace platform for MSMEs using the design thinking approach, which is aligned with the smart city concept to support digitalization and facilitate effective government oversight. Through the five phases of Design Thinking-Empathize, Define, Ideate, Prototype, and Test (not yet conducted)-key solutions, such as a simplified user interface and government monitoring tools, were developed. The result of the high-fidelity prototype addresses MSME needs and enables efficient government monitoring. Strategic recommendations for integrating this marketplace into Pringsewu's smart city ecosystem emphasize resource allocation,

collaboration, and comprehensive policy frameworks to foster a smart economy and ensure sustainable digital transformation of MSMEs. This study provides practical insights and best practices for MSME digitalization, supporting smart economy initiatives and guiding policymakers in sustainable digital transformation.

11:10 ***User Satisfaction in Digital Banking Through Artificial Intelligence***

Sarah Andien Sujanto, Justin Filbert Surya, Justin Ramaputra and Anderes Gui (Bina Nusantara University, Indonesia)

In era of disruptive technology, artificial intelligence (AI) is transforming how people carry out everyday tasks, including business transactions. As traditional business and transaction processes are being reshaped by digital disruption, discussions surrounding the evolution of digital banking (DB) have taken center stage in the industry. AI is becoming a necessary tool for financial institutions to fulfill changing consumer expectations and improve operational efficiency. This study aims to understand how several critical factors influence user satisfaction and provide insights for enhancing digital banking services. Data was collected using the purposive sampling method using questionnaires distributed to a diverse sample of digital banking users in Indonesia. Digital banking continues to evolve and expand in Indonesia since it has been driven by the positive response and demands from public increases drastically since Covid-19 pandemic. With the growth of digital banking, it is important to know the factors that increase user satisfaction to improve digital banking. This research investigates user satisfaction in digital banking within the Indonesian banking sector, focusing on the roles of AI. The use of AI has improved banking operations, especially in meeting customer satisfaction. Eight hypotheses are proposed to examine these relationships. The analysis was conducted using SmartPLS to evaluate the relationships between AI and user satisfaction. The findings reveal significant impacts of AI on user satisfaction, offering valuable recommendations for digital banks to optimize their digital banking strategies.

11:25 ***Understanding Heritage Through E-WOM: Malacca, Malaysia***

Putri Mustika and Andi William (Bina Nusantara University, Indonesia); Patricia Angelica Heliawanto (BINUS Business School Program, Indonesia); Agung Gita Subakti and Nurul Sukma Lestari (Bina Nusantara University, Indonesia); Muhammad Shabir Shaharudin (Universiti Sains Malaysia, Malaysia)

This study examines the influence of electronic word-of-mouth (e-WOM) on heritage tourism in Malacca (Melaka), Malaysia, a UNESCO World Heritage Site renowned for its rich social heritage. By analyzing the relationship between e-WOM measures (social media notifications, surveys, influencer content) and markers of tourism growth (visitor numbers, revenue, socioeconomics), this paper seeks to determine the role of advanced engagement in attracting tourists to Malacca's landmarks. This research assess the impact of e-WOM on guest recognition and investigate how different types of heritage-such as authentic design, local traditions, and culinary offerings-are communicated online. In addition, this study provides a comparative investigation of heritage tourism in Malacca and comparative destinations in Southeast Asia to contextualize Malacca's status within a location. This study explores the impact of electronic word-of-mouth (e-WOM) on heritage tourism in Malacca

(Melaka), Malaysia, a UNESCO World Heritage Site. It examines how e-WOM elements-like social media, surveys, and influencer content-affect tourism indicators such as visitor numbers, revenue, and engagement with heritage features like local traditions and cuisine. A comparison with other Southeast Asian destinations provides further context. Findings reveal that high digital engagement significantly boosts tourism, with certain events and landmarks gaining popularity after e-WOM spikes. The study highlights eWOM as a key tool for promoting tourism, offering strategies to enhance marketing, leverage guest feedback, and improve visitor experiences. Data from 263 respondents (115 men, 148 women) showed most participants were aged 20-40 and had undergraduate education, reflecting a digitally active and informed demographic.

Tuesday, December 17 12:40 - 14:10

3A: Cybernetics and Information Management in Business

12:40 ***Integration of Bundling Product Recommendation System and Stock Management in Fast Fashion Retail Business***

Susana Limanto (University of Surabaya, Indonesia); Dhiani Tresna Absari (University of Surabaya); Evangeline Alicia Thamrin (PT Bank Central Asia, Tbk, Indonesia)

Fast fashion presents products with designs that change quickly according to trends but at lower prices. This condition forces fast fashion business actors to update their stock quickly. However, uncertain public demand often results in piles of stock in the warehouse. One way to overcome this is to provide discounts through bundling product sales. In order for bundling product recommendations to be right on target, it is necessary to consider the level of complementarity of product combinations with public interest. The complementarity level of product combinations by public interest can be obtained by analyzing sales data. In this study, a bundling product recommendation system was developed and integrated with the purchasing and sales information system. Bundling product recommendations are carried out using the apriori algorithm. The recommendation system was applied using sales data from the information system between December 27, 2023 and January 2, 2024. The minimum support used was 0.1, and the minimum confidence used was 0.4. The system produces three bundling product recommendations within 30 seconds and showing that most consumers are inclined to buy a cloth set (tops and pants) and prefer neutral colors, namely white and black. The time required by the system to generate recommendations is 97.6% faster than if done manually. In addition, four fashion store owners validated the developed information system and the recommendation results. The validation results stated that the system facilitates business administration, monitors stock, analyzes consumer behavior, and develops marketing strategies with bundling promos. Finally, integrating the information and recommendation systems can increase data consistency and reduce data input time by 50% compared to systems developed separately.

12:55 ***OBE-Based Course Outcomes Prediction using Machine Learning Algorithms***

Ellysa Tjandra (University of Surabaya, Indonesia); Ridi Ferdiana and Noor Akhmad Setiawan (Universitas Gadjah Mada, Indonesia)

Educational data mining has emerged as a powerful tool for exploring hidden patterns in student data, predicting academic success, and reducing the dropout rate, especially in higher education. The OBE approach has been widely used in almost all educational institutions to ensure that students have the competencies determined by the study program and to measure student achievement. This study proposes a prediction model using machine learning algorithms using Regression to predict student course outcomes in an integrated OBE attainment system utilizing midterm component scores. This study identifies the most potential machine learning techniques for predicting learning outcomes in an OBE-based framework. By predicting student course outcomes early, it is possible to identify at-risk students who fail to meet desired outcomes early so that lecturers can take preventive actions. The performance of the decision trees, random forests, support vector, and K-nearest neighbor algorithms was computed and compared to predict the students' course outcome results. This study uses a dataset of 2423 students enrolled in 30 courses in 6 study programs at a private university in Indonesia during the first semester of 2023-2024. The predictions were made using mid-term course components' scores defined in the course learning plan, such as assignments, class engagement, quizzes/exams, and case-based projects. This research finds support vector regression recommended for use in large classes, while decision trees and random forests are more suitable for smaller classes.

13:10 ***Detection of Employee Fatigue based on Image Processing using Deep Learning Model***

Michael Ethan and I Gede Putra Kusuma Negara (Bina Nusantara University, Indonesia)

Fatigue in workplace is a common thing shared by all employees. Continuous exposure of fatigue could lead to negative productivity for companies. Current research on fatigue detection mostly focused to detect fatigues from a single 2D image data, meanwhile research on fatigue detection using each frames from video data is needed for better detection for fatigue process. The main advantage of using each timesteps of frames from video data which makes the model is able to predict long term dependency of fatigue person. To solve this problem, a deep learning model is proposed that could detect employee fatigue based on image processing using video data. Three models are used to train data using Convolutional Neural Network (CNN), which are Time Distributed CNN LSTM, 3D CNN, and 3D CNN LSTM. Out of those three models, the best model to detect fatigue person from video data is Time Distributed CNN Model with F-1 Score value of 0.77 and Accuracy Score of 0.76 for testing data. The model that gives best inference time is also Time Distributed CNN Model with the average value of 382 miliseconds to detect fatigues from 58 testing data with each of the data has duration of 3 seconds and 12 frames.

13:25 ***Estimating SIR Model Parameters for Predicting Covid-19 Cases in Bandung City***

Kahfi M Bintang (Telkom University, Indonesia); Norma Alias (Universiti Teknologi Malaysia, Malaysia); Wandi Yusuf Kurniawan (School of Computing, Telkom University, Indonesia); Ni Kadek Winda Patrianingsih and Gde Palguna Reganata (Universitas Bali Internasional, Indonesia); Putu Harry Gunawan (Telkom University, Indonesia)

The COVID-19 pandemic has profoundly impacted global public health, with Indonesia among the most severely affected. In response, the Bandung City Government implemented various control measures, including the Mayor's Circular on COVID-19 prevention and enforcing restrictions on

community activities, known as PPKM. This study applies the SusceptibleInfected-Recovered (SIR) model to analyze the progression of COVID-19 in Bandung City, specifically during the first and second waves. The SIR model was calibrated using historical case data and incorporated the finite probability of recovered individuals becoming susceptible again, which is critical for generating oscillatory solutions in epidemic modeling. The study focused on determining the best transmission rate for both waves. The first wave, occurring between July 4th and October 22nd, 2021, exhibited an optimal transmission rate of 0.38 (MAE: 0.0424). In contrast, the second wave, spanning February 1st to May 15th, 2022, required a higher transmission rate of 0.54 (MAE: 0.0142), reflecting the increased transmissibility of the Omicron variant. Meanwhile, the recovery rate was calculated based on an average incubation period of 14 days, equivalent to 1/14, approximately 0.0714. The results demonstrate that the SIR model successfully captures the epidemic dynamics in the region, providing insights into the effectiveness of governmental policies and restrictions in controlling the virus. Future studies may explore the inclusion of additional parameters, such as vaccination coverage and mobility patterns, which could enhance the model's predictive accuracy. Moreover, hybrid modeling approaches integrating SIR with machine learning may offer more adaptive solutions to rapidly changing epidemic conditions.

13:40 ***Human-artificial intelligence teaming model in cybersecurity***

Masike Malatji (University of South Africa SBL, South Africa)

The escalating complexity and sophistication of cybersecurity threats necessitate innovative approaches. One such approach is adopting autonomous artificial intelligence (AI) agents in collaboration with humans. This paper introduces a hybrid Human-AI Teaming (HAIT) model designed to optimise cybersecurity operations across multiple domains by integrating diverse Human-Machine Interaction (HMI) paradigms. Leveraging insights from previous research on HMI effectiveness in cybersecurity (see paper entitled Evaluating Human-Machine Interaction Paradigms for Effective Human-Artificial Intelligence Collaboration in Cybersecurity), the model strategically combines approaches such as Human in the Loop, Human on the Loop, and Coactive Systems to address the multifaceted nature of AI- driven cybersecurity tasks. The proposed HAIT model comprises five key elements: a Decision-Making Matrix, Dynamic Paradigm Allocation, Task-Specific Customisation, Feedback Loops, and Interoperability. These components work together to enhance adaptability, efficiency, and resilience in the face of evolving cyber threats. The paper explores the implications of this model for cybersecurity practitioners. It outlines a phased implementation strategy and identifies avenues for future research, such as enhancing the model's contextual understanding through advanced AI and machine learning tools.

13:55 ***Adversarial Robustness in DeepFake Detection: Enhancing Model Resilience with Defensive Strategies***

Pallavi N (VTU, India & M S Ramaiah Institute of Technology, India); Pallavi TP (Ramaiah Institute of Technology, India); Sushma B (Ramaiah Institute of Technology & Visvesvaraya Technological University, India); Goutam R (Atria Institute of Technology, India)

Detection of DeepFakes presents formidable challenges primarily due to adversarial attacks that

can dramatically reduce model accuracy. Current detection models are reasonably effective in real scenarios; however, these detectors are vulnerable to adversarial attacks, resulting in misclassifications. The current study examines defensive approaches to strengthen the robustness of DeepFake detection approaches when facing adversarial attacks. Explored several alternatives, including adversarial training, input preprocessing, and model ensembles against a manipulated media dataset. The results demonstrate that the model has predicted image appropriately at average of 86.34% but after the adversarial attacks the prediction of the image was 99.8% inappropriate. although adversarial attacks greatly lower the effectiveness of a model, it is possible to improve the robustness of a model through defense methods, particularly adversarial training in combination with an ensemble method which predicted the image appropriately at an average of 52.06%. However, despite the improvement, the defense methods still fail to protect all adversarial examples. The results illustrate the importance of developing new methods of defense against DeepFake detection in light of future adjustments and variants of an attack.

3B: Cybernetics and Data Science

12:40 ***Detection of Narcotics Money Laundering in Suspicious Financial Transactions Using Convolutional Extreme Gradient Boosting (ConvXGB)***

Leonardus Verrell Sayoga Kinantra Winarno (Bina Nusantara University, Indonesia); Antoni Wibowo (Bina Nusantara University & Jakarta, Indonesia)

With the development of narcotics problems that continue to increase, the Indonesian Government responds through the Badan Narkotika Nasional (BNN) with data showing the condition of narcotics tends to grow every year and is followed by the number of assets of money laundering (ML) crimes against narcotics cases. One of the banks in Indonesia as a reporting party for suspicious financial transactions (SFT) has obstacles in detecting narcotics ML due to complex and rarely found patterns. Some previous studies conducted experiments using Convolutional Neural Network (CNN), Extreme Gradient Boosting (XGBoost), and even a combination of both into Convolutional Extreme Gradient Boosting (ConvXGB), and improved model performance in several datasets. This paper designs a model using the ConvXGB algorithm by adopting the CNN architecture, LeNet-5, by applying several convolution layers and pooling layers as a baseline model for feature learning, and the XGBoost as feature classification. Three phases of research are the preprocessing phase by collecting data, transforming data, balancing data with a hybrid sampling technique, splitting data, and scaling data, followed by the implementation phase by creating a ConvXGB model, training and testing the model, then finally the evaluation phase by analyzing results and hyperparameter tuning. The dataset used is SFT from the bank during 2023. This ConvXGB has three convolution layers, a pooling layer, and a flattened layer. The performance test results are the accuracy value and F1-Score value of 99.11% each after hyperparameter tuning. By performing a hybrid model, the model performance results are better.

12:55 ***Implementation of CRISP-DM to Predict Student Graduation on Time Using Naïve Bayes Algorithm***

Tito Galaxy Wijaya, Oktariani Nurul Pratiwi and Irfan Darmawan (Telkom University, Indonesia)

The problem of on-time graduation of students at Telkom University, majoring in Information Systems, shows a decrease in the percentage of graduation until 2018. The inability of students to complete their studies within the specified time can have an impact on the reputation of the institution, increase education costs and living costs, delay professional careers, and overcapacity of campus facilities. To overcome this problem, a graduation prediction system that is fast, accurate, and effective is needed. This research applies the CRISP-DM methodology combined with data mining techniques using the Naïve Bayes classification algorithm to predict timely graduation. The CRISP-DM approach guides each step of the process, from understanding the problem and preparing the data to model evaluation, ensuring a structured and systematic workflow. The model without SMOTE shows good performance with an accuracy of 86.38%, precision of 95.76%, and recall of 87.78%, and the accuracy varies from 76.1% to 91.5% using K-fold CV with 5 fold experiments. Meanwhile, the model with SMOTE applied resulted in 83.93% accuracy, 94.48% precision, and 78.08% recall, with accuracy varying from 65.9% to 87.8%. Although SMOTE helps in some folds, the model without SMOTE shows a more stable and better performance in predicting timely graduation. In conclusion, the Naïve Bayes model without SMOTE is more recommended to be used in predicting students' on-time graduation.

13:10 ***A Systematic Analysis of Machine Learning and Deep Learning Strategies for Identifying Fake Reviews***

Shobrun Jamil Bagastio and Sinung Suakanto (Telkom University, Indonesia); Hanif Fakhrurroja (National Research and Innovation Agency, Indonesia & Telkom University, Indonesia)

Fake reviews have become a growing concern in various online platforms, as they mislead consumers and damage the credibility of businesses. These fraudulent reviews are often used to manipulate public perception, making it essential to develop robust detection methods. Given the increasing complexity and sophistication of fake reviews, there is a pressing need to explore advanced techniques that can effectively address this issue. This paper offers a systematic literature review that compares traditional machine learning methods and deep learning approaches for identifying fake reviews in multiple domains. The review traces the evolution from machine learning methods like Support Vector Machines and Naive Bayes to deep learning approaches such as LSTM, CNN, and BERT. While machine learning methods have been effective in identifying basic patterns, deep learning models have demonstrated superior performance, particularly in detecting more complex and adaptive fraudulent reviews. These deep learning models have shown notable improvements in detecting complex and adaptive fraudulent reviews. The study also examines the progression in feature extraction techniques, highlighting a shift towards experimental and hybrid approaches that combine methods such as TF-IDF, Word Embedding, and attention mechanisms, tailored to specific domain challenges. By providing a comprehensive comparison of these methodologies and their application across various review domains, this review offers valuable insights into the strengths, limitations, and rapid advancements in fake review detection. This research can help improve the reliability of online review systems, providing businesses and consumers with more trustworthy information for decision-making.

13:25 ***Towards a Web-Based Fisheries Management System: An ANN Approach to Fish Weight Prediction***

Nurul Firdaus (Universitas Sebelas Maret, Indonesia); Agita Setya Hanifah (Sebelas Maret

University, Indonesia); Fiddin Yusfida A'la and H Hartatik (Universitas Sebelas Maret, Indonesia)

This research introduces a web-based fisheries management system that leverages Artificial Neural Networks (ANNs) to accurately predict fish weight. By utilizing a public dataset sourced from a fish market, encompassing seven species (Perch, Bream, Roach, Pike, Smelt, Parkki, and Whitefish), and employing advanced machine learning techniques, the developed system demonstrates exceptional performance in fish weight estimation. The dataset includes various fish characteristics such as length1, length2, length3, height, and width. The ANN model, trained on this comprehensive dataset, achieved an R-squared value of 0.987, indicating a strong correlation between predicted and actual fish weights. Furthermore, the model exhibited low mean squared error (MSE) of 1720.63 and root mean squared error (RMSE) of 41.48, demonstrating its accuracy and reliability. The system's ability to provide precise fish weight predictions is crucial for sustainable fisheries management, enabling informed decision-making regarding catch quotas, population assessments, and aquaculture practices. This innovative tool offers a significant advancement in fisheries management, promoting efficient resource utilization and conservation. Additionally, the system's user-friendly interface and intuitive design make it accessible to fisheries managers of all levels of expertise. As a comprehensive fisheries management information system, it offers a range of functionalities, including financial management, equipment rental, fish stock tracking, member interaction, and information dissemination.

13:40 ***Negation Handling on XLNet using Dependency Parser for Sentiment Analysis***

Ferdinand Winaya and Abba Suganda Girsang (Bina Nusantara University, Indonesia)

Negation handling is often overlooked in Indonesian sentiment analysis, making it difficult to automatically and accurately determine the polarity of sentences containing negation words. Negation is a challenging issue in natural language processing, as it can drastically alter the meaning of a sentence. For example, common Indonesian negation words such as "tidak" (no/not), "belum" (not yet), or "jangan" (do not) can reverse the sentiment polarity in a text. Previous studies have proposed rule-based approaches, relying on linguistic rules or dependency parse trees to handle negation. However, negation is a complex problem that cannot be effectively addressed by simple rules alone, as they often lack flexibility in handling diverse sentence structures and negation complexities. Therefore, a more dynamic approach is needed, such as combining a dependency parser with an embedding layer, which can map syntactic relationships between words and learn vector representations of negation. This allows the model to flexibly determine the scope of negation words, enabling more accurate sentiment analysis even in complex sentences. This study evaluates the impact of negation handling on a transformer-based model, specifically XLNet, in Indonesian sentiment analysis. Using the proposed method, the model's F1 score increased by 2.13%, from 71.42% to 73.55%, compared to the baseline model. This demonstrates that the proposed negation handling strategy enhances sentiment prediction accuracy, making the model more effective at handling texts with negation.

13:55 ***iSUKAT: Capture, Measure, and Know Your Perfect Shoe Size Using Image Recognition***

Andrea Elaine Francisco, Jowan Gavriel J. Jumamoy, Bryle Elys N. Lim and Criselle J Centeno (University of the City of Manila, Philippines); Ariel Antwaun Rolando Sison (PLM, Philippines); Erwin D. Marcelo and Raymund M Dioses (University of the City of Manila, Philippines)

iSUKAT represents a groundbreaking web-based application that harnesses advanced image recognition technology, specifically Roboflow 3.0 Instance Segmentation with a COCO-seg checkpoint, to revolutionize foot measurement and shoe selection. By employing sophisticated machine learning algorithms, the system accurately captures and analyzes foot dimensions, identifying foot types and shoe brands with high precision. The application directly addresses the critical issue of improper shoe sizing, which impacts 63-72% of consumers and leads to significant discomfort and potential foot health problems. Utilizing a comprehensive evaluation methodology based on ISO 25010 quality standards, the research assessed the system's performance through quantitative metrics including Mean Average Precision for foot detection and segmentation, instance segmentation accuracy, and real-time image processing inference time. The empirical results were notably impressive, with the system achieving excellent ratings across key performance domains: Functional Appropriateness scored 3.35/4.00, Usability reached 3.26/4.00, and Reliability was evaluated at 3.31/4.00, resulting in an overall system acceptance of 3.21/4.00, which was classified as satisfactory. The application strategically addresses e-commerce shoe shopping challenges by providing personalized recommendations based on precise foot measurements. However, the research also revealed nuanced performance insights, with only 11.6% of users strongly agreeing on measurement precision, while 40.5% expressed concerns about measurement accuracy. Despite these challenges, the study ultimately underscores iSUKAT's transformative potential in digital footwear selection, presenting an innovative solution that seamlessly integrates advanced image recognition, machine learning, and user-centric design to dramatically enhance the online shoe shopping experience.

3C: Cybernetics and Internet-of-Things (IoTs)

12:40 *Centralized Rule Sharing Implementation in the Mata Elang Intrusion Detection System (IDS)*

I Gede Gilang Dharma Suputra (Politeknik Siber dan Sandi Negara, Indonesia); Septia Ulfa Sunaringtyas (National Cyber and Crypto Polytechnic, Indonesia)

In 2022, the National Cyber Security Operations Center (Pusopkamsinas) of the National Cyber and Crypto Agency (BSSN) recorded 976,429,996 traffic anomalies, with MyloBotnet being the dominant threat. Although the number of anomalies decreased compared to the previous year, cyber threats continue to evolve, posing new risks to the confidentiality, integrity, and availability of systems. Intrusion Detection System (IDS) and Security Information and Event Management (SIEM) systems are crucial solutions for detecting and handling attacks. The Mata Elang system, developed by Politeknik Elektronika Surabaya, utilizes Snort IDS and Pulledpork for automated rule configuration. However, limitations arise during rule customization, especially when involving multiple sensors. This research aims to address this issue by developing a centralized rule sharing approach that enables efficient automated IDS rule configuration across various sensors. This approach reduces reliance on the community for rule updates and optimizes attack handling more quickly. The research employed the SDLC Waterfall methodology to design, implement, and test a centralized rulesharing system. This system allows organizations using the Mata Elang IDS to streamline rule distribution across sensors, reducing manual tasks and enhancing response times during attacks. Functional and non-functional testing confirmed that the push-based mechanism successfully distributed rules across

sensors, providing identical configurations, improving detection capabilities, and aligning with the project's goals of improving operational efficiency and mitigating cyber threats in real time.

12:55 ***Semantic Segmentation with Deeplabv3 for Privacy Preservation in Intelligent Transport System***

Muhammad Jibril, Aji Gautama Putrada and Ryan Wicaksono (Telkom University, Indonesia)

Intelligent transport systems (ITS) with camera imagery have made rapid progress. However, there is a threat of privacy-preservation violation, where the camera can capture human movement, which is not needed in ITS. This study proposes semantic segmentation for privacy-preservation in ITS and evaluates its performance. To streamline the discussion, we refer to this approach as SS4PP: Semantic Segmentation for Privacy Preservation throughout the paper. We obtain image datasets for semantic segmentation from visual object classes (VOC) segmentation datasets. Deeplabv3, fully connected network (FCN), and lite reduced atrous spatial pyramid pooling (R-ASPP) are three semantic segmentation methods that are compared, where they are combined with three backbones, namely ResNet50, ResNet101, and MobileNetV3. We use Gaussian blur to blur the human, which semantic segmentation detects. Pixel accuracy and structural similarity (SSIM) index are chosen for testing metrics. The test results show that Deeplabv3 with MobileNetV3 backbone outperforms four other models that combine the mentioned semantic segmentation methods and the backbones. This is related to aspects with pixel accuracy of 0.92 and SSIM of 0.367. In addition, the test results also show that SSIM is more related to pixel accuracy than peak signal-to-noise ratio (PSNR) with R 2 of 0.2 compared to 0.1. Based on our SS4PP implementation on ITS, it is a challenge to create a more robust semantic segmentation of objects in cropped, small, and clustered images in the future.

13:10 ***Deep Learning Segmentation Models Evaluation for Deforestation Monitoring Embedded Systems***

Álvaro Sampaio Careli, Evandro Cesar Vilas Boas and Eduardo Henrique Teixeira (Instituto Nacional de Telecomunicações, Brazil); Elaine Cristina de Cássia Silva (National Institute of Telecommunication, Brazil); Guilherme Pedro Aquino (Instituto Nacional de Telecomunicações, Brazil); Felipe Augusto Pereira de Figueiredo (INATEL, Brazil)

This work evaluates deep learning segmentation models to propose a deforestation monitoring embedded system. The approach stands for environmental monitoring using remote sensing imagery, edge computing, and a deep learning segmentation model. Thus, the performance of you only look once architecture version 8 (YOLOv8) and Mask Region-based convolutional neural networks (Mask R-CNN) embedded in Raspberry Pi Model 4 regarding Intersection over Union (IoU), mean Average Precision (mAP), and time per image processing metrics is compared. The models are combined with a pixel-based algorithm that analyzes the temporal segmented images to define their forest area percentage for deforestation monitoring and detection. The results demonstrate YOLOv8x model achieved an IoU of 0.762, with a time per image of 0.4777 seconds, while Mask R-CNN R101 FPN 3x obtained an IoU of 0.763, with a time per image of 0.2669 seconds. The average times for YOLOv8 ranged from 0.0434 to 0.4777 seconds, and for Mask R-CNN from 0.1969 to 0.2669 seconds. Finally, this work proposes evaluating the model's performance when working with generative AI models Dall-

e, Craiyon, and Tess-AI to create a synthetic dataset to augment the initial one with synthetic samples and improve the model's training with a large dataset. The Dall-e has been shown to outperform the others regarding the IoU metric, which was suggested to augment datasets with synthetic samples.

13:25 ***A Smart Aquaponics System: IoT-Driven Water Quality Control for Lettuce Cultivation***

Sugondo Hadiyoso, Akhmad Alfaruq, Inung Wijayanto and Dadan Nur Ramadan (Telkom University, Indonesia); Senthil Kumar Appusamy Venkataraman (Bharathiar University, India & Hindusthan College of Arst and Science, India); I Dyah Irawati (Telkom University & Institut Teknologi Bandung, Indonesia)

The increasing world population will be linear with the need for food from both livestock and agriculture. Food security is an essential issue for all countries, including Indonesia. However, most of them need more agricultural land. Therefore, alternative agricultural technology is needed to meet food needs. Aquaponic technology is one solution that modern farmers have widely applied. Aquaponics allows the growing of vegetables along with fish farming. Maintaining water quality is one of the important parameters in aquaponic to ensure the quality of vegetables and fish in addition to environmental conditions. In the context of aquaponics, despite the high potential benefit of automation, there are still many water quality inspections rely on using manual methods. By performing automation in aquaponics, it may significantly affect the production efficiency and quality because automation is able to provide continuous and accurate monitoring. This study designed a mobile water quality monitoring system in aquaponics. The proposed system is implemented using an Internet of Things (IoT) platform. The water quality parameters measured included pH, temperature, and turbidity. The IoT user interface application is built using the Blynk platform. The developed system has been implemented for aquaponics monitoring in Purwakarta, West Java, Indonesia. This innovation meets the urgent demand for effective oversight and administration in aquaponics systems.

13:40 ***DistilQ-NILM: A Hybrid Quantization-Knowledge Distillation LSTM Model for Edge-Based Load Monitoring***

Mochamad Nabiel Adiputra, Aji Gautama Putrada and Ikke Dian Oktaviani (Telkom University, Indonesia)

In addition to adding information to users when using load monitoring, non-intrusive load monitoring (NILM) based on long short-term memory (LSTM) can also be useful for determining strategic follow-up to electrical power information. However, applying LSTM to NILM can still increase the system's complexity, compromising real-time response. This study proposed using a compression model for responsive edge computing-based NILM. We used the NILM dataset from Kaggle, which has power data from three sources: lamps, air conditioners (AC), and plugs. Then, three different model compression methods were applied to LSTM: quantization, knowledge distillation, and hybrid quantization knowledge distillation (DistilQ). We measured the performance of the three models from the model size and accuracy loss. Then, we evaluated the performance of NILM based on its confusion matrix. The test results showed that the original LSTM has a training, validation, and testing accuracy of 0.99. The F1-score of LSTM-NILM for predicting AC, plug, and lights classes were 0.98,

0.99, and 0.99, respectively. Then, the DistilQ method gave the lowest model size and the highest compression rate (CR) among the four methods, with values of 12.9 kB and 11.8×, respectively. Finally, the quantization method gave the highest accuracy and lowest accuracy loss among the three compression models, with values of 0.987 and 0.000, respectively.

13:55 ***A Comprehensive Review: Intrusion Detection System Using Machine Learning in Internet of Things***

Ameer Ahmed Ghani (University of Babylon & Information Technology College, Iraq); Suad Abdullelah Alasadi (University of Babylon & Information Technology College, Iraq)

Internet of Things (IoT) refers to a wide range of internet-connected devices used for data collecting, transfer, and dissemination. The increasing use of these devices causes important privacy and security issues. More attention is being given to internet security to protect a large number of vulnerable devices from harmful online activities. The increasing complexity of these threats has led to the need for an Intrusion Detection System (IDS) designed to detect and mitigate these security threats. However, Machine Learning (ML) refers to develop algorithms and statistical models that enable computers to autonomously select a particular task by identifying patterns in large datasets without explicit programming, such as supervised, unsupervised, and semi- supervised learning. This survey analyzes multiple implemented ML strategies in IDS for IoT, which adapt their techniques to the new needs of IoT environments and data security. The best result was achieved by Random Forest and XG-Boost for F1- score and precision nearing 100% with high accuracy rates up to 99.6% on the UNSW-NB15 dataset. Implementing ML with IDS in IoT networks effectively enhances security by identifying threats, addresses the complex and evolving nature of cyber threats, and offers improved detection accuracy and adaptability in dynamic IoT environments, therefore supporting a more resilient and secure IoT.

3D: Cybernetics and Data Science

12:40 ***Comparative Evaluation of Graph Neural Network Algorithms for Music Recommendation Systems***

Farhan Rangkuti and Fitriyani Fitriyani (Telkom University, Indonesia)

The recommendation system is an important aspect of music streaming services. Various studies indicate that an effective recommendation system can enhance user satisfaction, raise revenue, and attract more users. Current music recommendation systems rely heavily on traditional collaborative filtering techniques, focusing only on the user interaction and items, resulting in less relevant recommendations. In addition, the Graph Neural Network (GNN) method can capture deeper relationships between users and items by considering the graph structure involving internode connections in greater detail. This recommendation system uses GNN-generated node embeddings to calculate node similarity through dot product. Recommendations are then given based on the highest dot product value, which indicates the highest similarity among every node in the graph. This research aims to evaluate how GNNs are employed in a music recommendation system with an emphasis on improving recommendation relevancy. This research utilized two GNN architectures, GraphSAGE

and GCN. The performances were evaluated using multiple metrics, including Area Under the Curve (AUC), precision, recall, F1-score, and training time. This research used three experiments with various parameters to evaluate the performance of both models. The results show that the GraphSAGE model performed better, with an AUC of 0.91, a precision of 0.89, and an F1-score of 0.79. In contrast, GCN outperformed GraphSAGE in recall with a score of 0.82 and slightly faster training time. These results were consistent across all three experiments.

12:55 ***Sentiment Analysis of Political Discourse on Platform X using Graph Neural Network (GNN)***

Bhagas Ade Pramono and Fitriyani Fitriyani (Telkom University, Indonesia)

Social media has become an essential platform for disseminating information in this fast-paced digital era, particularly in political discourse. Sentiment analysis of political discourse is a compelling study area, as it plays a crucial role in influencing policies within a country. Numerous studies have been conducted to examine sentiment across a variety of platforms and different conditions. Graphs machine learning enables the modeling of complex relationships between words and entities, thereby enhancing accuracy in capturing sentiment patterns within text. This research presents a comparison between the Graph Attention Network and the Graph Convolutional Network for sentiment analysis of political discourse on platform X. The results show that GAT performs slightly better across all evaluation criteria, namely, precision, accuracy, recall, and F1-Score, achieving an accuracy of 92.41% using 50 epochs. GCN also presents acceptable and consistent results, with an accuracy of 91.85%, which is comparable to that achieved when using GAT. However, GAT requires a longer training time due to the complexity of computing attention between two nodes. This makes GCN particularly suitable for tasks where faster training speed is prioritized overachieving maximum performance. Applying GNN facilitates sentiment analysis not only from individual texts but also through graph structures that capture communication and influence patterns among users, thereby offering deeper and more accurate insights. This represents one of the significant achievements in uncovering underlying sentiments and gaining a deeper understanding of public perception.

13:10 ***Sentiment Analysis of Raya Digital Bank Application Reviews using the TF-IDF Method and Support Vector Machine***

Hanif Azil Siroot, Mahendra Dwifebri Purbolaksono and Utami Kusuma Dewi (Telkom University, Indonesia)

This research examines sentiment analysis on user reviews of the Raya Digital Bank application, employing term frequency-inverse document frequency (TF-IDF) and support vector machine (SVM) techniques. As digital banking continues to rise in Indonesia, understanding customer feedback is critical for enhancing the user experience. The dataset, comprising user reviews scraped from the Google Play Store, underwent preprocessing steps, including cleansing, case folding, stopword removal, stemming, and tokenization. The TF-IDF method was applied to quantify word importance, converting text data into feature vectors, which were then classified using SVM. Four experimental scenarios were tested to optimize the model's performance: varying data splits (50:50 and 80:20), evaluating the impact of stemming, comparing Unigram and Bigram configurations, and testing

different SVM kernels (linear, polynomial, RBF, and sigmoid). Results indicate that the best accuracy was achieved using a linear SVM kernel with an 80:20 data split, Unigram configuration, and without stemming, yielding a precision of 86.31%, recall of 85.37%, and F1-score of 85.67%. These findings indicate that combining Unigram-based TF-IDF and a linear SVM model effectively classifies sentiment in application reviews. The study recommends further tuning kernel parameters and testing trigrams to improve accuracy, especially for compound word usage common in app reviews. This approach provides a robust model for analyzing user sentiment, aiding digital banks in refining customer-oriented services.

13:25 ***Performance Analysis of Public Sentiment Towards Electric Vehicles in Indonesia on Social Media X Using Word2Vec and Graph Neural Network***

Alya Selynindya and Fitriyani Fitriyani (Telkom University, Indonesia)

The issue of climate change and air pollution represents a significant global challenge that demands critical attention. In 2017, the transportation sector in Indonesia accounted for approximately 46.58% of total energy consumption and contributed 53% of total exhaust emissions. Despite an 82.8% public interest in Electric Vehicles (EVs), doubts and concerns persist regarding the viability of battery technology, the availability of supporting infrastructure, and the cost of ownership. This study conducted a sentiment analysis of public perceptions of Electric Vehicles. The approaches employed in this study are Word2Vec and Graph Neural Network (GNN). The combination of Word2Vec and GNN was selected due to its advantages in understanding the semantic meaning of text and enhancing accuracy through the utilization of relational information between words. The objective of this sentiment analysis is to gain insights into public perceptions of Electric Vehicles (EVs) in Indonesia. The results of Word2Vec and GNN achieved an F1-score of 78.81% with an embedding size of 100, a window size of 9, and 200 epochs, higher than other comparable methods, including Word2Vec and CNN (70.50%), SVM (69.28%) and Naive Bayes (61.52%). The most effective model could serve as a reference for future studies on public acceptance of EVs.

13:40 ***Customer Sentiment Analysis of Local Skincare Reviews using IndoBERT and Graph Neural Networks***

Dominica Febryanti and Fitriyani Fitriyani (Telkom University, Indonesia)

The local skincare market in Indonesia has experienced significant growth, accompanied by an increasing public interest in domestic products. The X social media platform is the leading platform for consumers to share experiences, opinions, and reviews of local skincare products. Consumer sentiment analysis is essential for understanding consumer preferences and perceptions of local brands, offering valuable insight that helps companies develop more targeted and effective marketing strategies for Indonesian consumers. This study conducts a sentiment analysis of local skincare brands using data from X in the Indonesian language. The IndoBERT model is applied as a feature extraction technique to capture the Indonesian language context more accurately, thus enhancing the sentiment classification process. This study evaluates the performance of Graph Neural Network (GNN) approaches for sentiment classification, focusing on the Graph Convolutional Network (GCN) and the Graph Attention Network (GAT). The experimental results showed that the combination of

IndoBERT and GAT achieved a higher accuracy rate, 81%, compared to the combination of IndoBERT and GCN, which achieved an accuracy of 79%. These findings indicate that GAT is more effective in capturing the sentiment pattern in the Indonesian language data, outperforming the GCN model in sentiment classification within the specific context of local skincare review analysis.

13:55 ***Improving Stunting Detection in Toddlers with Boosted KNN and Boosted Naïve Bayes Techniques***

Gibran Shevaldo and Putu Harry Gunawan (Telkom University, Indonesia)

Stunting is one of the primary health concerns for children in Indonesia. Preventing stunting in toddlers is essential to mitigate long-term effects on both their health and society as a whole. Preventing stunting involves monitoring the growth of toddlers. Therefore, a predictive system for identifying stunting in toddlers is crucial. Machine learning offers many methods that can be used to build a system to predict stunting conditions in toddlers. This research analyzes some potentially suitable machine learning models for predicting stunting classes using Ensemble Learning, which are Boosted K-Nearest Neighbor (BK) and Boosted Naïve Bayes (BN). The boosting is done by assigning an initial weight to each sample and increasing each failed classified sample's weight. This approach enhances the learning done by the machine learning model by focusing on learning more about the failed classified samples. The dataset has an imbalance issue in this research, with the data categorized as short and very short at less than 2% of the total dataset. Therefore, oversampling of the dataset is done by generating a random dataset based on the distribution of the imbalanced dataset. After that, the normal category dataset is reduced to ensure the data is evenly distributed. The result of elaborating on this oversampling has been unsatisfactory, as the data distribution remains imbalanced despite efforts to stabilize the quantity between classes. Therefore, additional boosting is necessary to ensure proper classification. After the data is balanced by oversampling and boosting, the F-1 score macro average reached 97.44% for the BK method and 57.91% for the BN method. Additionally, the accuracy achieved was 98.62% for BK and 80.62% for BN. These results indicate that the BK method outperforms the BN method, despite the BN method achieving better outcomes than the other previous research.

3E: Cybernetics and Information Management in Business

12:40 ***Analyzing and Forecasting of Real-Time Marketing Campaign Performance and ROI in the U.S. Market***

Anupom Debnath and Md Zikar Hossan (Graduate Teaching Assistant, USA); Sadia Sharmin (International American University, USA); Md Saddam Hosain, Fatema Tuz Johora and Mohammad Hossain (Graduate Teaching Assistant, USA)

This study examines how ARIMA and Random Forest models can forecast Return on Investment (ROI) for realtime marketing (RTM) campaigns in the U.S. market. As RTM grows in importance, marketers require reliable methods to predict campaign outcomes and make informed budget decisions. Time-series models like ARIMA, configured to capture trends and seasonality, have demonstrated strong accuracy in this area, with low error rates (MAE: 0.053, MSE: 0.004, MAPE: 1.08%), which makes it

well-suited for stable, trend-driven data. ARIMA's performance indicates its strength in accurately forecasting ROI for RTM campaigns, allowing marketers to optimize timing and allocate resources for a more significant impact. While Random Forest is typically effective with complex, non-linear data, it struggled with the timedependent nature of RTM data, showing a notably higher MAPE of 37.31%. This discrepancy underscores Random Forest's limitations in predicting ROI for time-series data in RTM contexts. By combining ARIMA's strength in capturing linear trends with Random Forest's flexibility in handling complex patterns, marketers could achieve enhanced forecasting accuracy. Future research should emphasize creating hybrid models that address data inconsistencies and adapt to rapid RTM changes. These models can enhance budget allocation precision and enable more effective, data-driven strategies for impactful, real-time marketing campaign management.

12:55 ***Using Data-Driven Marketing to Improve Customer Retention for U.S. Businesses***

Syeda Kamari Noor and Md Ahsan Ullah Imran (Graduate Teaching Assistant, USA); Mustakim Bin Aziz (Westcliff University, USA & Graduate Teaching Assistant, USA); Barna Biswas and Sanchita Saha (Graduate Teaching Assistant, USA); Rakibul Hasan (Westcliff University, USA & Freedom IT, USA)

This study investigates how data-driven marketing might help businesses in the United States retain more customers. Through the utilization of predictive models, we aimed to discover successful solutions. An Ordinal Neural Network (ONN) and an ensemble in which Random Forest (RF) and LightGBM were combined were the two primary models that we evaluated and contrasted. A score of 0.9063 on the Cohen's Kappa test indicated that the ONN was superior to the ensemble model in terms of its alignment with actual consumer behavior. This contrasts with the score of 0.5780 that the ensemble model received. Even though the ensemble model had a Mean Absolute Error (MAE) of 0.3236, which was slightly lower than the ONN's value of 0.3258, the ONN's higher Kappa score demonstrated that it was superior in terms of capturing the ranking connections seen in the data. In addition, our findings brought to light a few problems, such as protecting the confidentiality of data and comprehending the intricacies of model predictions, which can make implementing these methods difficult. This study suggests using data-driven personalization to retain customers and target high-risk consumers. We recommend adding real-time data and scaling models to handle larger datasets to improve projections. US firms must pay special attention to these facts to maximize marketing efforts and build consumer loyalty.

13:10 ***Data Analytics for Improving Employee Retention in the U.S. Technology Sector***

Mohammad Hossain, Mia Md Tofayel Gonee Manik and Anamika Tiwari (Graduate Teaching Assistant, USA); Jannatul Ferdousmou (International American University, Indonesia); Nur Vanu and Anupom Debnath (Graduate Teaching Assistant, USA)

Employee retention is growing important in the U.S. technology industry, where continuous turnover disturbs output, innovation, and team chemistry. This work uses Stack Overflow Developer Survey data to investigate and project staff retention trends using a hybrid machine learning approach combining Principal Component Analysis (PCA) with XGBoost. We lower the dimensionality of retentionrelated data using PCA, separating essential elements such as compensation, work-life balance, career growth,

and remote work flexibility, which tremendously influence employees' choices to stay with their companies. Using these enhanced components, XGBoost predicts retention risk with higher interpretability and accuracy. Based on this, our proposed model exhibits a balanced capacity to identify retained and atrisk personnel by obtaining good performance metrics with a 90% accuracy rate, 0.91 precision, and 0.98 recall. These outcomes surpass baseline models, including Random Forest (RF) and Support Vector Classifier (SVC), proving our PCAXGBoost method's effectiveness in prediction accuracy. The results reveal how decisions concerning remote work, chances for professional growth, and competitive compensation scales affect retention. This paper provides HR teams in IT companies with a helpful tool for data-driven retention strategies through a scalable and interpretable framework, boosting long-term workforce stability and tackling important retention issues in the always-changing tech environment.

13:25 ***A Predictive Analysis of Tourism Recovery Using Digital Marketing Metrics***

Md Ahsan Ullah Imran, Raiyan Raiyan, Md Samiun, Sweety Rani Dhar and Syeda Kamari Noor (Graduate Teaching Assistant, USA); Hasan M Sozib (Ahsanullah University of Science and Technology, Bangladesh)

This study examines how digital marketing metrics can help predict tourism recovery, especially after COVID-19. By analyzing data from various marketing channels, such as click-through rates (CTR), conversion rates (CVR), and Google's Search Volume Index (SVI), we aimed to uncover patterns in consumer behavior that signal recovery trends. Using advanced machine learning models, like the Voting and Stacking Classifiers, we found that the Voting Classifier achieved impressive results, with an accuracy of 93.4% and a weighted F1-score of 0.94. These metrics help tourism providers understand customer interest and engagement, allowing them to tailor marketing efforts to boost conversions. The findings underscore the importance of metrics like Click-Through Rate (CTR) and Search Volume Index (SVI), which are closely linked to consumer intent and provide timely insights for tourism stakeholders. We recommend that tourism organizations adopt a multi-channel marketing strategy, integrating various platforms to reach broader audiences effectively. Additionally, regularly updating predictive models can help organizations adapt to evolving market conditions and shifts in consumer behavior. Future research could build on these insights by incorporating social and environmental variables, offering a more comprehensive view of tourism recovery. This study provides practical strategies and tools to support a data-driven, resilient, and sustainable recovery for the tourism industry, enhancing its long-term growth and adaptability.

13:40 ***AI-Driven Cyber Threat Detection: Revolutionizing Security Frameworks in Management Information Systems***

Mani Prabha (International American University, USA); Md Azhad Hossain (University of Westcliff, USA); Md Samiun, Mohammad Abu Saleh and Sweety Rani Dhar (Graduate Teaching Assistant, USA); Md Abdullah Al Mahmud (International American University, USA)

Management Information Systems (MIS) in today's sophisticated cyber risk landscape are at risk, exposing the need for sophisticated and adjustable security solutions to meet these threats. The framework proposed in this paper works to increase the accuracy and efficiency of cybercrimes

identified and mitigated through an AI-enhanced framework. This study explores and implements dimensionality reduction via Principal Component Analysis (PCA) for high dimensional data handling and Local Interpretable Model-agnostic Explanations (LIME) to increase model explainability using the CICIDS 2017 dataset. This approach enables cybersecurity professionals to understand the prediction because there is transparency, and it can trust the automated threat detection. Multiple machine learning models are evaluated, including XGBoost, Random Forest, Support Vector Machines (SVM), and K Nearest Neighbors (KNN). XGBoost achieved a near-perfect accuracy of 99.99% on these, and so might be able to classify these as they do cyber threats accurately. This proposed framework combines PCA and LIME in a new configuration specifically suited for real-time MIS applications: this makes it possible to achieve both high accuracy and interpretability in the face of various attack types using the CICIDS 2017 dataset. Considering interpretability, this analysis emphasizes cybersecurity in which transparent decision-making models allow professionals to understand, validate, and respond convincingly to detected anomalies. Combining robust interpretability tools with more advanced AI techniques can yield strengthened cybersecurity resilience in MIS and should be part of a client's toolbox. This framework integrates these methodologies to rapidly and accurately detect and manage real-time threats with explainability, thus improving MIS defenses against more sophisticated cyberattacks. This work provides the basis for future research, including model efficiency optimization and exploring other explainable AI techniques for broader cybersecurity applications.

13:55 ***Evaluation of User Experience (UX) of PT. Bio Farma's SMDV Application Using the User Experience Questionnaire Method***

Andi Brilianti, Meilina Eka Ayunningtyas, Rafiq Alfansa and Cornelius M Sarungu (Bina Nusantara University, Indonesia)

The distribution system is integral to pharmaceutical supply chain management, particularly for vaccine delivery. PT Bio Farma, Indonesia's leading vaccine producer, developed the Vaccine Distribution Management System (SMDV) to enhance the efficiency and safety of vaccine distribution across diverse regions. SMDV integrates real-time tracking, IoT-based monitoring for storage conditions, delivery schedules, and detailed reporting, addressing critical logistical needs. However, user evaluations indicate several interface challenges, including a non-intuitive layout, information overload, and misaligned visual elements, which have led to increased administrative task times and reduced workflow efficiency. This research assesses SMDV's usability through the User Experience Questionnaire (UEQ) across six dimensions: Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty. Findings highlight neutral perceptions in key areas such as Attractiveness (-0.112) and Dependability (-0.295), indicating room for improvement, while positive scores in Efficiency (1.268) and Stimulation (1.114) underline its strengths in usability and engagement. The study further employs cooperative evaluation techniques to ensure comprehensive user insight. Benchmarking these results against similar systems reveals essential areas for SMDV's UI and UX enhancement, aiming to improve staff productivity and streamline vaccine distribution tasks. This research offers actionable insights for redesigning SMDV, reinforcing PT Bio Farma's mission to support efficient, large-scale vaccine distribution and strengthen public health efforts across Indonesia.

Tuesday, December 17 13:15 - 14:15

8C: Cybernetics and Information Management in Business

13:15 ***The Impact of User-Generated Content and Digitization in Green Marketing towards Green Consumer Behaviour to Use E-commerce***

Angelia Hartanto Teng (Bina Nusantara University & Information Systems Management Department, Indonesia); Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia)

This research was conducted in Indonesia during a sampling period from February to October 2024. This study successfully collected data from 444 participants, predominantly situated in Jakarta. This research utilizes purposive sampling. It classifies individuals based on gender, occupation, monthly income, educational background, age, and housing location. This study assesses societal awareness of climate change and the propensity to adopt behavioural intentions for utilizing E-commerce to support green consumption. Adopting green products has been essential in mitigating the growing global climate change issue. The results of this research can significantly assist businesses, professionals, and scholars dedicated to employing sustainable practices to combat climate change. In contemporary society, individuals predominantly rely on social media. Consequently, it can function as a conduit for enhancing knowledge of environmental concerns. Prior studies demonstrate that Generation Z generally allocates an average of 6 to 7 hours daily to interact with various social media sites, such as YouTube, Twitter, Instagram, TikTok, Snapchat, and Facebook. Individuals today depend on digital channels as their principal source of information. Moreover, the utilization of user-generated content on digital platforms can affect and encourage users to participate in specific behaviours or make targeted acquisitions. This research aims to illustrate the significant impact of usergenerated content in enhancing environmental awareness, acknowledging its intrinsic potential. Consequently, it is essential to promote society's shift towards sustainable products.

13:30 ***AI Chatbot Implementation on Government Websites: A Framework for Development, User Engagement, and Security for DHS Website***

Balaji Shesharao Ingole (IEEE Senior, USA); Vishnu Ramineni (Albertsons Companies, USA); Vivekananda Jayaram (Florida International University, USA); Gokul Pandy (IEEE Senior Member, USA); Manjunatha Sughaturu Krishnappa (Oracle, USA); Vidyasagar Parlapalli (KLA Corporation, USA); Seeram Mullankandy (Elumina Health & IEEE, Boston University, USA); Amey Ram Banarse (YugabyteDB, USA)

As digital transformation reshapes public services, the integration of AI-driven chatbots on government websites has emerged as a promising solution to streamline user support and enhance accessibility. This paper presents a comprehensive framework for implementing an AI chatbot on the Department of Health service (DHS) website, targeting the efficient resolution of diverse user needs while addressing the unique security challenges inherent in government digital infrastructure. The proposed framework covers critical aspects of chatbot development, including the configuration of natural language processing (NLP) models, user intent mapping, and data protection strategies tailored to sensitive government information. Additionally, it explores strategies to ensure user

engagement and accessibility, considering the diverse demographics of DHS website visitors. This paper examines potential security risks, such as data breaches and unauthorized access and mentions best practices to deal with these issues. The framework offers a pathway to balance the dual objectives of responsive service and robust cybersecurity, ultimately advancing the role of AI in enhancing the accessibility and security of government services. The deployment of AI chatbots in public service contexts requires meticulous planning to align with legal and regulatory standards, particularly in managing sensitive health data. This study emphasizes the importance of ongoing monitoring and adaptive learning mechanisms to keep the chatbot updated with evolving public policies and user needs.

13:45 ***TAM Expansion: Analysis on Factors Influencing Mobile Learning Adoption by Students***

Febry Ayu Dyah Ganevi and Rio Guntur Utomo (Telkom University, Indonesia)

The number of students in Indonesia using mobile learning (m-learning) for remote studies has increased significantly in the wake of the global pandemic caused by the SARS-CoV-2 virus. However, m-learning remains a topic of debate due to concerns about security, privacy, and perceived risks. This study examines the factors that influence the adoption of mobile learning (m-learning) using an extended Technology Acceptance Model (TAM) that incorporates trust-related factors, such as risk, privacy, and security. Furthermore, the study assesses the quality of service, system, and content provided by m-learning platforms to ascertain their impact on user adoption. Structural equation modeling (SEM) was employed to test the model, with the objective of analyzing the impact of each factor on university students' intentions to adopt m-learning in Indonesia. The findings indicate that students are more likely to utilize m-learning when it is user-friendly, offers evident advantages, and is perceived as secure. It is noteworthy that privacy does not exert a significant influence on trust, indicating that students tend to prioritize security and ease of use over privacy concerns. These findings highlight the practical implications for developers and educational institutions to prioritize security, usability, and content quality. By incorporating these elements in m-learning design, developers can foster greater acceptance and encourage sustainable engagement, ultimately contributing to an effective and accessible educational experience for Indonesian students.

14:00 ***Evaluation of a Long-Method Refactoring Technic Using Reusability Assessment Metrics Based On ISO/IEC 25023 in Php Program Code***

Tiara Rahmania Hadiningrum and Siti Rochimah (Institut Teknologi Sepuluh Nopember, Indonesia)

This study explores the application of various refactoring techniques in PHP programs to improve code reuse, guided by the ISO/IEC 25023 standard for software quality. The main focus is on refactoring long methods, which are often plagued by complex logic and multiple responsibilities. This study uses several techniques such as Extract Method, Move Method, Replace Temp with Query, Introduce Parameter Object, and Replace Method with Method Object to improve the internal structure of the code. The results show a marked improvement in code modularity and separation of concerns. In particular, the MRE-1G metric, which measures reuse, showed a 3.6% improvement (from 0.877 to 0.894), while the MRE-2S metric saw a 14.6% improvement (from 0.123 to 0.141). Moreover,

the creation of new classes during the refactoring process was crucial in achieving these higher reuse rates, which emphasizes the importance of modular design in software development. The findings show that refactoring, particularly through the introduction of new classes, leads to better code reuse and highlights the importance of maintaining well-structured code in software development practices. This study provides valuable insights into how refactoring can improve software quality and reuse, as well as offering practical guidance for developers looking to improve the maintainability of their PHP codebase.

Tuesday, December 17 14:15 - 15:15

4A: Cybernetics and Information Management in Business

14:15 ***Implementation of Scrum Method on Mobile-Based Billing Information System Design (Case Study: ABC Company)***

Dhiwani Maharani Aulia Nur Esa, Salsabila Amara Putri and Imanuel Revelino Murmanto (Bina Nusantara University, Indonesia)

ABC Company, a prominent leather shoe manufacturer, has been facing a series of internal problems that have significantly impact its overall business performance. These issues are diverse, including an ineffective billing system that lacks automation and accuracy, customers displaying passive behavior when it comes to timely payments, and collectors failing to carry proper billing cards during transactions. Moreover, there is an evident lack of integrated records or reports regarding billing and payment statuses, which leads to confusion and delays in processing. To address these pressing concerns, the author has meticulously designed a mobile-based billing information system using the Scrum approach, which was selected for its inherent flexibility and emphasis on iterative development. Scrum allows for constant feedback and adjustments, ensuring that the system evolves to meet the company's needs as the project progresses. The result is an innovative, mobile-based billing system that has been thoroughly evaluated for its potential to enhance operational efficiency and improve the quality of service offered to both customers and internal staff. This evaluation demonstrated marked improvements, including timely customer payments, streamlined billing processes, and significantly better tracking and reporting of all billing activities. The successful implementation of this system is projected to have broader impacts beyond the company itself, contributing to local economic development by enhancing productivity, increasing operational efficiency, creating new job opportunities, and fostering avenues for further business development. As ABC Company strengthens its financial management systems, the potential for scaling and contributing to a more vibrant local economy becomes increasingly feasible.

14:30 ***Approval System Development in Information System for Project Management in a Retail Company***

Akbar Ardhean Santoso, Moh Yusuf Surya Adi Winata, Muhammad Luthfi Abid Cahyadi and Imanuel Revelino Murmanto (Bina Nusantara University, Indonesia)

Information Technology plays a crucial role in business processes in the era of digitalization. A key

issue in the business process of submitting or modifying an information system is that the users are required to manually seek approval from each responsible individual person in a hierarchical manner using to sign in physical paper. This makes the process inefficient, ineffective, and time-consuming. Additionally, since the submission relies on a sheet of paper, managing system documentation becomes challenging, requires physical storage space, and takes a long time to retrieve. The aim of this research is to develop a project management information system that supports hierarchical approval processes, where progress can be directly monitored by the user who submitted the request. Existing project management applications have not yet been able to accommodate this feature. In developing this project management information system, the author uses the Waterfall development methodology, conducting an analysis through interviews with several users involved in the process of submitting and modifying information systems. The result of this implementation is a system that helps users monitor the progress of their submission requests for creating or modifying information systems. Additionally, this project management information system assists users in organizing project documentation more effectively, making it easier to retrieve.

14:45 ***Learning Analytics in Higher Education: A Bibliometric Analysis***

Yulia Magdalena (Universitas Bina Nusantara, Indonesia); Harco Leslie Hendric Spits Warnars (Bina Nusantara, Indonesia); Harjanto Prabowo (Binus University, Indonesia); Sfenrianto Sfenrianto (Bina Nusantara University, Indonesia)

The rapid advancement of technology has significantly transformed higher education, leading to an increased focus on learning analytics (LA) emerged as a vital strategy to enhance student outcomes, engagement, and retention rates, amongst many others. This study conducts a bibliometric analysis to investigate publication trends related to the implementation of learning analytics in higher education, examining a total of 235 publications from 1993 to 2024. Utilizing a structured approach, data was collected from the SCOPUS database, followed by statistical analysis and visualization using R Bibliometrix Biblioshiny. The analysis indicates a significant surge in interest since 2016, particularly in related areas of learning analytics, such as artificial intelligence, data analytics, predictive analytics, and selfregulated learning. It is also indicated a strong international collaboration, particularly among authors from Australia, the United Kingdom, and Germany, showing global interest on the topic. The findings reveal key insights into significant publication sources, authorship diversity, co-authorship patterns, indicating a growing trend and importance of international collaboration. Future research is encouraged to explore how AI, emerging technologies, and methodologies impact learning analytics implementation in higher education. This study provides valuable insight into the current state of learning analytics in higher education, highlighting its implication for future research endeavors.

15:00 ***Techno-Economic and Regulation Analysis Related to Health Tech In Indonesia***

M Fajar Zulvan Nugraha (University of Telkom, Indonesia & Telkom University, Indonesia); Miftadi Sudjai and Sofia Hertiana (Telkom University, Indonesia)

Health is a fundamental aspect of human life, and technological advancements have revolutionized the healthcare sector. In Indonesia, the Health Technology (Health Tech) sector has shown rapid growth, offering opportunities to improve healthcare accessibility and efficiency. This study analyzes

the techno-economic and regulatory aspects of Health Tech in Indonesia, addressing the challenges of balancing innovation with patient data protection and rights. However, the development of Health Tech also requires significant investment in infrastructure and workforce training. The technological analysis demonstrates robust network performance with Quality of Service (QoS) metrics showing a delay of 2.4415 seconds (categorized as "very good"), jitter of 2.4808 seconds ("good"), and throughput of 2.580 Mbps ("good"). Economically, the business is viable with an NPV of Rp 2,798,289,898.85, an IRR of 24%, a Payback Period of 7 years, and a PI of 1.63. However, regulatory challenges remain critical, with a lack of comprehensive frameworks governing data security and application interoperability. This study recommends stricter regulations to ensure patient data protection and calls for collaborative efforts between the government, private sector, and civil society. Future research should focus on addressing scalability and public awareness to maximize Health Tech's impact, especially in underserved regions.

4B: Cybernetics and Information Management in Business

14:15 ***Brand Health Analysis of Local Beauty Products E-Commerce in Indonesia***

Viany Utami Tjhin and Andi William (Bina Nusantara University, Indonesia); Patricia Angelica Heliawanto (BINUS Business School Program, Indonesia)

This research paper investigates the brand health of local beauty products in Indonesia's e-commerce sector by analyzing consumer perception and market dynamics. Local brands have gained significant traction as the beauty industry flourishes in Indonesia, presenting a formidable challenge to international competitors. The rise of e-commerce has transformed how consumers engage with beauty products, making it essential to understand the factors influencing brand health in this digital landscape. Utilizing a mixed-method approach that combines quantitative surveys and qualitative interviews, this study explores critical aspects of brand health, including brand awareness, loyalty, perceived quality, and brand associations. Additionally, it examines the impact of socio-cultural factors, marketing strategies, and product innovation on brand performance, highlighting how these elements contribute to consumer decision-making in an online shopping environment. This research provides valuable insights for local beauty brands seeking to enhance their competitiveness and strengthen their market position in Indonesia's rapidly evolving e-commerce landscape. While the study offers significant implications for strategic brand management, market positioning, product development, brand communication, and consumer education, it also acknowledges limitations such as sample size constraints and challenges in generalizing findings beyond the studied context. Ultimately, this research underscores the critical role of brand health in helping local beauty brands adapt to consumer demands and leverage e-commerce opportunities for sustainable growth in Indonesia's vibrant beauty market.

14:30 ***Performance Variations in Digital Talent: Gender-Based Insights from STEM and AI Education Backgrounds***

Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia); Azani Cempaka Sari, Irma Kartika Wairooy, Muhamad Keenan Ario, Said Achmad and Devi Fitrianah (Bina Nusantara University, Indonesia)

In the digital era, digital talent development has become increasingly vital for organizations and economies to thrive. While much focus has been placed on technical skills, this report emphasizes the often-overlooked role of soft skills in developing digital talent. Through an extensive literature review and data analysis, the study identifies that soft skills are crucial in enhancing digital talent performance. This research explores the factors that influence Digital Talent Performance in Indonesia, specifically comparing the performance levels of male and female digital talents. Data were collected from college students in the Jabodetabek area (cities surrounding Jakarta, Indonesia) using a purposive sampling method, with an online questionnaire distributed to 378 respondents. The study utilized Structural Equation Modeling (SEM) to analyze the collected data using SmartPLS 4.1. software. Key variables examined include Communication Skills, Teamwork, Emotional Intelligence, Academic Achievement, Problem-Solving, Digital Readiness, Digital Skills, Digital Technology, and Digital Talent Performance. Out of the nine hypotheses tested, one was not statistically significant. The results suggest that a combination of both technical and soft skills significantly affects digital talent performance, with important gender-based differences in performance levels emerging from the analysis. This research contributes to understanding Indonesia's complex dynamics of digital talent development.

14:45 ***Evaluating The Effectiveness Of Voucher Utilization In Influencing Decisions To Use Digital Payment In E-Commerce***

Nicholas Lie Hermawan, Dyotiskhanti Kusuma, Nathanael Manurung and Suryanto (Bina Nusantara University, Indonesia)

Recent advancements in information technology have markedly reshaped the business landscape, especially through the proliferation of e-commerce platforms and the widespread adoption of digital payment systems, this is especially apparent with the rise of e-commerce and the widespread use of digital payment methods. This study examines the role of voucher utilization in shaping consumer decisions to use digital payment methods in e-commerce transactions. Through a quantitative approach, 413 respondents from Jakarta and Tangerang were surveyed, focusing on the impact of discount vouchers, cashback offers, and free shipping incentives. The research is grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT) framework, analyzing key factors such as facilitating conditions, performance expectancy, and perceived usefulness. The results from Partial Least Squares Structural Equation Modeling (PLS-SEM) reveal that these factors positively influence behavioral intention, with vouchers acting as a significant motivator for adopting digital payments. The study highlights how strategic incentives not only enhance the convenience and attractiveness of digital transactions but also contribute to customer loyalty and satisfaction. The findings emphasize the importance of integrating promotional vouchers into digital payment platforms to drive consumer engagement and foster growth in e-commerce. Future study may investigate larger samples and incorporate additional variables to further enhance the understanding of consumer behavior in the digital economy.

15:00 ***iTaskDev: A Software as a Service with Adaptive Algorithm for Optimized Software Development Planning Across Methodologies***

Aldren John M Mendoza, Norman Alexiz D. Nacilla, Charles Sherwin B. San Gabriel, Mark

Anthony S. Mercado, Vivien A. Agustin, Erwin D. Marcelo and Criselle J Centeno (University of the City of Manila, Philippines)

In software development, selecting the appropriate Software Development Life Cycle (SDLC) can be challenging due to the wide variety of available models, each suited to different project needs. Existing software tools often fail to capitalize on SDLC frameworks and lack automation capabilities. This study proposes a web-based workspace system designed to streamline software engineering projects. The system leverages a Natural Language Processing (NLP) model to recommend suitable SDLCs, optimizing the development process through a dynamic programming algorithm that automates task allocation, adapting to the recommended SDLC approach. The NLP model was developed using Azure ML with the OpenAI API to ensure the accuracy of SDLC suggestions. Automated task allocation and real-time notification were tested across various project scenarios. GitHub API services were implemented to provide project analytics through repository commits and issue tracking. After the system's development, the study evaluated user perceptions and satisfaction regarding iTaskDev's main objectives through Likert scale method. The NLP-based methodology suggested, and workspace system achieved a mean score of 3.75, whereas task automation along with project analytics through dynamic programming algorithms and API integration attained mean scores of 3.63 and 3.68, respectively. The system was further evaluated using ISO/IEC 25010 standards, demonstrating strong performance in functional suitability, performance efficiency, usability, and reliability, with an overall mean score of 3.67 out of 4.

4C: Cybernetics and Data Science

14:15 ***Classification of Mango Plant Leaf Diseases Using Optimized ConvNeXt***

Ahmad Taufiq Nur Rohman and Febryanti Sthevanie (Telkom University, Indonesia); Kurniawan Nur Ramadhani (Universitas Telkom, Indonesia)

Mango plants hold significant economic potential, particularly in tropical and subtropical countries. In Indonesia, mangoes are a high-value export commodity, requiring an effective monitoring and early disease detection to maintain their quality and market value. This study focuses on developing a modified ConvNeXt model for classifying mango leaf diseases. While ConvNeXt is known for its performance in image classification, we introduced specific modifications to enhance its suitability for this task. The model was optimized by reducing the number of blocks in each stage to improve computational efficiency and by incorporating residual connections across stages. These architectural changes successfully facilitate better gradient flow and stabilize training, achieving a balance between high accuracy and computational feasibility. The model was trained on a comprehensive dataset combining images from four sources, covering eight distinct classes: Anthracnose, Bacterial Canker, Cutting Weevil, Die Back, Gall Midge, Powdery Mildew, Sooty Mould, and a category for healthy leaves. Results demonstrated that our modified ConvNeXt achieved an impressive 97.52% accuracy, significantly outperforming the baseline ConvNeXtTiny model, which reached only 95.21%. This research provides a practical and efficient approach for early disease detection, enabling farmers and stakeholders to take timely action, thereby safeguarding crop quality and supporting consistent agricultural productivity.

14:30 ***Evaluation of Modified Inception-v3 Model in Tomato Fruit Ripeness Classification on Image***

Muhammad Faiq Jabbar and Febryanti Sthevanie (Telkom University, Indonesia); Kurniawan Nur Ramadhani (Universitas Telkom, Indonesia)

This study introduces an enhanced deep-learning approach for accurately classifying tomato ripeness levels using a modified Inception-v3 model with applications in large-scale agricultural environments. Leveraging a dataset of 7,224 RGB images of tomatoes in varying ripeness stages, the modified model achieved a validation accuracy of 98.42%, with precision, recall, and F1-score values exceeding 98%. These results outperform the base Inception-v3 model and other commonly used architectures, such as ResNet and VGG, showcasing the model's superior classification accuracy and computational efficiency. Key modifications include adjustments to filter sizes and the configuration of inception blocks, which significantly reduce the parameter count, thereby optimizing computational resources and enhancing feature extraction for multi-scale image analysis. The model was tested under three lighting conditions, achieving over 97% accuracy across all categories. Confusion matrices validate its effectiveness, highlighting adaptability to real-world agricultural environments and suitability for IoT-based systems offering real-time automated ripeness assessments. This optimized model is well-suited for implementation in IoT-based systems, offering real-time, automated ripeness assessments via mobile or web applications. By automating ripeness classification, this model supports improved harvest quality, reduces manual labor, and potentially increases profitability by ensuring timely crop collection. Experimental evaluations demonstrated that the modified model achieved faster convergence and lower training loss compared to its counterparts, underscoring its robustness and adaptability for various agricultural applications.

14:45 ***Model Predicting Airline Passengers Purchasing Seat Upgrade Ancillaries Products on Indonesian Domestic Routes with Random Forest Machine Learning***

Anggara Mahardika (Binus University, Indonesia); Ahmad Nurul Fajar (Bina Nusantara University, Indonesia)

To increase profitability, airlines are starting to focus on generating revenue not only from ticket sales, but also from the sale of ancillary products. The research focuses only on ancillary seat upgrade products and aims to create a Machine Learning (ML) model to predict economy class passengers who are likely to accept a seat upgrade offer to business class based on historical data on seat upgrade offers received by airline passengers in the 2023 period. The challenge faced in developing a Machine Learning Prediction model is that the number of passengers who take the upgrade offer and those who do not take it is very unbalanced. In previous literature, most investigations covered European, United Kingdom, China routes, most of which use hub and spoke route networks, while in this research try to fill this gap, especially for airlines operating in Indonesia that have domestic routes and use a point to point route network model. The background of domestic routes is the object of research because 80% of the routes flown are domestic routes between cities in Indonesia, and the top 10 routes that contribute the most to ancillary seat upgrade sales are also domestic routes. To build the model, the author uses machine learning for classification, which is combined with Feature Engineering, Data Balancing and Data Dimension Reduction Techniques. Based on an empirical analysis of a historical dataset of passengers who upgraded their seats, it was found that the

best combination was provided by Random Forest, PCA, and Stratified Sampling to predict Indonesian passengers who would receive a seat upgrade with 95.6% accuracy.

15:00 ***Sentiment Analysis and Topic Modeling For Duolingo Application on Google Play Store***

Rizaldi Farhan Firdaus, Oktariani Nurul Pratiwi and Iqbal Yulizar Mukti (Telkom University, Indonesia)

Knowing user satisfaction is an important thing for Duolingo to do. There are many ways that Duolingo can get feedback from users. One of them is by exploring user opinions through user reviews on Google Play. By performing sentiment analysis and topic modeling, Duolingo can find out how users view the application without having to read all the reviews that can reach hundreds of thousands. The Naive-Bayes Classifier (NBC) algorithm can be used to perform sentiment analysis. From this research, the model with a data sharing ratio of 80:20 produces excellent performance, with an accuracy of 90.51%. On the other hand, Latent Dirichlet Allocation (LDA) was used to perform topic modeling. The results of this study found that the optimum number of topics widely discussed in Duolingo user reviews is 5 topics, each with positive and negative sentiments. Based on this study, most Duolingo users leave reviews with positive sentiments. Most users felt that Duolingo is a good app and extremely helpful in learning foreign languages. However, a few users also expressed their complaints about the Duolingo application in terms of features, application performance, and content. This research shows that Naive-Bayes Classifier (NBC) and Latent Dirichlet Allocation (LDA) are very suitable and able to work well in sentiment analysis and topic modeling on user reviews of the Duolingo application.

4D: Cybernetics and Internet-of-Things (IoTs)

14:15 ***Leveraging Artificial Intelligence and Blockchain to Stabilize Rice Price Fluctuations in DKI Jakarta, Indonesia***

Jeremy Raphael (BINUS Business School Program, Indonesia); Andi William (Bina Nusantara University, Indonesia); Elsyira Carissa Praspera and Michael Vincentius (BINUS Business School Program, Indonesia)

Rice price fluctuations have become a persistent issue in Indonesia, impacting the public and food security in DKI Jakarta. This study finds that the rising rice prices are disproportionate to the milled rice output, creating a market imbalance that disadvantages small-scale farmers relative to more giant aggregators in an oligopolistic market structure. This imbalance threatens food security by affecting rice availability. A literature review reveals the potential of Artificial Intelligence (AI) and blockchain technologies to address these challenges, primarily by enhancing transaction security. This research aims to assess the potential application of AI and blockchain in stabilizing rice prices in DKI Jakarta. AI can predict rice prices based on historical pricing, weather, production, and economic data. At the same time, blockchain can track rice movement from farmers to consumers, improving transparency, traceability, and trust among stakeholders. Integrating AI and blockchain can aid the government and other stakeholders in formulating policies and interventions to curb price volatility, enhance market transparency, prevent price manipulation, and foster a fairer rice market for farmers and consumers.

Prior research in precision agriculture further supports this approach, highlighting its role in ensuring crop yield certainty. This study is essential for providing sustainable recommendations on using AI and blockchain to mitigate rice price fluctuations in DKI Jakarta.

14:30 ***Robust Reversible Watermarking using Polar Harmonic Transform on RGB Image***

Syifa Dwi Sulistyowati, Ledya Novamizanti and Gelar Budiman (Telkom University, Indonesia)

As access to digital information continues to expand, the protection of digital content has become increasingly critical. This research addresses the pressing challenges of data security by proposing a novel watermarking scheme based on Polar Harmonic Transform (PHT) specifically designed for RGB images. This approach significantly enhances both imperceptibility and robustness in RGB images. Unlike many existing watermarking techniques that primarily focus on grayscale images, this study uniquely applies the method developed by Tang et al. to RGB images, broadening its applicability. To evaluate the proposed scheme, two experimental approaches are employed: one involves watermark embedding in a single layer of RGB images, while the other entails embedding across all layers. By integrating advanced techniques such as PHT, Direct Current Quantization Index Modulation (DC-QIM), and Phase Encoded Encoding with Hamming Space (PEE-HS), the method demonstrates substantial improvements in imperceptibility and data recovery capabilities. Experimental results indicate that when the watermark is embedded in the green layer of RGB images, a peak signal-to-noise ratio (PSNR) of 44.96 dB is achieved, along with a bit error rate (BER) of 0. Robustness tests conducted against various attacks, including JPEG compression with quality factors greater than or equal to 30, Gaussian filtering with kernel sizes up to 7 × 7, and Speckle noise with variances less than or equal to 0.027, further confirm the effectiveness of the proposed watermarking scheme in resisting different types of attacks.

14:45 ***Implementation of Advanced Encryption Standard (AES) 256 Algorithm on Web Based Application for Protecting Sensitive Data on Mikrotik CCR 1009 VPNIP Device***

Aufa Yuslizar Rajab, Windarto Windarto, Achmad Solichin, Muhammad Syafrullah, Hendri Irawan and Lauw Li Hin (Universitas Budi Luhur, Indonesia)

Despite various security strategies for securing sensitive data, there has not been a significant increase in adding new network services in the past year. Network services data remains insufficiently protected and primarily functions as an archive and report. Therefore, analyzing the data within the company's network services is essential to strengthen its security framework. To ensure data protection against unauthorized access, the company should implement an advanced security system. The Advanced Encryption Standard (AES) is a highly secure, symmetric encryption algorithm that is widely accepted as a robust encryption method. This study focuses on the implementation of AES 256, which utilizes a 256-bit key for encrypting network services data, ensuring sensitive information is safeguarded from unauthorized access. By employing AES 256, every sales transaction undergoes encryption before storage, ensuring that only those with a valid decryption key can access the data. This process plays a crucial role in maintaining data confidentiality and protecting essential operational information. The expected outcome of this study is an enhancement in data security, providing management with improved strategies to protect their network services data. Additionally,

the analysis and implementation of AES 256 encryption are anticipated to contribute to more secure data handling practices and support management in establishing better security measures to mitigate risks associated with unauthorized data access.

15:00 ***Enhancing Multiclass Classification of Child Nutritional Status Using KNN and Random Forest with SMOTE***

Aqeela Fathya Najwa, Indwiarti Indwiarti and Putu Harry Gunawan (Telkom University, Indonesia)

This study investigates the application of SMOTE (Synthetic Minority Over-sampling Technique) to address class imbalance in children's nutritional status datasets, focusing on two indicators: BB/U (Weight-for-Age) and BB/TB (Weight-forHeight). The goal is to enhance the predictive performance of machine learning models, particularly in classifying underrepresented nutritional categories. K-Nearest Neighbors (KNN) and Random Forest were employed to evaluate SMOTE's effectiveness. The results reveal significant improvements in recall for minority classes. For KNN, testing accuracies reached 96.66% for BB/U and 93.58% for BB/TB, with enhanced recall values for minority categories. Random Forest demonstrated superior performance with cross-validation accuracies of 97.59% for BB/U and 94.79% for BB/TB, achieving balanced classification across major and minor classes. The dual use of BB/U and BB/TB as target columns proved crucial for a comprehensive assessment of nutritional status, as each captures different dimensions of child growth. Additionally, key features such as gender and prior weight status were found to significantly influence model predictions. By improving the ability to detect at-risk groups, this study offers actionable insights to support more precise and data-driven nutritional interventions. The findings provide valuable guidance for policymakers and healthcare professionals in Indonesia, contributing to more effective strategies to combat childhood malnutrition and promote equitable health outcomes. These results highlight the potential of machine learning techniques, when combined with SMOTE, to address public health challenges in a robust and scalable manner.

Tuesday, December 17 15:25 - 17:55

5A: Cybernetics and Internet-of-Things (IoTs)

15:25 ***Comparison of Classification Algorithms on Product Boycott Sentiment Analysis in Real Time***

Trisna Ari Roshinta (Universitas Sebelas Maret, Indonesia & Budapest University of Technology and Economics, Hungary); Darmawan Lahru Riatma, Masbahah Masbahah, Yusuf Fadlila Rachman, Nur Azizul Hakimi and Sevyra Nanda Octavianti (Universitas Sebelas Maret, Indonesia)

Real-time monitoring of boycotted products is crucial for safeguarding brand reputation, maintaining customer trust, and enabling data-driven decision-making in today's rapidly changing consumer landscape. As social media platforms, particularly Twitter, become significant venues for public discourse, companies can harness sentiment analysis to capture and understand public opinion. However, sentiment analysis demands robust methods capable of processing large datasets while handling the complexity of long-term dependencies within the text. The effectiveness of real-time

sentiment analysis relies heavily on selecting the most suitable algorithm. This paper aims to compare the performance of two prominent algorithms in text mining, Long Short-Term Memory (LSTM) and Naive Bayes, focusing on real-time sentiment analysis using boycott-related data from Twitter. Both algorithms were tested for their accuracy and efficiency in classifying sentiment data in a real-time setting. The results demonstrate that Naive Bayes consistently outperforms LSTM, achieving a remarkable accuracy rate of 95.23%. This superior performance highlights Naive Bayes as a more reliable and efficient option for real-time sentiment classification, especially in the context of boycotted products. These findings have provided valuable insights for businesses seeking to monitor consumer sentiments and make informed decisions in real-time, emphasizing the importance of algorithm choice in real-time sentiment analysis.

15:40 ***Performance Analysis of Vehicle Counting and Classification using YOLO at a Four-Way Intersection based on Indonesian Road Capacity Manual***

Muhammad Ammar Murtaqib (Bandung Institute of Tech, Indonesia); Figo Agil Alunjati (Institut Teknologi Bandung & Smart City and Community Innovation Center, Indonesia); Ulva Elviani (Bandung Institute of Tech, Indonesia); Fadhil Hidayat (Jalan Ganeca No. 10, Indonesia & Smart City Community and Innovation Center, Indonesia); I Gusti Bagus Baskara Nugraha (Institut Teknologi Bandung, Indonesia); Suhono Harso (Indonesia)

This study introduces a vehicle volume analysis system utilizing video analytics technology to improve traffic counting accuracy at intersections using CRISP-DM methodology. By leveraging the YOLO (You Only Look Once) algorithm, it can detect, classify, and count vehicles using footage from public CCTV cameras based on Indonesian Road Capacity Manual. This research focuses on a four-way intersection in Sedayu, Yogyakarta, Indonesia, and involves preparing a dataset by extracting and labeling video frames. This research train and evaluate several YOLO models- YOLOv5s, YOLOv7, YOLOv8s, and Gelan-c from YOLOv9- to assess their effectiveness in real-world traffic scenarios. The results demonstrate that YOLOv8s delivers superior performance compared to the other versions, achieving a precision of 0.971 and a recall of 0.988 across all vehicle classes. This high accuracy highlights the potential of YOLOv8s for improving traffic volume counting at busy intersections. However, challenges remain, including false positives, double detections, and misclassifications, which tend to occur under certain traffic conditions, such as low visibility or dense vehicle clustering. Despite these issues, YOLOv8s shows promise for enhancing the efficiency and precision of traffic analysis systems. The contribution of this paper is to support the evaluation of intersection performance based on turn movement count in accordance with the Indonesian Road Capacity Manual, where currently the evaluation is still carried out manually. Future research will focus on addressing these challenges by refining the detection process and incorporating additional techniques, such as advanced post-processing methods and model enhancements, to increase robustness in various traffic environments.

15:55 ***Intersection Performance Evaluation based on Indonesian Road Capacity Manual with Video Analytics***

Figo Agil Alunjati (Institut Teknologi Bandung & Smart City and Community Innovation Center, Indonesia); Fadhil Hidayat (Jalan Ganeca No. 10, Indonesia & Smart City Community and Innovation Center, Indonesia); Ayub Seipanya (Bandung Institute of Technology, Indonesia);

Muhammad Ammar Murtaqib (Bandung Institute of Tech, Indonesia)

Intersections play an important role in traffic flow management, and their performance analysis is different from that of roads. Indonesian Road Capacity Manual 1997 or in Indonesia called MKJI provides guidance for evaluating intersection performance by assessing vehicle movement between intersection arms using the Turn Movement Count (TMC). This study investigates the use of video analytics to assess intersection performance using the MKJI 1997 framework. The system is organized into three layers: perception, analytics, and business. In the analytics layer, video analytics is implemented using the YOLOv8s model, which has the greatest Recall and F1-Score of 0.85 and 0.919 when compared to other models. This is combined with the Bytetrack tracker, which outperformed Deepsort in MOTA tests across three scenarios. The video analytics system computes the TMC for each intersection leg, and the Sedayu intersection in Yogyakarta was tested over two days (weekdays and weekends) at three different time intervals. The findings revealed that the intersection has a mediocre Service Level, scored E or F in all time intervals. Several enhancements can be made to increase capacity based on the MKJI 1997 standards, and future research could concentrate on minimizing signal cycle times and developing more efficient vehicle recognition models with real-time, high-FPS capabilities for precise tracking.

16:10 ***A Practical Indoor Positioning System based on Collaborative PDR and Wi-Fi Fingerprinting***

Made Harta Dwijaksara (University of Indonesia, Indonesia & Pusat Ilmu Komputer UI, Indonesia); Raissa Tito Safaraz (Univerity of Indonesia, Indonesia); Muhammad Asyraf and Julius Prayoga Raka Nugroho (University of Indonesia, Indonesia); Siva Priya Thiagarajah (Multimedia University, Malaysia)

An Indoor Positioning System (IPS) is vital in providing location-based service (LBS) indoors. The shortcomings of the Global Positioning System (GPS) indoors have led to the development of many alternative solutions for IPS. Wi-Fi fingerprinting is a promising solution due to its ability to accurately predict indoor locations. Moreover, the widespread deployment of Wi-Fi infrastructures makes the Wi-Fi fingerprinting-based IPS technique readily applicable. However, this technique requires high overhead due to the need to define many reference points (RPs) within the subject area. Multiple Wi-Fi received signal strength (RSS) samples shall be collected from each RP, introducing extensive manual work. This fact makes the Wi-Fi fingerprinting-based IPS is less practical. This issue is addressed by employing pedestrian dead reckoning (PDR) as part of the proposed technique. Realizing a practical IPS based on collaborative use of PDR and Wi-Fi fingerprinting. In the proposed method, most of the time, the location prediction will be based on PDR. When the step count reaches a threshold, a switch from PDR to Wi-Fi fingerprinting is made to decide the user's location. Then, the system resets the step count and uses the PDR again. This approach significantly reduces the total number of RPs needed by the system. The numerical results show that the proposed technique has 99% lower overhead than the conventional Wi-Fi fingerprinting technique and achieves 55.6% better prediction accuracy than the standalone PDR technique. The results justify the benefits of the proposed IPS based on collaborative PDR and Wi-Fi fingerprinting.

16:25 ***Improving Skin Disease Classification with EfficientNetB0: A Deep Learning Approach to***

Overfitting Control

Raihan Atsal Hafizh, Rifki Wijaya, Afrizal Ihyauddin Yafi' and Satria Aji Permana Siwi (Telkom University, Indonesia)

This study presents a deep learning approach for skin disease classification using the EfficientNetB0 architecture, targeting five distinct categories: Normal, Melanoma, Arsenic, Psoriasis, and Eczema. Using the EfficientNetB0 model, The model was trained on a large dataset of 7,356 dermatoscopic images, all meticulously annotated with professional diagnoses. To improve the generalization capabilities of the model, a number of data augmentation techniques were employed. To improve generalization, data augmentation was applied and conducted experiments by training the model over different duration with varying epochs (20, 30, and 50) to identify the most effective training period. The best performance was achieved at 50 epochs, with a training accuracy of 0.9988 and a validation accuracy of 0.8912, demonstrating strong capability in identifying skin diseases. This performance illustrates the robust ability of the model to accurately identify and classify skin conditions. However, some classification errors were observed, particularly between conditions with similar visual characteristics, such as Psoriasis and Eczema. Overfitting was mitigated using data augmentation, L2 regularization, and dropout, though further enhancements such as adaptive learning rates or early stopping could improve performance. This EfficientNetB0-based model shows substantial potential as a supportive tool in dermatological diagnostics, providing a solid foundation for automated skin disease classification with opportunities for future optimization.

16:40 ***Detection of Muscle Synergy by Wrist Electromyogram***

Toma Nakagawa, Shin-ichi Ito, Momoyo Ito and Minoru Fukumi (Tokushima University, Japan)

Humans have a large number of muscles, and independently control each one. It is believed that enormous amount of computation is required to operate muscles. Therefore, it is estimated that complex human muscle movements can be represented by a small number of functional units called muscle synergies. If the existence of muscle synergy can be explained, it can be utilized effectively in various fields such as rehabilitation and robotics. Therefore, in this paper, we try to explain the existence of muscle synergy. What we did in this paper was to measure seven simple movements of bending and extending the thumb, index finger, and the middle, ring and little fingers simultaneously, neutral movements and five complex movements like "rock" and "scissors" in rock-paperscissors that can be made by combining these simple movements, using electromyogram at the wrist. Then, we considered the measured simple movements as muscle synergies and implemented them using a neural network so that complex movements can be explained by combinations of simple movements. The results are based on two axes: the first is recognition of the complex movements and the second is the influence rate of the simple movements on the complex movements by looking at the output layer on the simple movements when the complex movements are recognized. The accuracy of complex movements is 92.0%. We believe that as the second result a large value of simple movements comprising complex movements is observed, which can explain to some extent the presence of muscle synergy.

16:55 ***Smart Monitoring and Watering System for Farm Management Assistance***

Muhammad Dzaki Dwi Putranto (Bandung Institute of Technology, Indonesia); Ahmad Ali Hakam

Dani (Bandung Institute of Technology, Indonesia & Universitas Andi Djemma Palopo, Indonesia); Hastie Audytra (Bandung Institute of Technology, Indonesia); I Gusti Bagus Baskara Nugraha (Institut Teknologi Bandung, Indonesia); Suhono Harso (Indonesia)

Indonesia, an agricultural nation with substantial fertile land resources, possesses an agricultural sector that contributes significantly to the national economy, accounting for 9.22% of the total Gross Domestic Product in 2022, and provides employment for 27.52% of Indonesia's workforce. However, as the sector with the highest water consumption rate globally, agriculture faces significant challenges, such as water scarcity, climate variability, and technological limitations, primarily due to excessive water usage. In certain regions of Indonesia, persistent drought threatens plant development and crop quality due to water scarcity. This study proposes the development of a Smart Monitoring and Watering System employing a system design approach and utilizing Internet of Things technology with support of 4G protocol, implementing variable watering using fuzzy logic methodology to address these challenges. The system enables real-time monitoring of field conditions, including soil moisture, air humidity, and temperature, using a monitoring dashboard. Based on implementation and testing, the system demonstrates the capability to monitor environmental condition factors with data availability approximating 93.73% and maintains an average soil moisture level of 73.67%, thereby optimizing plant irrigation requirements in accordance with the specific needs of the farm-land.

17:10 ***Enhancing Urban Waste Management: An IoT and LoRa-Integrated Smart Bin System for Volume Monitoring and Analysis***

Muhammad Farhan Imanudin and Rezky Kinanda (School of Electrical and Informatics Engineering Bandung Institute of Technology, Indonesia); Noor Falih (Universitas Pembangunan Nasional Veteran Jakarta, Indonesia); Arry Arman (Institut Teknologi Bandung, Indonesia); Emenda Sembiring (School of Electrical and Informatics Engineering Bandung Institute of Technology, Indonesia); Suhono Harso (Indonesia)

Waste management in urban areas has become an increasingly pressing challenge in Indonesia, given the population of 270.20 million people. Rapid urbanization and population growth have led to rising waste generation, creating significant environmental and logistical issues. This study proposes the development of a smart waste bin system utilizing Internet of Things (IoT) and LoRa technology, designed to monitor waste volume in real-time and optimize waste management processes. The system is structured around three main components: Sensor Nodes, a Gateway, and a Data Platform & Analytics. The Sensor Nodes, equipped with ultrasonic level sensors, measure the fill level of waste bins, and identify different types of waste. This data is then transmitted via LoRa technology to the Gateway, which serves as the communication bridge to a centralized platform. The Data Platform & Analytics processes the incoming information, providing valuable insights to optimize waste collection routes and schedules. By implementing an IoT-based approach, waste management authorities can make informed decisions, reduce operational costs, and minimize the carbon footprint associated with waste collection. Additionally, this system addresses waste accumulation issues in major cities and supports long-term sustainability strategies by promoting more efficient resource management. The research also aims to increase public awareness of the importance of responsible waste disposal and to encourage the adoption of a circular economy that transforms waste into valuable resources. Overall, this innovation holds the potential to revolutionize urban waste management and contribute

significantly to Indonesia's environmental and sustainability goals.

17:25 ***Application of Transformer Models for Autonomous Off-Road Vehicle Control: Challenges and Insights***

M A Hannan Bin Azhar (Canterbury Christ Church University, United Kingdom (Great Britain)); Zoltan Meszaros and Tasmina Islam (King's College London, United Kingdom (Great Britain))

This paper addresses the critical challenge of advancing autonomous vehicle control in off-road environments, where traditional driver assistance technologies often prove inadequate. While AI-powered systems in modern vehicles have become highly effective at navigating structured urban landscapes, adapting these technologies for rural and off-road settings remains a complex and necessary undertaking due to varied and unpredictable obstacles. Off-road scenarios present unique challenges, such as dense vegetation, rugged terrain, uneven surfaces, and water bodies, which demand robust detection and classification capabilities beyond those found in urban areas. This study explores the application of state-of-the-art machine learning models, particularly transformer-based architectures, to enhance feature recognition and classification in rural contexts. We evaluate several advanced models, including hybrid architecture that combine convolutional neural networks (CNNs) with transformers, to determine their effectiveness in identifying complex off-road features. Findings reveal that, although current data limitations restrict the development of fully autonomous systems for off-road navigation, meaningful progress can still be achieved to improve driver assistance functionalities. This paper emphasises the urgent need for broader, more diverse datasets to ensure model robustness and generalizability for autonomous navigation in unstructured, unpredictable environments. Ultimately, this work highlights a promising path toward safer, more effective driver assistance technologies tailored specifically for challenging off-road applications and scenarios.

17:40 ***Comparative Analysis of User Experience Shopee and TikTok Shop Utilizing User Experience Questionnaire***

Emanuel Ristian Handoyo (Universitas Atma Jaya Yogyakarta, Indonesia); Aurelia Melinda Nisita Wardhani (Universitas Sanata Dharma, Indonesia)

The rapid growth of e-commerce has led to the emergence of mobile and social commerce models, with Shopee and TikTok Shop representing distinct approaches in the Indonesian market. This comparative study investigates user experience (UX) differences between these platforms, focusing on understanding how social commerce integration affects user perceptions and behavior. Using the User Experience Questionnaire (UEQ), we measured six UX aspects: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. Data were collected from one hundred active users through a mixed-method approach combining surveys and semi-structured interviews. Both quantitative statistical analysis and qualitative content analysis were performed to provide comprehensive insights. The results revealed significant differences in four UX aspects: attractiveness, perspicuity, efficiency, and stimulation, while dependability and novelty showed no significant differences between platforms. TikTok Shop demonstrated superior performance across all measured aspects, with the most substantial difference in attractiveness. Qualitative findings supported these results, with users emphasizing TikTok Shop's promotional strategies, interactive features, and social commerce

integration. These findings provide valuable insights into the evolving landscape of e-commerce, suggesting that social commerce integration may enhance user experience. The results contribute to both theoretical understanding and practical implications for developing more effective e-commerce strategies in the Indonesian market, while highlighting areas for improvement in security and innovative features.

5B: Cybernetics and Internet-of-Things (IoTs)

15:25 ***Low-Rank Factorization For Edge Computing in Fall Detection with Wearable Sensors***

Geo Nanda Iswara, Aji Gautama Putrada and Hilal H. Nuha (Telkom University, Indonesia)

Machine learning performs fall detection by learning different patterns between people falling and people not falling in the accelerometer signal on wearable sensors. However, the problem of running machine learning on wearable sensors is limited computational resources. This paper proposes using low-rank fac-torization so that deep learning can run on wearable sensors with limited resources. First, four classes of the fall detection dataset were used with accelerometers from Kaggle: "Free falling," "sitting down," "running then falling," and "running then sitting." Then, a deep neural network (DNN) training process classifies the four labels. Then, low-rank fac-torization is applied, whose function is compression on the DNN model-accuracy, precision, recall, and f1-score measures the original model's prediction performance. The number of parameters (params) compares the size of the two models. The test results indicate that the "Running Then Falling" class achieved the highest precision and f1-score, at 0.99 and 0.98, respectively. Following this, the "Running Then Sitting" class demonstrated the highest recall with a value of 0.99. The DNN model's performance in detecting falls based on accelerometer data achieved an overall accuracy of 0.97. Notably, the low-rank DNN model, configured with a rank of 12, proves more efficient than the original model. This efficiency comes with a substantial 53.8% reduction in parameters, achieved without any loss in accuracy.

15:40 ***Comparative Performance Evaluation of LoRa RFM-95W and RA-01H Modules at 921.4 MHz Range and Signal Quality Analysis with Rubber Duck and Spring Antennas***

Raihan Radhitya Setiawan, Reynaldhi Tryana Graha and Ridho Ansyah Sojuangon Panggabean (Telkom University, Indonesia); Hanif Fakhrurroja (National Research and Innovation Agency, Indonesia & Telkom University, Indonesia); Linda Meylani and Dita Pramesti (Telkom University, Indonesia)

This study investigates the impact of antenna selection on the performance of 921.4 MHz Long Range Radio (LoRa) communication, focusing on the relationship between distance, Received Signal Strength Indicator (RSSI), and Signalto-Noise Ratio (SNR). The RFM-95W and RA-01H LoRa modules were tested with two antenna types, rubber duck and spring antennas, over distances ranging from 50 to 1400 meters. Results show that the rubber duck antenna consistently outperformed the spring antenna, achieving a maximum range of 1400 meters with an average RSSI of -115.8 dBm and an average SNR of -9.6 dB when paired with the RFM-95W module. In contrast, the spring antenna performed better at shorter distances, such as 50 meters, with an average RSSI of -69.4 dBm and an average SNR of 6.1 dB on the same module. The RA-01H module performed best with the rubber

duck antenna, achieving a maximum range of 400 meters, with an average RSSI of -120 dBm and an average SNR of -5.4 dB. Environmental factors and antenna characteristics played critical roles, with the rubber duck antenna proving more effective for longer-range communication due to its larger size, higher gain, and greater maximum power input. These findings provide valuable insights for optimizing LoRa systems at 921.4 MHz in Indonesia, aligning with regional regulatory constraints and environmental challenges. The results guide antenna selection based on specific distance and application requirements, offering practical recommendations for deploying LoRa systems in various realworld scenarios where reliable long-range communication is crucial.

15:55 ***AI-Driven Personalized Fitness Workout Assistance and Tracker Using YOLOv8 Algorithm***

Laurence Ray E. Bautista, Chynna G. Mangalindan, Airis Jun Marie G. Masagca, Criselle J Centeno, Marilou B. Mangrobang and Dan Michael A. Cortez (University of the City of Manila, Philippines)

The Smart FitPal app aims to transform how people approach fitness by using artificial intelligence (AI) and advanced technology to offer personal workout guidance. The main goal of the app is to create a virtual assistant powered by the "You Only Look Once (YOLO) version 8" algorithm, a modern object detection technology that works in real-time. This means the app can track your exercises, analyze your body posture, and provide real-time feedback on how to improve your form. This helps make workouts safer, reduces the chance of injury, and increases the effectiveness of each session by ensuring proper technique. Another key feature of the app is the inclusion of user-friendly tools like a calorie counter and a diary to track both exercises and food intake. These features allow users to easily monitor their daily calories, log their workouts, and keep track of their eating habits, helping them stay on course to achieve their fitness goals. By simplifying the process of tracking health data, the app makes it easier to maintain a healthy lifestyle. In addition, the app is built to meet International Organization for Standardization (ISO 25010:2022) quality standards, which ensures that the software is of high quality, secure, reliable, and easy to use. This means the app provides users with smooth experience while also protecting their personal data. With its advanced AI features, simple design, and strong security measures, Smart FitPal offers a complete fitness solution for users at all fitness levels. It supports users in staying healthy, tracking their progress, and reaching long-term fitness success in a structured and engaging way.

16:10 ***Cost Effective IoT-Based Smart System for Avoidance of Obstacle and Intruder Detection***

Md. Shadman Sakib Talukdar, Mahiyan Rahman Takbir, Imam Tajnoor Hossain Amrit, Md Mahin Rahman and Mohammad Noor Nabi (Independent University, Bangladesh, Bangladesh)

This study introduces a cost-effective integrated system that significantly enhances the safety and security of autonomous vehicles by merging obstacle avoidance and intrusion detection functionalities through Internet of Things (IoT) technologies. The system employs ultrasonic sensors for accurate obstacle detection, with an Arduino Uno and Raspberry Pi 3 handling data processing and control tasks. Facial recognition technology is incorporated to monitor and identify unauthorized individuals in real time. This integration allows the vehicle to autonomously navigate while also securing itself against potential intruders, all achieved with readily available and affordable components. The system demonstrates strong performance in detecting and avoiding obstacles

in straightforward scenarios, although accuracy may diminish in more complex environments. The facial recognition component achieves consistent and reliable results under controlled conditions. By combining these technologies in a budget-friendly solution, this research offers practical advancements in intelligent and secure autonomous vehicle systems, suitable for applications in various domains including robotics and smart vehicle technology.

16:25 ***Defect Detection in Printed Circuit Boards Based on EdgeML and Computer Vision***

Felipe G. F. Rocha (INATEL, Brazil); Hyago Vieira Silva (Instituto Nacional de Telecomunicações, Brazil); Rodrigo B. Vimieiro (University of Sao Paulo, Brazil); Felipe Augusto Pereira de Figueiredo (INATEL, Brazil)

The production of electronic boards is a common activity in the industrial environment, and ensuring their quality is essential for obtaining reliable products. This work presents a comparative study of the performance of three machine learning architectures: YoloV8, FOMO, and MobileNet. The dataset was created based on four classes for assembly fault detection. The model that achieved the best results was FOMO, with precision, recall, and F1-Score above 95%, as well as processing 10.5 frames per second and having a total size of 152 kB.

16:40 ***LubriScan: A Deep Learning Approach for Revealing Counterfeit Motorcycle Oil/Lubricants via Primary Packaging Analysis***

Joselito Joshua S Abrera, Jr (University of the City of Manila, Philippines); Denmark O Santiago and Gab P Caballes (Pamantasan ng Lungsod ng Maynila, Philippines); Criselle J Centeno and Richard C. Regala (University of the City of Manila, Philippines); Diony S. Abando (Pamantasan ng Lungsod ng Maynila, Philippines)

LubriScan is a mobile application developed to accurately detect and classify the authenticity of motorcycle lubricants through their primary packaging, aiming to enhance user accessibility and awareness towards counterfeit products. The mobile application utilizes the latest YOLOv8 multi-label classification algorithm to identify key features on the bottle of the lubricant and enhance user's awareness on the lubricants they purchase. The model was trained by purchasing genuine lubricants from authorized resellers while counterfeit lubricants were obtained from Shopee by inspecting the number of 1-star reviews provided by consumers after acquiring these products. 310 images of counterfeit lubricants and 249 images of genuine ones, with a total of 559 images were used as dataset for the model. The model was validated using 112 images from the dataset and achieved a Mean Average Precision (mAP) of 91%, demonstrating high precision and recall. Additionally, the model achieved an accuracy of 88.4% and an F1 score of 90.44% with few instances of false positives and false negatives due to misclassification. Motorcycle riders and motor shop staff and owners evaluated LubriScan using the ISO/IEC 25010 software quality model under the Functional Suitability, Performance Efficiency, Usability, and Reliability. The system received an overall mean score of 4.48 as "Satisfied", indicating the respondent's positive reception of the app's capabilities. LubriScan effectively combines accessibility and accurate detection, making it a valuable tool for both consumers and retailers in spotting counterfeit motorcycle lubricants as well as enhancing awareness towards motorcycle lubricants.

16:55 ***Cyberattack Incidents In South Africa: A Survey***

Cynthia Hombakazi H Ngejane, Samson Chishiri, S, Sivuyile Shwayimba, Siwe Moyakhe, Sanele Miya and Geena Lwana, G (CSIR, South Africa)

Cybersecurity attacks and cybercrimes rank among the top ten global risks, as the World Economic Forum reported in 2023. Despite various technical and strategic solutions deployed by the public and private sectors, these attacks continue to rise. This paper explores the increasing frequency of cyberattack incidents and data breaches in South Africa, focusing on their significant impact on the public and private sectors. Based on a 12-month survey of 309 participants from diverse industries, the study identifies malware as the most common attack type. Findings reveal that approximately 88% of respondents experienced at least one security breach in the past year, with many facing multiple incidents. The financial impact is considerable, with costs often exceeding R50 million per incident, highlighting an urgent need for stronger cybersecurity measures. By analysing attack patterns and root causes such as phishing and third-party vulnerabilities, this study provides insights for stakeholders to counter cyber threats proactively. The conclusions advocate for enhanced cybersecurity awareness and resilience to effectively mitigate future risks.

17:10 ***Leveraging Honeypot to Uncover Attack Behaviors on Redis***

Mariano Joseph Tendean, S.Kom (Swiss Germany University, Indonesia & Swiss German University, Indonesia); Charles Lim and Kalpin Erlangga (Swiss German University, Indonesia)

As cyber threats targeting Redis servers continue to evolve, the need for proactive defense mechanisms becomes increasingly critical. This research explores the application of combining threat categorization and Common Vulnerabilities and Exposures (CVE) mapping to enhance the detection and mitigation of attacks targeting Redis honeypots. Our analysis of attacker interactions reveals distinct attack patterns, offering valuable insights into the specific threats facing Redis servers. The findings demonstrate that integrating honeypots with CVE mapping and threat frameworks significantly improves threat detection capabilities and facilitates the development of targeted mitigation strategies. This approach not only strengthens the security posture of Redis servers but also offers a scalable solution for addressing evolving attack vectors in the broader cybersecurity landscape.

17:25 ***Enhancing Honeypot Realism: A Framework for Improved Cyber Threat Intelligence through Dynamic Web Cloning***

Ismail Choiri, Charles Lim and Kalpin Erlangga (Swiss German University, Indonesia)

As cyber security threats continue to evolve in sophistication, honeypots solution remain essential tools for observing attacker behavior and gathering threat intelligence. Traditional honeypot setups, however, often prove inadequate as attackers become increasingly skilled at detecting honeypot for deception capabilty. This paper introduces an advanced honeypot framework designed to address these limitations by closely emulating realistic web applications. Leveraging a dynamic website cloning method, the framework successfully attracts a broad spectrum of attacks, including credential stuffing, brute-force attempts, and reconnaissance scans. The honeypot was deployed in two stages: an initial baseline setup, followed by an enhanced configuration incorporating web cloning and interaction

modules, which led to a threefold increase in captured attacks. These realistic features not only improved attacker engagement but also encouraged adversaries to employ more sophisticated techniques, exploiting perceived vulnerabilities. The resulting data offers actionable intelligence and deeper insights into attacker tactics, techniques, and procedures (TTPs), which are critical for developing robust cybersecurity defenses. By simulating authentic web interactions, this framework demonstrates the potential of advanced honeypots to proactively inform and strengthen cybersecurity strategies against evolving threats. This research underscores the value of realistic honeypot environments in enhancing threat detection and response capabilities for cyber security organisation teams.

17:40 ***Critical Success Factor of Discord Usage: A Systematic Literature Review***

Natalicia Margatan (BINUS University, Indonesia); Tanty Oktavia (Bina Nusantara University, Indonesia)

Discord has evolved from a gaming-centric communication tool into a platform widely used in education, professional settings, and community building. This systematic literature review explores the critical success factors (CSFs) driving Discord's growth from 2019 to 2024, focusing on ease of use, cross-platform compatibility, customization, and integration with tools like GitHub and YouTube. In education, Discord's real-time and asynchronous communication features enhance student engagement, support remote learning, and foster interactive classrooms. In professional contexts, its adaptability aids project collaboration, workflow efficiency, and remote team management, making it a valuable workplace tool. User satisfaction averages 85%, with a reported 20% increase in workflow efficiency among teams. However, challenges such as information overload and privacy concerns limit its effectiveness, underscoring the need for improved protocols and security. These findings highlight Discord's usercentered design and feature versatility as key success factors. Despite its strengths, research gaps remain regarding its longterm impact on productivity and user satisfaction outside gaming. Addressing these through future studies is crucial for maximizing Discord's potential in reshaping communication, collaboration, and community building.

5C: Cybernetics and Data Science

15:25 ***Virality Prediction on Twitter Using Combined CNN and BERT Models***

Hilarius Ryan Auxilio Benedecas and Abba Suganda Girsang (Bina Nusantara University, Indonesia)

Nowadays, social media serves as a platform for sharing and receiving information. One indicator of the importance of information is its virality. Virality is an interesting topic in the world of Natural Language Processing (NLP), including the prediction of virality and identifying features that influence it. Research in this area has utilized Bidirectional Encoder Representations from Transformers (BERT) models and yielded promising results. Previous studies aimed to predict virality based on specific features. This research aims to predict virality by combining the abilities of Convolutional Neural Network (CNN) and BERT models. The BERT model transforms textual data into numerical and adds new features, while the CNN model excels in numerical classification. Data for this study is

sourced from Twitter and in Indonesian language. The proposed model demonstrates improvements compared to the model from previous research. Specifically, it shows a 7.1% increase in precision, a 9.9% increase in recall, a 3.8% increase in accuracy, and an 8.1% increase in F1-Score compared to the previous model. These findings contribute to future research on similar topics, particularly in leveraging multiple models for prediction tasks. Overall, the study provides insights into effectively utilizing the strengths of various models and combining them in prediction tasks.

15:40 ***Exploring Ensembles Method for Predicting Corporate Bankruptcy***

Riyana Kartika Pratiwi, Tora Fahrudin and Dedy Rahman Wijaya (Telkom University, Indonesia)

Corporate bankruptcy prediction is an important issue in finance and risk management. The critical challenges in corporate bankruptcy prediction are addressed in this study using machine learning approaches with ensemble methods. This research aims to evaluate and compare the effectiveness of different ensemble methods in predicting corporate bankruptcy, especially in predicting the bankrupt class. Eight ensemble models-Gradient Boosting, Ada Boost, XG Boost, Cat Boost, Voting Classifier, Bagging, Random Forest, and LightGBM- were implemented using a dataset from Taiwan Economic Journal for the years 1999-2009, which includes company financial data for the period 1999 to 2009. The dataset consists of 95 attributes covering various financial ratios, asset growth, liquidity and leverage. The experimental results show that all models have high accuracy in detecting non-bankrupt companies, with an average accuracy above 96%. Among all models tested, AdaBoost demonstrated the best performance in the bankruptcy prediction with the highest recall of 24% for bankruptcy class, although the overall accuracy remained at 96%, making it a strong candidate for identifying potential bankruptcy risks.

15:55 ***Exploring Deep Learning Algorithm for Credit Scoring***

Velani Febriana Putri and Tora Fahrudin (Telkom University, Indonesia)

This study investigates the use of deep learning algorithms in credit scoring, a crucial instrument for determining a borrower's creditworthiness. As technology develops, there is a rising movement to incorporate technology including credit scoring into the financial sector. Numerous research endeavours have attempted to ascertain whether deep learning can enhance the credit scoring system. The capacity of deep learning algorithms to study and understand vast volumes of data makes them extremely effective methods with noticeable increases in classification performance in a variety of machine learning applications. This study assesses the effectiveness of models on deep learning using an extensive dataset of borrower data. In addition to using three methods Deep Learning, Convolutional Neura Network (CNN), Feedfordward Neural Network (FNN), and Autoendoders, classification metrics were used as evalution tools. Deep learning algorithms are therefore thought to hold a lot of promise for raising the credit scoring system's precision and effectiveness.

16:10 ***Dust-Induced Power Loss in Solar Plants: A Real- time Web Application for Degradation Prediction using Decision Trees and Random Forests Regressions***

Zulkifli Tahir and Syafruddin Syarif (Hasanuddin University, Indonesia); Tyanita Puti Marindah Wardhani (Universitas Hasanuddin, Indonesia); Moh Abib Safaqdillah (Hasanuddin University,

Indonesia)

Solar power plants are an important alternative for implementing sustainable energy. However, their efficiency is often compromised by the presence of dust on solar panels. This research attempts to develop a real-time web system that can monitor and predict power loss in solar panels using environmental data and dust concentration metrics. Two regression models are used, namely Decision Tree Regression (DTR) and Random Forest Regression (RFR), to predict the output of the solar panel. These environmental factors include temperature, humidity, sunlight, dust concentration, and electric current. The efficacy of both models was assessed via Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE). In low-dust environments, the RFR model achieved MSE, RMSE, and MAE values of 0.00248, 0.0498, and 0.03912, respectively. Then the DTR model shows values of 0.00261, 0.05116, and 0.04055, respectively. In high dust environments, the RFR model shows superior performance with MSE, RMSE, and MAE values of 0.00173, 0.04159, and 0.04061, respectively. Then the DTR model produces worse values of 0.00181, 0.04263, and 0.04164, respectively. These findings consistently show that the RFR model outperforms the DTR model in both low and high dust conditions. Next, a real-time electric current prediction system is developed, featuring a user-friendly web-based application. The system uses a pre-drilled RFR model to predict future electric current values with more accurate results. By visualizing real-time data, comparing prediction results, and providing insightful insights, the application can be used by users to make timely decisions and improve energy system performance.

16:25 ***Sentiment Analysis: Indonesia Netflix User's Comment Using Multiple Lexicon-Based Dictionaries***

Sebastianus Adi Santoso Mola, Tiwuk Widiastuti and Rosa V. K. Isabela Ohe Roma (Nusa Cendana University, Indonesia); Andrea Stevens Karnyoto (Binus University & BDSRC, Indonesia); Bens Pardamean (Bina Nusantara University, Indonesia)

A subscription movie streaming service from the United States, Netflix, has been present in Indonesia since 2016 and provides a wide variety of films without showing any single advertisements that can be viewed from anywhere, as long as there is access to the internet. Despite these advantages, many users have complained through the Google Play Store's comments column. Some of the common complaints include frequent buffering and connectivity issues, dissatisfaction with the limited selection of Indonesian movies, lack of subtitles for specific languages, or pricing concerns have also been raised. In this study developed two combined scenario methods using the InSet and SentiStrength_id dictionary to obtain better performance and compare them against independent InSet and SentiStrength_id. This study collected users' comments for the Netflix app in the Google Play Store as a dataset using web scraping techniques through the Google Collaboration tool. The dataset contains 3250 rows spanning the period from January 22, 2024, through June 6, 2024. To ensure proper processing of the text, data cleaning, lowercasing, normalization, tokenization, stemming, and stopwords removal are conducted. The results show that most user opinions are negative. The InSet dictionary has an accuracy of 92%, SentiStrength_id 78%, Combined scenario 1 is 87%, and scenario 2 reaches the highest among others which is 92.52%.

16:40 ***Vessel Visual Surveillance Based on YOLOv8 Architecture: Daytime and Night Comparison***

Khusnul Muchlisin and Reza Fuad Rachmadi (Institut Teknologi Sepuluh Nopember, Indonesia); Supeno Mardi Susiki Nugroho (Sepuluh Nopember Institute Of Technology, Indonesia)

This paper is conducted by researchers focusing on the field of vessel visual surveillance using deep learning techniques. They aim to develop an effective surveillance system to enhance safety and security in the maritime environment. This study investigates the performance of the YOLOv8 architecture in detecting vessels during daytime and night. YOLOv8 is a powerful and efficient object detection algorithm that has shown promising results in various applications. The researchers compare the performance of the model trained on a daytime dataset when applied to night images, to assess its generalization ability under different lighting conditions. This paper focuses on vessel surveillance in maritime environments, including ports, shipping lanes, and other water areas. The ability to accurately detect and track vessels under varying lighting conditions is crucial for efficient traffic management and incident prevention. This study is conducted to address the challenges of round-the-clock vessel surveillance, both during the day and at night. Varying lighting conditions can significantly affect the performance of object detection algorithms, making it essential to evaluate and optimize models for 24/7 operation. Reliable visual vessel surveillance is critical for various applications, including maritime traffic management, collision prevention, illegal activity detection, and emergency response. By developing robust surveillance systems based on deep learning technologies like YOLOv8, researchers aim to enhance the safety, security, and efficiency of maritime operations. The YOLOv8 model is trained using an extensive dataset of daytime vessel images. The trained model is then evaluated on night images to assess its detection performance under different lighting conditions. The results show that while the model achieves high accuracy on daytime data, its performance deteriorates on night images, with some cases of false positives and false negatives. To optimize the model, the researchers suggest data augmentation techniques such as coloring the background to mimic night conditions or using a combined dataset of daytime and night images. This study emphasizes the need for further research and the development of more diverse datasets to improve vessel surveillance performance under various lighting conditions.

16:55 ***Predicting Stunting Prevalence in Indonesia Using XGBoost and Artificial Neural Networks***

Adinugraha Dharmaputra and Indwiarti Indwiarti (Telkom University, Indonesia); Wandi Yusuf Kurniawan (School of Computing, Telkom University, Indonesia); Amila Nafila Vidyana (Telkom University, Indonesia); I Kadek Arya Sugianta (Universitas Bali Internasional, Indonesia); Putu Harry Gunawan (Telkom University, Indonesia)

Stunting remains a critical public health issue in Indonesia, particularly in rural areas, where the prevalence of stunted children continues to rise. Stunting refers to a condition where toddlers have a height significantly below the average for their age, caused by prolonged inadequate nutritional intake. This condition poses severe long-term consequences, including delayed brain development, reduced cognitive abilities, and an increased risk of chronic diseases such as diabetes, hypertension, and obesity. According to the Indonesian Nutrition Status Survey (SSGI), the stunting prevalence rate in Indonesia was 21.6% in 2022, a figure that threatens the development of the nation's younger generation. To address this issue, effective monitoring and predictive models are essential for supporting government decision-making and policies aimed at reducing stunting rates. This study

implemented and evaluated the performance of Artificial Neural Networks (ANN) and XGBoost algorithms as regression models for predicting stunting prevalence in Indonesia. Hyperparameter optimization was conducted using the Tree-Structured Parzen Estimator (TPE) approach to improve model accuracy. Among the tested models, the XGBoost algorithm demonstrated superior performance, achieving a Mean Squared Error (MSE) of 21.57 for training and 16.11 for testing, outperforming both ANN and Linear Regression (LR). Additionally, the computational cost analysis revealed significant differences in training times: approximately 1 minute for an ANN with one layer, 1.5 minutes for an ANN with two layers, 0.1 seconds for XGBoost, and 0.05 seconds for LR. These findings underscore XGBoost's effectiveness and efficiency, making it a promising tool for stunting prediction and policy support in Indonesia.

17:10 ***Gap Analysis on Interoperability of Blockchain Enabled Traceability Tools for Digital Product Passports***

Soumya Kanti Datta (Digiotouch, Estonia)

This paper investigates the challenges hindering interoperability among Digital Product Passport (DPP) platforms and proposes recommendations for a more standardised and interoperable ecosystem. DPPs are envisioned to be a key component of a circular and sustainable European economy by providing transparency throughout a product's lifecycle. The key gaps identified in this paper by surveying the current standardisation efforts, particularly when utilising blockchain technology, including incompatible data formats across different platforms, lack of standardised governance frameworks for managing data updates and corrections in blockchain-based DPPs, and absence of universal certification standards for different sectors, among others. The paper introduces recommendations for Standard Development Organisations (SDO) to address these gaps.

17:25 ***Artificial Intelligence-Powered Intent Classification for Indonesian E-Wallet Customer Service Chatbots***

Christopher Owen and Derwin Suhartono (Bina Nusantara University, Indonesia)

The rapid expansion of e-wallet services in Indonesia has significantly heightened the need for efficient customer service solutions, making chatbots an essential tool for user support. However, many providers continue to rely on rulebased chatbots, resulting in rigid interactions that struggle to meet diverse user needs or handle the linguistic complexities of the Indonesian language. This study addresses these limitations by developing an AI-powered intent classification model specifically tailored for Indonesian e-wallet customer service, aimed at delivering a more accurate, adaptive, and usercentered experience. A custom dataset was created from user comments on social media associated with Indonesia's top ewallet providers, followed by data pre-processing and clustering using the BERTopic model. To improve interpretability, OpenAI's GPT-4 was employed for label refinement, resulting in enhanced clarity. Various models were tested, including IndoBERT, RoBERTa, and Convolutional Neural Network (CNN) architectures in both 2D and 3D configurations. The highest-performing model combined IndoBERT embeddings with a 3D CNN classifier, achieving an accuracy of 84.30%, precision of 84.33%, recall of 84.30%, and an F1-score of 84.24%. This study contributes a unique Indonesian-specific dataset and demonstrates the potential of AI to

transform customer service interactions in Indonesia's e-wallet sector, offering a clear advancement over traditional rule-based approaches.

17:40 ***Clustering High-Dimensional Spaces Using a Modified EM Algorithm with Fractional Order Assignment***

Shivani Saxena (Institute of Advanced Research, India); Prince Rajyaguru (SPEC India, India); Shruti Saxena (National Forensics Sciences University, India); Nilesh Patel (INSTITUTE OF ADVANCED RESEARCH, India); Ahsan Rizvi (Swedish University of Agricultural Sciences, Sweden)

Clustering high-dimensional data presents significant challenges due to the curse of dimensionality, which complicates the detection of meaningful patterns and clusters. Traditional methods struggle to manage the increasing complexity, often becoming sensitive to noise, inefficient in capturing intricate relationships, and unable to handle uncertainties effectively. To address these issues, this study introduces EM-FASL, a novel clustering algorithm designed to improve accuracy in high-dimensional spaces by accounting for complex relationships and uncertainties. EM-FASL is an adaptation of the Expectation-Maximization (EM) algorithm, enhanced through fractional order assignment and logistic regression (LR). The method begins by initializing the parameters for a Gaussian Mixture Model (GMM) and an LR model. In the Expectation (E) step, it fits the GMM, computes fractional assignments, and evaluates fractional entropy to measure the uncertainty in assignments. In the Maximization (M) step, the GMM parameters are updated using the fractional assignments, while LR coefficients adjust the mean vectors of the GMM. The algorithm iterates between these steps until fractional entropy converges. The algorithm is evaluated on a range of high-dimensional datasets from the UCI repository, demonstrating its robustness across diverse data structures. Experimental results demonstrate that EM-FASL significantly outperforms existing clustering methods, offering superior accuracy in high-dimensional data by effectively capturing intricate data patterns. This innovative approach provides a robust solution to the challenges of high-dimensional clustering and opens up new avenues for future research.

5D: Cybernetics and Information Management in Business

15:25 ***Unveiling Generative Adversarial Network Adoption in Design Processes***

Priscilla Anthonio Kurniawan, Veny Veny, Michelle Chau and Anderes Gui (Bina Nusantara University, Indonesia)

With rapid advancements in artificial intelligence, Generative Adversarial Network (GAN) technology is increasingly embedded in designers' workflows, supporting a range of tasks from basic to complex. Despite its potential, the adoption of GAN technology in design processes faces challenges such as user acceptance and the understanding of its capabilities. In order to address this gap and challenge, this research analyzed responses from 376 valid participants (from an initial 439), using Partial Least Squares Structural Equation Modeling (PLS-SEM). Eight hypotheses were tested, which four were accepted and the rest rejected. Results indicated that perceived usefulness, ease of use, task-technology fit, and computer anxiety do not significantly impact behavioral intention toward GAN adoption. In contrast, social influence, perceived self-efficacy, and perceived enjoyment showed

a positive impact on adoption intentions. Additionally, this study has found that Generation Z respondents are particularly influenced by social trends and enjoyment, which are factors that often outweigh traditional motivators like ease of use. These findings underscore the importance of community influence and enjoyment in driving technology adoption among younger designers. In the end, this study highlights important factors for integrating GAN technology into creative processes to provide insights, and foster innovation for technology developers, educators, and designers.

15:40 ***The Influence of Social Media, Environmental Awareness, Willingness to Pay, and Eco-Labeling on Environmental Purchasing Behavior in E-Commerce***

Ivory Thania (Bina Nusantara University, Indonesia); Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia)

This paper investigates the links between the influence of social media, environmental awareness, ecolabeling, willingness to pay, and environmental purchasing behavior within e-commerce. This study uses survey data and quantitative analysis to investigate how these elements influence online consumers' decisions about environmentally friendly items. A total of 445 participants, the bulk of whom resided in JABOTABEK, were recruited for this study, which was carried out in Indonesia. For Structural Equation Modeling (SEM), this study uses the statistical tool known as SMART-PLS. The findings indicate that customers' opinions of eco-labels are highly influenced by social media, increasing their willingness to pay for environmentally friendly options in e-commerce platforms. Furthermore, increased environmental awareness increases the frequency with which consumers acquire ecolabeled products online, underscoring the substantial influence of transparent labeling systems on consumer decision-making. Several practical implications for e-commerce companies are presented in the conclusion of the study. These implications highlight the need for focused social media campaigns and stringent eco-labeling requirements to encourage sustainable customer habits. In addition to laying the groundwork for additional research on consumer environmental engagement and the efficacy of eco-labels in e-commerce, this study offers useful information that can be utilized by policymakers and businesses who are interested in promoting sustainable consumption habits in the digital marketplace.

15:55 ***A Novel Enterprise Artificial Intelligence Architecture Framework (NAEF) for Business Capabilities to Decisions/Insights Analysis***

Heru Ipung (Swiss German University, Indonesia)

This paper proposes a novel framework for architecting enterprise AI, emphasizing the integration of three frameworks-TOGAF, BADIR, and INSIGHT-to create a robust and comprehensive methodology. This integrated approach addresses the unique challenges and considerations inherent in designing, implementing, and managing AI systems within an enterprise context. This approach leverages the strengths of three distinct frameworks, TOGAF (The Open Group Architecture Framework), offers a structured approach to designing the data, application, and technology architecture necessary for AI implementation. Decisions Analysis, like BADIR (Business Question, Analysis Plan, Data, Insight, Recommendation), guides the translation of business objectives into data-driven decisions, ensuring AI initiatives are driven by clear business needs and result in actionable recommendations. Insights

analysis is started by identifying key questions related to business processes and activities, guiding the design process with a focus on user feedback and iterative refinement, and promoting stakeholder engagement and data-driven decision-making. Simulated approach is provided in the paper as well as sample cases, integration considerations to legacy system, AI governance considerations and future directions.

16:10 ***Unlocking Efficiency through a Comparative Analysis of Predictive Text on User Chatting Experience in iOS and Android Smartphones***

Ni Putu Tara Diva, Tiziara Adzani Kusumawardana and Yohannes Kurniawan (Bina Nusantara University, Indonesia)

Smartphone chatting features on both iOS and Android operating systems have benefited from the features developed through a feature referred to as predictive text. As the name suggests, by using artificial intelligence people's previous typing behaviors, predictive text could automatically recommend any word(s) or phrase(s) which in turn, could potentially reduce the amount of time people spend in typing out the messages. The purpose of this study is to evaluate how accurate prediction helps the common user in his or her day-today communication through their smartphone apart from the professional realm and in informal chatting. If information about the usage of predictive texts was to be obtained, then a quantitative method was used. Surveys were posted on different social networks regarding Google Forms to access as many participants as possible. From the findings, it is clear that both iOS and Android users find the predictive text helpful as it enhances typing speed and greatly lessens typing errors. Most importantly saves time and minimizes typing errors, especially for frequently used words or phrases. Participants said it takes less time to write messages when the phone predicts the words as it helps in the overall flow of the conversation since people do not have to make corrections for wrong actions made when typing the message. Although there may sometimes be problems with the results, only a few participants had complaints regarding this feature, and the majority considered it highly useful for communication in their everyday lives.

16:25 ***The Influence of Social Learning Factors on Customer Purchase Intention in Online Stores***

Hian Dwiputra Let Let, Stanley Natan Aminius, Steven Laurencius and Manise Hendrawaty (BINUS University, Indonesia)

This study examined the influence of social learning factors on consumers' purchase intentions in the online shopping context. A survey-based approach was employed, collecting data from 400 respondents in the JABODETABEK region of Indonesia. Structural Equation Modeling (SEM) was used to evaluate the relationships between the constructs. The results showed that learning from forums and communities had a significant positive influence on both affective appraisal (path coefficient = 0.370) and cognitive appraisal (path coefficient = 0.278). Similarly, learning from ratings and reviews positively impacted affective appraisal (0.276) and cognitive appraisal (0.255), while learning from social recommendations influenced affective appraisal (0.252) and cognitive appraisal (0.216). Importantly, affective appraisal was found to have a strong positive effect on purchase intentions (0.588), while cognitive appraisal also significantly influenced purchase intentions (0.313). These findings suggest that both emotional and rational factors play crucial roles in shaping online

consumers' purchasing decisions. The insights from this study can help online businesses develop effective marketing strategies that leverage social learning to enhance customer engagement and boost sales.

16:40 ***Generation Z's Impulsive Buying Comparison on Using Conventional Transaction and Digital Banking Application***

Okta Nabilla Syahdini, Aurel Devina Krisanti, Audrey Marchella Firzy and Yohannes Kurniawan (Bina Nusantara University, Indonesia)

Through the use of technology which has become the fabric of their everyday lives' generation Z, people born between the years 1997 and 2012. This generation have the tendency to make unplanned and spontaneous purchases (impulsive buying). This tendency got amplified by the convenience and features provided by digital banking applications, such as real-time spending alert or personalized saving targets. The research question of this study is as follows: what prompts the members of Generation Z to engage in impulsive buying while using digital banking application, as compared to physically handling cash and utilizing published media. This paper aims to fill this gap by establishing the following objective to achieve this objective, a quantitative research approach was employed. The questionnaires in the form of online surveys were conducted throughout Indonesia from August 2024; the survey received 181 responses from Generation Z respondents across the regions. The study examines correlations among five key variables that potentially influence impulsive buying behavior: The measure scales for this study include Performance Expectation (PE), Social Influence (SI), Trust (T), Behavioral Intention (BI), and Impulse Purchase Intention (IPI). The studies show that all proposed associations between these variables were revealed to be significant except the impact of BI on IPI cannot be accepted since the value of ‘p' is greater than 0.05. This result shows that even though Generation Z's behavioral intentions to use digital banking depends on performance expectations, social influence and trust, the buying impulse does not have a strong relationship with the overall behavioral intention to use these applications. These findings present useful implications for digital banking services seeking to unravel experience-related differences and other behavioral stimuli between Generation Z consumers.

16:55 ***How content marketing to customer advocacy through entertainment intention leverage in social media platform?: The Evidence from Indonesia***

Rajiv Dharma Mangruwa (Telkom University, Indonesia); Uswatun Khasanah (School of Economics and Business, Telkom University Indonesia, Indonesia); Nurafni Rubiyanti (Telkom University, Indonesia)

This research investigates the role of content marketing in shaping customer advocacy within the TikTok platform, highlighting entertainment intention as a central mediating element, alongside gender and age as potential moderating factors. Based on data from 250 Jakarta-based TikTok users, the study employed purposive sampling within a nonprobability framework, with data interpretation conducted through Structural Equation Modeling (SEM) utilizing the Partial Least Squares (PLS) approach. Findings reveal that content marketing plays a pivotal role in amplifying entertainment intention, which subsequently fosters stronger customer advocacy. These insights underscore the

need for businesses to leverage visually compelling, informative content to promote customer advocacy by emphasizing entertainment-oriented strategies on TikTok.

17:10 ***Assessment of Supply Management Maturity Through Information Extraction and Enterprise Modelling at PT Indosat Tbk***

Muharman Lubis, Fitriyana Dewi, Yumna Zahran Ramadhan, Kusumah Anggraito and Rafian Ramadhani (Telkom University, Indonesia)

PT Indosat Tbk (Indosat Ooredoo) is a leading provider of telecommunications, informatics, and convergence technology services in Indonesia. With the rapid advancement of technology, the company is currently facing competition, and to remain competitive in the global business world, it must develop its business process management and technology utilization. Business processes play a crucial role in delivering high-quality products and services. Effective business process implementation can enhance company performance. To ensure the efficiency and effectiveness of the company, it is necessary to measure the maturity level of its business processes. Measurement is the key to improvement. The Business Process Maturity Model (BPMM) serves as a reference to measuring the maturity level of the business processes conducted by the organization to achieve the highest maturity level, which is continuous improvement. Enterprise modeling and data extraction streamline supplier management process improvement. The assessment evaluates all maturity levels based on specific goals and specific practices in the Business Process Maturity Model. The results of the maturity level assessment indicate that the company is at level 2, with conditions almost fulfilling level 3, with a score of 89%. Therefore, recommendations for improvement are made for each specific practice that has not yet achieved the maximum assessment.

17:25 ***Fostering Digital Innovation in Indonesia: The Role of STEM-AI Skills in Overcoming Talent Deficits and Gender Stereotypes***

Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia); Amalia Zahra (BINUS Graduate Program, Bina Nusantara University, Indonesia); Maryani Maryani (Bina Nusantara University, Indonesia); Lili Ayu Wulandari (Universitas Bina Nusantara, Indonesia); Devi Fitrianah and Virienia Puspita (Bina Nusantara University, Indonesia)

This research explores the optimization of digital talent in advanced industries, particularly in the context of rapid digital transformation. Despite the increasing importance of digital talent for gaining a competitive edge, several challenges persist. In Indonesia, for example, there is a significant shortage of digitally skilled workers, with the World Bank reporting a gap of 9 million skilled individuals over the past 15 years. Additionally, artificial intelligence (AI) is expected to impact 9.5 million jobs, further exacerbating the demand for digital skills. Furthermore, the employability of graduates remains low, largely due to inadequate training, poor language proficiency, and limited cultural sensitivity. Many companies face difficulties in finding qualified individuals, quickly upskilling their workforce, and fostering an innovative organizational culture. This study seeks to evaluate the factors influencing digital talent performance in the context of these challenges. It examines seven key variables: digital readiness, digital technology adoption, relevance of AI, digital skills, individual performance, problem-solving ability, and overall digital talent performance. Hypotheses were tested using Partial Least

Squares Structural Equation Modeling (PLS-SEM). Data was collected from 378 participants, primarily students with STEM backgrounds, in the Jabodetabek area of Indonesia in November 2024. The findings reveal that all hypotheses are significant, with results indicating that user satisfaction and the perceived value of digital talent in Indonesia have a notable impact on continued usage intentions in digital roles.

17:40 ***The Impact of Social Media's Live Shopping Feature on the Behavioural Responses of Indonesia's Generation Z***

Patrick William Porsan, Stephanie Surja and Heny Kurniawati (Bina Nusantara University, Indonesia)

Live streaming commerce has emerged as a dynamic form of e-commerce, where vendors and consumers interact in real time, creating a more attractive and immersive shopping experience. This unique format enables immediate feedback, personalized engagement, and a sense of urgency, all of which contribute to a more compelling purchasing environment. Utilizing the Stimulus-Organism-Response (S-O-R) framework, this study examines how factors such as attraction and trust influence consumptive behaviour in live shopping contexts. Data was gathered from 455 live shopping users in Indonesia through an online survey. The analysis, conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM), reveals that psychological engagement positively impacts perceived enjoyment, which subsequently drives impulse buying behaviour. Additionally, variables like convenience, exclusivity, and price are found to positively influence perceived value, which also enhances perceived enjoyment. However, perceived value does not directly impact impulse purchase behaviour, suggesting that while value plays a role in shaping enjoyment, it is the emotional engagement that primarily drives impulsivity in purchasing. These findings indicate that live shopping's success hinges on fostering positive emotional experiences, which can increase consumers' tendencies toward unplanned purchases. For vendors, strategically enhancing interactions-such as through exclusive deals and engaging presentations-can create an environment that encourages impulse buying. This study provides actionable insights for live shopping platforms, emphasizing the importance of building trust, psychological engagement, and exclusivity to maximize customer engagement and boost sales through emotionally driven interactions.

Wednesday, December 18 9:05 - 10:05

6A: Cybernetics and Data Science

9:05 ***Machine Learning Approach to Analyzing and Predicting Revenue Trend in Mineral Water Sales***

Ernesta Felicia (Multimedia Nusantara University, Indonesia & Medang, Indonesia); Ririn Desanti (Universitas Multimedia Nusantara, Indonesia)

Mineral water sales in Indonesia have experienced rapid annual growth, driven by factors such as population increase, lifestyle changes, and a 40.64% preference for bottled water among households. The increasing demand and sales of mineral water present new challenges for companies in data

processing. To address this, companies are turning to digital solutions for processing raw data and transforming it into visualized easily analyzable information. By applying machine learning techniques, both descriptive and predictive analyses are conducted to identify historical sales patterns, while predictive analysis leverages historical data to forecast future revenue trends. This study uses machine learning, specifically the K-Nearest Neighbors (KNN) and ARIMA models for data analysis. The integration of machine learning and Business Intelligence through real-time visualizations using tools like Power BI helps companies monitor performance metrics, identify opportunities, and respond to market changes effectively. This combination enables a more granular analysis of factors such as customer preferences, demand fluctuations, and supply chain efficiencies, which ultimately helps in tailoring strategies that maximize operational effectiveness and profitability. Additionally, machine learning models can be providing organizations with the agility needed to stay competitive in a dynamic marketplace to support the continuous improvement of business operations, resource allocation, and overall strategic planning.

9:15 ***Reconstructing Detailed 3D Car Geometries from a Single 2D Image by Repurposing PIFu***

Fadrianto Sulistiyorahman, Bedy Purnama and Edward Ferdian (Telkom University, Indonesia)

User-generated content is an integral part of the Internet. With VR and AR technologies becoming more accessible and affordable, there will be an increase in demand to create 3D content independently. Through AI, the process of creating 3D content for the average user can be made easier. In this study, we will focus on PIFu, one of the most prominent 2D to 3D reconstruction methods. PIFu is an end-to-end deep learning reconstruction method that uses an implicit representation that locally aligns the pixels of the 2D image with the global context of its corresponding 3D object. Using the same method, it can also infer the texture colours of the object. PIFu was originally designed for reconstructing 3D geometry of humans wearing clothes along with their intricate 3D textures, such as folds and creases. In this study, we tested the capability of PIFu in reconstructing non-human geometries. We trained this model on the car object categories to reconstruct detailed 3D car geometries. We evaluated the test results for twenty-four geometries, resulting in 0.046 ± 0.019 m, 0.343 ± 0.118 m, and 0.677 ± 0.124 for average symmetric surface distance, Hausdorff distance, and intersection over union, respectively. Visually, the geometry also has pronounced details, most notably the clear separation between the wheels and the body.

9:25 ***Research Trends on e-Tendering Implementation - A Systematic Literature Review (SLR)***

Syifa Nurgaida Yutia and Christanto Triwibisono (Telkom University, Indonesia); Sasmi Hidayatul Yulianing Tyas (University of Telkom, Indonesia)

The tender process in the modern era is supported by an electronic tender system called e-tendering. E-tendering offers the advantage of being more efficient compared to the traditional tender process. However, the e-tendering system is not free from problems, one of these points is that it becomes susceptible to security risks unless it is incorporated into both the design and implementation of the system. So, based on this, the need for literature to study research trends in the application of e-tendering technology is urgently needed to find out the problems or security challenges faced by the technological solutions used. This study examines research trends related to e-tendering in 2019-2023

that need to be correctly identified using the Systematic Literature Review (SLR) method. With the SLR method, research will be determined using keywords in searches sourced from the digital libraries, namely IEEE eXplore and ACM Digital Library. Based on the specified inclusion and exclusion criteria, 20 papers have been selected from 167 papers for investigation. The literature results show that research trends in this field continue to grow, and blockchain is the latest technology developing and used in the e-tendering system. The results of this study can be used as a guide by researchers and other readers to see current research trends.

9:35 ***Pneumonia Detection through X-ray Images Using EfficientNet Architecture on TensorFlow Lite***

Galih Akbar Nugraha and Untari N. Wisesty (Telkom University, Indonesia)

A serious lung infection, pneumonia remains a leading global cause of death, especially among vulnerable groups like the elderly and children. Effective treatment relies on early, accurate diagnosis, often involving chest X-rays to detect pneumonia. This study examines pneumonia detection from chest X-ray images using deep learning models, specifically EfficientNetV2 variants (EfficientNetV2S, V2M, and V2L). Transfer learning was used to train and evaluate the models, focusing on balancing accuracy, inference speed, and model size. Data augmentation techniques were used to improve generalizability, while TensorFlow Lite was used for efficient deployment on mobile devices. The novelty lies in the integration of EfficientNetV2 with TensorFlow Lite to optimize performance specifically for mobile and resource-constrained environments. This unique approach balances model size, inference time, and accuracy, demonstrating significant improvements in computational efficiency for mobile applications. Results indicate that EfficientNetV2S, V2M, and V2L all achieve high accuracy: EfficientNetV2S with 98.72%, EfficientNetV2M with 98.38%, and EfficientNetV2L with 98.89%. EfficientNetV2S emerged as the most efficient model, featuring a model size of 77.17 MB and an inference time of 0.04 seconds. The TensorFlow Lite conversion reduced model size by approximately 67% and inference time by over 99%, making the models feasible for real-world use in resource-constrained environments. This research demonstrates the potential of combining EfficientNetV2 variants and TensorFlow Lite to create an effective, lightweight solution for pneumonia detection, particularly in remote areas, and suggests future work on advanced optimizations and direct comparisons with other methods.

9:45 ***Pneumonia Detection based on Chest X-Ray Images with MobileNetV2 Architecture***

Falah Asyraf Darmawan Putra and Untari N. Wisesty (Telkom University, Indonesia)

Pneumonia is a serious lung infection requiring early, accurate diagnosis. Traditional methods rely on chest X- rays, but interpreting these images can be challenging due to variability in radiologist expertise. This study aims to enhance pneumonia detection using deep learning, specifically MobileNetV2, for its efficiency and potential deployment in resource-limited settings. Transfer learning was applied to reduce training time, while data augmentation (rotation, flipping) was used to increase robustness and reduce overfitting. To balance accuracy and computational demands, different input dimensions (128x128 to 224x224) and hyperparameter tuning were explored for potential real-time use in future settings. Results showed that MobileNetV2 achieved high accuracy,

reaching 99% with non-augmented data and an F1- score of 99%. After augmentation, performance slightly declined, with precision dropping to 94.97% and recall to 98.13%. The F1-score decreased from 99.36% to 98.24%. Despite this, the model retained strong recall (95% for normal cases and 98% for pneumonia cases), indicating robust classification. This study uniquely evaluates MobileNetV2's performance across various input dimensions, demonstrating its feasibility for pneumonia detection, especially in low-resource and mobile settings. Future work will address challenges like class imbalance and further optimization for edge deployment, paving the way for accessible and consistent pneumonia diagnosis in diverse clinical environments, ultimately improving patient outcomes.

9:55 ***Detecting Motorcycle Crime Gangs in CCTV Video Footage Using YOLOv9 and CNN***

Versa Syahputra Santo, Gamma Kosala and Rifki Wijaya (Telkom University, Indonesia)

Street crime, such as criminal motorcycle gangs, has become a severe problem that concerns Indonesian society, especially for those who live in big cities. Criminal Motorcycle gang members often disturb the surrounding community. One of the activities of motorcycle gangs that often cause disturbance is the activity of street convoys using motorbikes. Various solutions to reduce motorcycle gang crime have been conducted by the authorities. One of them is patrolling. However, this effort is less efficient due to limited time, workforce, and coverage of the area that can be monitored. Another preventive solution is to install CCTV. This solution also requires human resources to monitor CCTV footage. This certainly increases the possibility of human error. Some studies have been conducted to automate CCTV surveillance by detecting anomalies or crimes. In this research, motorcycle gang detection consists of three stages. The process begins with detecting and tracking motorcycles in the video using YOLOv9, which achieves an AP50 of 93.2%, alongside ByteTrack. The second step involves mapping each motorcycle's center coordinates to represent each motorcyclist's motion patterns. Finally, these patterns are examined and classified using CNN to detect motorcycle gangs. This method achieves 93.4% accuracy in detecting motorcycle gangs' presence in a video.

6B: Cybernetics and Biomedical Engineering

9:05 ***Analysis of Psychological Stress and Muscle Activity Using Electromyography and Stress Test***

Eldhian Bimantaka Christianto and Beni Rio Hermanto (Bandung Institute of Technology, Indonesia)

Stress is a significant contributor to mental and physical health deterioration and has been widely studied through various physiological measures, one of which is electromyography (EMG), especially the trapezius muscle. This study investigates the relationship between psychological stress and muscle activity using EMG. To induce psychological stress, the Mental Arithmetic Test (MAT) with three increasing levels of difficulty was used. Additionally, stress levels were assessed using the Perceived Stress Scale (PSS-10) and Visual Analogue Scale (VAS) in between stress and rest phases. Data analysis involved calculating the correlation between EMG signals, MAT scores, PSS-10 and VAS scores. The Spearman correlation between all shows that EMG RMS weakly correlates with VAS ($r = -0.18$) and not with MAT scores. VAS moderately correlates with MAT ($r = -0.41$), and RMS shows a positive link with PSS-10 ($r = 0.52$), indicating higher perceived stress aligns with increased muscle activity. These

findings provide insights into the complex relationship between psychological stress, muscle activity, and perceived stress measures. Increased task difficulty generally raised EMG RMS values, likely due to cognitive load and stress, though RMS sometimes decreased in later, more challenging stages, possibly due to muscle fatigue or cognitive overload. Despite limitations such as individual differences in muscle reactivity and task-related fatigue, these findings highlight EMG's potential as a tool for stress detection, offering insights into physiological responses to cognitive stress. Future research should explore multi-modal approaches, larger samples, and more rigorous control of individual variability to strengthen EMG's application in accurately detecting psychological stress.

9:20 ***Architecture Design of TBCare: Mhealth for Drug Adherence Intervention in Tuberculosis Patients***

Dadi Rahmat, Allya Paramita Koesoema and Beni Rio Hermanto (Bandung Institute of Technology, Indonesia)

The effectiveness of anti-tuberculosis drugs is related to adherence. Monitoring patient medication activity with digital medication monitoring tools is used to improve success rates. Subjective feelings of improvement drive the reason patients discontinue their tuberculosis treatment before treatment evaluation or the adverse effects of anti-tuberculosis drugs that lead to decreased patient motivation to complete the treatment. The TBCare mobile health application is designed to address the problem of tuberculosis adherence. Features such as reminders, push notifications, an explore page and a list of informative videos are implemented to intervene in patient medication adherence. Gemini AI is used to deliver information on the explore page to overcome cognitive barriers to treatment issues. The feature behavior change technique is considered for implementation based on intervention goals to help improve patient adherence to tuberculosis treatment with action planning, prompt/cues, self-monitoring, shaping knowledge, and information about health consequences. A TBCare design is proposed with a service-oriented architecture by a 3-layer canvas using a low code development platform. This study aims to build the TBCare application and design research methods to test the impact of using TBCare on the stage of change of adherence to TB medication. Future research will investigate the causal relationship between mhealth interventions and adherence to medical treatment. The impact of TBCare on adherence will be measured with the transtheoretical model using the stage of change questionnaire, where the process of change intervenes in the decision balance scale and self-efficacy.

9:35 ***Modified ReLU in Deep Learning Models and Explainable AI Techniques for Accurate and Interpretable Breast Cancer Subtype Classification***

Wahyu Adi Nugroho, Catur Supriyanto, Guruh Fajar Shidik and Pujiono Pujiono (Universitas Dian Nuswantoro, Indonesia)

Breast cancer is a serious condition that presents a considerable risk to life if not identified in its initial stages. Numerous approaches for identifying breast cancer remain to be performed conventionally through medical examination, which entails limits in accuracy and reliability. Recent technological advancements have led several researchers to create diverse deep learning methodologies for automated breast cancer diagnosis, particularly convolutional neural network (CNN) models. The main

objective of this study is to make the CNN model work better by modifying the rectified linear units (ReLU) activation function to distinguish eight subtypes of breast cancer. Based on the experiment results, the DenseNet201 model with LessNegativeReLU modified activation function obtained the best performance with accuracy, precision, recall, and F1-Score of 96.04% (α = 0.09), 96.45% (α = 0.03), 96.04% (α = 0.09), and 96.14% (α = 0.03), respectively. The findings demonstrate that the proposed method effectively enhances and optimizes the CNN model performance. This study also employed explainable AI (XAI) techniques to improve the understanding of model prediction results, consequently enhancing clinician's confidence in its implementation. By improving the interpretability of AI-driven predictions, this study aims to support the practical adoption of these models in clinical settings, ultimately contributing to better diagnostic processes and outcomes in breast cancer care.

9:50 ***A Machine Learning Framework for Valve Disease Detection and Cardiac Parameter Estimation Using Seismocardiogram Signals***

Moirangthem James Singh (Indian Institute of Technology Guwahati, India); L N Sharma (IIT Guwahati, India); Samarendra Dandapat (Indian Institute of Technology Guwahati, India)

Effective early screening is essential for preventing the progression of valvular heart diseases, such as stenosis and regurgitation. Diagnostic tools such as echocardiography, which are costly and require trained experts, often limit early detection in low-resource settings. This study explores the potential of seismocardiogram (SCG) signals as a cost-effective, userfriendly alternative for cardiac health monitoring. We propose a machine learning framework utilizing SCG signals to detect valve diseases and estimate key cardiac parameters: ejection fraction (EF), left ventricular end-diastolic dimension (LVEDD), and left ventricular posterior wall thickness (LVPW). Our novel feature extraction approach integrates Berthil cepstrum with spectral and wavelet-based methods to process artifactfree 2-second SCG segments. These features are used to train XGBoost classifiers and regressors. Evaluated on a cohort of 16 stenosis and 13 regurgitation patients from a publicly available SCG database, our model demonstrates remarkable performance improvements over existing methods. Using the Root Mean Squared Logarithmic Error (RMSLE) objective function, XGBoost regressor models achieve significant improvement compared to those using Mean Squared Error (MSE). Feature importance analysis reveals that the top 20 features retain the most relevant information, making the model computationally efficient with minimal performance loss. This study presents a promising and reliable tool for the early detection of stenosis and regurgitation, along with accurate estimation of cardiac parameters.

6C: Cybernetics and Internet-of-Things (IoTs)

9:05 ***Performance Evaluation of the Dragino DLOS8N and Four-Faith F8L10GW LoRaWAN Gateways in an Urban Scenario***

Reynaldhi Tryana Graha and Raihan Radhitya Setiawan (Telkom University, Indonesia); Hanif Fakhrurroja (National Research and Innovation Agency, Indonesia & Telkom University, Indonesia); Linda Meylani and Dita Pramesti (Telkom University, Indonesia)

This study evaluates the performance of two widely used outdoor LoRaWAN gateways, the Dragino

DLOS8N, and Four-Faith F8L10GW, in a dense urban environment. Urban areas, characterized by dense buildings, vehicle activities, narrow streets, commercial complexes, and substantial interference, present unique challenges to LoRaWAN networks, particularly under non-line-of-sight (NLOS) conditions. Measurements were conducted at distances ranging from 500 to 2000 meters, with key metrics such as Received Signal Strength Indicator (RSSI) and Signal-to-Noise Ratio (SNR) assessed across various Spreading Factors (SF). Comparing the Dragino DLOS8N and Four-Faith F8L10GW gateways is essential, as each device has distinct hardware specifications and antenna configurations, influencing network reliability and coverage in identical urban settings. The findings reveal that while both gateways maintain acceptable RSSI levels at shorter distances, SNR deteriorates significantly over longer distances, especially when physical obstructions are present. Notably, the Dragino DLOS8N achieves better range performance due to its higher antenna gain, highlighting the importance of selecting gateways with suitable specifications for urban deployments. These insights provide practical guidance for optimizing LoRaWAN deployment in densely built environments, highlighting the critical role of careful gateway selection and strategic placement in enhancing coverage and reliability. The results are particularly relevant for urban IoT applications, such as smart city infrastructure and industrial automation, where reliable connectivity is essential for data transmission.

9:20 ***Design and Development of a Woman Safety Device Prototype with Fingerprint Authentication***

Danang Enggar Risyaf Alam (National Cyber and Crypto Polytechnic, Indonesia); Fetty Amelia, Dion Ogi and Desi Marlena (Politeknik Siber dan Sandi Negara, Indonesia)

The growing need for personal safety, especially for women and children, has driven the development of Internet of Things-based wearable security devices. This paper presents the design and development of a security device equipped with GPS and GSM for real-time location tracking and emergency notification. The device also integrates fingerprint biometric authentication to ensure secure access and prevent unauthorized use. Additional features such as a camera and voice recorder enable the collection of audio-visual evidence that can be used as legal proof. The ASCON-128 encryption algorithm is used to protect user data privacy by securing the stored recordings, and the cryptographic keys are generated directly from biometric data. The testing showed that the device functions well in sending emergency notifications, tracking location, and recording the event as the evidence, both in the form of images and sound. The average location deviation of this prototype based on GPS sensor reached 5.43 meters and the furthest deviation reached 10.53 meters. The device's power consumption with a standby mode usage of 60.84 Wh and an active mode usage of 41.25 Wh. However, challenges in the decryption process required further improvement. Overall, this device offers an innovative solution to enhance the safety and legal protection of women in dangerous situations, with potential for further development.

9:35 ***Public Perceptions Regarding Data Privacy in Use of Smart Speaker***

Frederic Gabriel, Jayson Cornelis, George Samuel Handaja and Anderes Gui (Bina Nusantara University, Indonesia)

This study aims to determine public perceptions of smart speakers regarding data privacy. Digital

technology such as artificial intelligent (AI) are growing every year and implemented in many devices, which includes smart speakers. Smart speaker as virtual assistant makes people can interact with system using internet of things. There are several issues related with this, one of them is data privacy because smart speakers track user voice input and processed it through the internet. This research uses quantitative methods through online questionnaires and the population are Indonesia citizens that have not yet use smart speakers with the sample size of 187 samples. A modified Technology Acceptance Model (TAM), is used for this research. which consists variable factors such as perceived privacy (PP), perceived enjoyment (PE), perceived usefulness (PU), perceived ease of use (PEOU), attitudes (AT), behavior intention (BI), and perceived trust (PT). This research revealed that perceived trust does not influence on attitude toward using smart speaker, but perceived usefulness, perceived ease of use, perceived privacy, and perceived enjoyment positively influence the attitude towards smart speakers. Perceived usefulness and attitude positively also influence the respondent intention in using smart speakers. The limitation of this study is small sample size and limited survey area.

9:50 ***Enhancing Community Project Effectiveness: A Real-Time Monitoring and Evaluation Framework with Rule-Based Algorithms, Advanced Encryption Standard, and Content-Based Filtering***

Renz Cyril V. Raymundo, Princess G. Lara and Criselle J Centeno (University of the City of Manila, Philippines); Ariel Antwaun Rolando Sison (University of the City of Manila); Jetro L San Diego and Mary Grace N. Gonzales (University of the City of Manila, Philippines)

This study addresses inefficiencies in the City Planning and Development Office's manual processes for monitoring and evaluating project proposals from 80 barangays. These processes are time-consuming, error-prone, and delay decision-making. To address these issues, this study proposes an ICT-based system to automate real-time monitoring, evaluation, and communication, improving transparency, accountability, and efficiency. The system employs a Rule-Based Algorithm to assess project performance, identify issues, and suggest corrective actions. Advanced Encryption Standard (AES) enhances data security, protecting sensitive project information. Additionally, Content-Based Filtering analyzes past proposals and trends to recommend projects that align with community needs, aiding barangay officials in informed decision-making. Key features include automated proposal consolidation, real-time project tracking, report generation, and suggestions for resolving implementation issues. It also integrates a secure messaging platform for efficient communication between barangay officials and the City Planning and Development Office. This improves coordination and streamlines formerly paper-based workflows. Aligned with Sustainable Development Goals (SDGs) for innovation, sustainable cities, and responsible consumption, the system provides a scalable and secure solution to enhance local governance. Agile methodology ensures continuous improvement, while ISO 25010 standards guide quality assurance. By automating submission, tracking, and evaluation, the system reduces inefficiencies and enhances resource allocation and project management within the City Planning and Development Office. It aims to transform traditional practices, fostering more sustainable and effective governance.

6D: Cybernetics and Biomedical Engineering

9:05 ***Implementation of Ensemble Machine Learning with Voting Classifier and CLAHE Pre-processing for Reliable Tuberculosis Detection***

Muhammad Ilham Jauhari, Catherine M Sudarno, Rifani Rachmat, Inung Wijayanto, Sugondo Hadiyoso and Achmad Rizal (Telkom University, Indonesia)

Tuberculosis is an infectious disease caused by microorganisms. Tuberculosis is spread through the air and saliva that contain mycobacterium tuberculosis. If not treated immediately, it can disperse to other vital organs, such as the heart and liver, and can even lead to death. In this study, developed a severe tuberculosis detection system using 4200 dataset consist from 3500 Normal and 700 TB from as a combination from three datasets, NLM, Belarus, and RSNA datasets. This study aimed to create lightweight computation with Voting Classifier in Ensemble Learning as the classifier using Imbalance data and Contrast-Limited Adaptive Histogram Equalization (CLAHE). Initial experiments used single machine learning with the best-performing models, Support Vector Machine (SVM), and Random Forest (RF) as classifiers produce an accuracy of 98.6% and 98%, respectively. Both methods were combined using Ensemble Learning without feature extraction. The accuracy, AUC, Recall, Precision, and F1-score using the voting classifier were 99.16%, 99.9%, 98%, 99.3%, and 98.78%, respectively. Apart from high accuracy, the proposed method can also overcome imbalanced data. These results compete with previous research using deep learning.

9:20 ***PCB-based Wireless Biomicrofluidic Device for Biochemical Detection toward Point-of-Care Applications***

Bao-Anh Hoang (VNU University of Engineering and Technology, Hanoi, Vietnam); Nguyen Thi Bich Ngoc (Ha Noi Unviversity of Science, Vietnam); Thuy Ha Tran Thi (Posts and Telecommunications Institute of Technology, Vietnam); Phu Nguyen Van (VNU University of Science, Vietnam); Tung Thanh Bui (VNU University of Engineering and Technology, Vietnam); Tuan Quoc Vu (VNU, University of Engineering and Technology (UET), Vietnam)

This study presents the design, fabrication, and characterization of a microfluidic device using printed circuit board (PCB) technology, laser engraving acrylic channels, and an LC wireless sensing technique. The proposed method enables rapid fabrication and testing of the microfluidic device. A wireless sensing element, consisting of a PCB-coplanar capacitive sensor and a PCB-coplanar inductor was designed and integrated. Microfluidic channels were fabricated using laser engraving on acrylic, then bonded to the PCB substrate with a UV resin layer to form a complete wireless sensing microfluidic device. The performance of the proposed device was then verified by injecting various biochemical solutions, such as NaCl, glucose, and BSA protein, into the microfluidic channel. The capacitive sensor embedded within the acrylic microchannel was connected to a PCB-coplanar inductor, forming a passive wireless LC sensor that exhibits frequency shifts in response to different biochemical solutions and solution concentrations. By analyzing these different frequency shifts biochemical solution and concentration can be determined, demonstrating the device's capability of detecting certain biochemical solutions. With these initial results, the proposed device has a high potential to be applied in point-of-care applications.

9:35 ***Classification of Prostate Precancerous Cells using DenseNet-201 and Inception-v3 Models***

Yessi Jusman, Dwi Ahirita Ramadani and Muhammad Ahdan Fawwaz Nurkholid (Universitas Muhammadiyah Yogyakarta, Indonesia)

Prostate cancer is globally recognized as the fourth most common cancer, with approximately 1.3 million cases reported annually. Diagnosing prostate cancer remains challenging due to the potential for diagnostic errors caused by unclear imaging, leading to prolonged diagnostic times. To address this issue, artificial neural networks offer a promising solution by assisting medical teams in classifying prostate cells with greater speed and accuracy. This study focuses on the comparative analysis of two convolutional neural network (CNN) models, DenseNet-201 and Inception-v3, for prostate cell classification. DenseNet-201 demonstrated superior accuracy during training, achieving an average of 98.85% (STD ± 0.89), compared to Inception-v3's 98.49% (STD ± 0.85). However, Inception-v3 excelled in processing efficiency, with an average runtime of 19 minutes and 6 seconds, significantly outperforming DenseNet-201's 95-minute runtime. During testing, both models achieved exceptional classification performance, with DenseNet-201 and Inception-v3 recording average accuracies of 97.32% and 97.39%, respectively. These findings confirm the effectiveness of both models for prostate cell classification, with DenseNet-201 excelling in accuracy and Inception-v3 offering faster processing. This research highlights the potential of CNNs in improving diagnostic workflows and underscores their applicability in medical image analysis. Future studies may explore hybrid models or optimizations to balance accuracy and efficiency for clinical deployment.

9:50 ***Digital Forensic on Image Manipulation Crime - A Systematic Literature Review***

Syifa Nurgaida Yutia, Christanto Triwibisono and Gagas Ezhar Rahmayadi (Telkom University, Indonesia)

Image manipulation crimes have become increasingly common due to the widespread use of advanced digital devices and social media. These crimes involve altering digital images to deceive, defraud, or cause harm, with significant implications for privacy, security, and trust. As images can be easily manipulated and disseminated online, it has become easier for malicious actors to spread misinformation, steal personal information, and commit fraud. This highlights the urgent need for robust detection and prevention methods. Verifying the authenticity of images, known as digital image forensics, is essential. Forensic methods used for image analysis include metadata analysis, frame analysis, and pixel analysis. Leveraging these methods is expected to offer solutions for tackling image manipulation; however, their implementation presents several challenges. The objective of this study is to apply the Systematic Literature Review (SLR) methodology to explore the challenges in digital image forensics related to image manipulation from the last five years (2018-2023) that remain unaddressed. Through the SLR method, research papers were identified using the IEEE Xplore Digital Library, following established inclusion and exclusion criteria. From an initial pool of 246 journals, 26 were selected for detailed investigation. The literature review shows that research in this field continues to grow, with 26 distinct methods identified. The three most common methods are Convolutional Neural Networks (CNN), Blockchain Technology, and Machine Learning. The results of this study provide valuable insights into current research trends and can serve as a guide for future studies in this evolving field.

Wednesday, December 18 10:15 - 12:15

7A: Cybernetics and Biomedical Engineering

10:15 ***Segmentation and Recognition of Aerial Handwritten Hiragana***

Kotaro Hosono, Shin-ichi Ito, Momoyo Ito and Minoru Fukumi (Tokushima University, Japan)

This study try to recognize handwritten hiragana in the air. Five or three characters, such as "a-i-u-e-o" or "yayu-yo", are written overlapping in the same area in the air. The trajectory of the fingertip at that time is acquired as 3D time series data using the Leap Motion Controller. The data value is normalized from the minimum of 0 to the maximum of 1 to reduce the effects of character size and writing position. For character recognition, multiple characters are divided into single characters. To do this, division by "movement strokes" is adopted. Characters are divided by finding "movement strokes," which are the parts that connect characters to the next character, from the character data and deleting them. By learning and identifying whether a character is a "moving stroke" using LSTM (Long Short Time Memory), character division can be performed even for unknown data. In addition, for each divided character, LSTM is similarly used to classify the 46 hiragana. The input multiple characters and the finally recognized multiple characters are evaluated using the Levenshtein distance. The accuracy rate was 52.333% for a Levenshtein distance cost of 0, 3.500% for 1, 36.167% for 2, and 8.000% for 3 or more. The accuracy rate for a Levenshtein distance cost of 0 when manually segmenting characters was 94.278%, so the accuracy of character segmentation needs to be improved.

10:32 ***A Real-time Analytics Approach for Computer Vision Syndrome Detection***

Gabriel Alvaro and I Made Murwantara (Universitas Pelita Harapan, Indonesia)

The widespread use of digital devices has increased the prevalence of Computer Vision Syndrome (CVS), characterized by symptoms such as low blink rates, eye strain, and irritation. Existing CVS prevention systems often focus solely on blink rate, limiting the range of symptoms detected. This paper presents a real-time CVS identification system that integrates multiple visual metrics, including pupil dilation, red-eye detection, and blink rate, for a more accurate and holistic CVS detection. A method based on eye and iris landmark detection relies on a pre-trained convolutional neural network model to track the eye region. The proposed method was demonstrated by training data from five racial groups using fifty equally distributed images between male and female subjects. The fastest detection was performed for Caucasian males, and the slowest was observed on East Asian male subjects, with the detection time consistently under one second. In detecting pupil dilation, the accuracy of the proposed method is 78% based on videos of normal and dilated pupils. Designed for efficiency with training data across diverse demographics, the system achieved an overall performance score of 84%, achieving strong detection precision and wide coverage of symptoms.

10:49 ***A Consideration on Understanding of a Learning Based on EEG and ECG analysis Using Artificial Intelligence Models***

Ryota Miyake, Shin-ichi Ito, Momoyo Ito and Minoru Fukumi (Tokushima University, Japan)

Many studies utilize biological signals such as electroencephalogram (EEG) and electrocardiogram

(ECG) to estimate human states. Several studies show that combining multiple signals improves the accuracy of estimating complex states compared to using a single signal. However, the effective processing and integration of heterogeneous signal types continues to pose significant challenges. In this paper, a method is proposed to combine EEG and ECG with various artificial intelligence (AI) models to estimate and analyze learning understanding. In the proposed method, EEG and ECG features are extracted by various AI models, and these features are combined to classify the presence or absence of understanding. Convolutional neural networks (CNN) and EEGNet are employed for EEG feature extraction, and LSTM, GRU, and CNN are employed for ECG feature extraction. The combination patterns are all combinations of each feature extraction AI model. In experiments, participants answer "I understand" or "I do not understand" to an IQ test, while EEG and ECG are recorded. The proposed method is validated and analyzed with EEG and ECG obtained from experiments. In experimental results, the combined model performed best in precision (75.7% ± 0.9%) and sensitivity (83.0% ± 2.0%) when a CNN was employed to extract EEG and ECG features. In addition, the comparison of each pattern confirmed that there were differences in the tendency of misidentification data depending on the combined model. The results suggest the effectiveness of the CNN-based combination of EEG and ECG. Also, Comparison of each pattern revealed effective processing and issues for the combination of EEG and ECG, respectively.

11:06 ***Evaluating XGBoost for Competitive Insurance Pricing: A Case Study on Motor Third-Party Liability Insurance***

Jonathan Ibrahim, Jonathan Stanley and Hendri Murfi (Universitas Indonesia, Indonesia); Fevi Novkaniza (University of Indonesia, Indonesia); Sindy Devila (Universitas Indonesia, Indonesia)

In numerous studies, the Gradient Boosting Machine (GBM) has shown strong out-of-sample performance on insurance claim data. This evidence has led to increased interest in enhanced versions of GBM, such as XGBoost. Some studies highlight the superiority of XGBoost over GBM on insurance claim data. However, many of them focus only on statistical model fit rather than assessing the model's effectiveness as a pricing tool, especially its economic value. Our study takes a different approach by evaluating the potential of XGBoost as a pricing model through both out-of-sample statistical performance and model lift. The experiment was conducted using Motor Third-Party Liability (MTPL) claim dataset obtained from a Belgian insurer in 1997. In terms of statistical performance, results show that XGBoost and GBM perform similarly on the frequency component, outperforming other models like Random Forest or Generalized Additive Model (GAM). For the severity component, neither XGBoost nor GBM surpasses the simple GAM. However, XGBoost is still generally a better severity model than GBM in most trials. Model lift reveals that XGBoost offers an economic advantage over GBM, especially when assessing low-risk policyholders. According to the Gini index, XGBoost is also identified as a model with minimal susceptibility to adverse selection, making it a promising choice for insurance pricing. Overall, our findings suggest that XGBoost is effective both statistically and economically. This supports its potential as a powerful pricing model.

11:23 ***Adaptive Software Management for Economic Drone: Leveraging Software Product Line Engineering for Multi-Mission Efficiency***

I Made Murwantara and Pujianto Yugopuspito (Universitas Pelita Harapan, Indonesia)

The control of software within drone ecosystems is a critical aspect of UAV (Unmanned Aerial Vehicle) operations. Drones assigned to multiple missions, such as surveillance, delivery, or search and rescue, require adaptable software configurations for efficient management. The use of Software Product Line Engineering (SPLE) has emerged as a promising approach to address these needs, allowing for the creation of modular, reconfigurable software that can be easily tailored to different mission requirements. SPLE enables the efficient preparation of drones for varied tasks, reducing development time and operational costs. Moreover, autonomous drone systems add complexity, requiring flexible software reconfiguration mechanisms. By implementing SPLE, the drone software ecosystem becomes more sustainable and flexible, ensuring effective operation across diverse flight scenarios. In obtaining adaptive flight mission, this work adopted models@runtime to provide on the fly reconfiguration with specific constraints. Such constraint deals with energy, manoeuvrability, distance and reliability to support flexibility of a simple drone. Some challenges arise in this work including sensor fusion to support flight management as a result of the absence of sophisticated navigation support devices. This paper discusses the importance of SPLE in enhancing the operational efficiency and adaptability of economic drones in dynamic mission environments by utilizing transition model.

11:40 ***A Prototype Tool for Assisting Stopwatch Calibration with a Data Recording System Based on Imaging Techniques***

Willi Sutanto (Metrology and Instrumentation Academy, Indonesia & Ministry of Trade, Indonesia); Grace Natalia Silaen, Gianto Gianto, Vera Firmansyah, Dudi Adi Firmansyah and Nandang Gunawan Tunggal Waras (Metrology and Instrumentation Academy, Indonesia)

A stopwatch serves as a crucial device utilized across multiple domains, including athletics, medical settings, and metrology, primarily for the purpose of quantifying time intervals. Stopwatch calibration is necessary to ensure accurate measurements and compliance with national or international standards. This study aims to develop a prototype for stopwatch calibration that employs a data recording method through an imaging technique based on the YOLO (You Only Look Once) algorithm. This prototype is designed to press the start and stop buttons automatically on both the test and the standard stopwatches and recording the time measurement results accurately. The prototype mainly consists of a RTC DS3231 as a time keeper, two push-pull solenoids to push stopwatch buttons, a microcontroller to control the solenoid, a webcam to capture images of the stopwatch display and a laptop to process the captured images. To transform the images into numerical data, this study used the YOLO version 8 algorithm and some programming applications. The findings showed that the prototype performed well in assisting stopwatch calibration activity which are shown by small errors and uncertainties in calibration results, and an effective detection system with an accuracy of 96.7%, precision of 0.967, recall of 1, and F1 score of 0.982. Therefore, this prototype is expected to enhance the efficiency and accuracy of stopwatch calibration for operators

11:57 ***Comparative Analysis of Interbeat Interval and Heart Rate Variability Measurements from Wearable Devices***

Raudha Munawarah, Hansel Valentino Tanoto and Nur Ahmadi (Bandung Institute of Technology, Indonesia); Rahmat Mulyawan (Institut Teknologi Bandung (ITB), Indonesia); Rayhan Maditra Indrayanto and Khamelia Malik (University of Indonesia, Indonesia); Trio Adiono (STEI

ITB, Indonesia)

Heart rate variability (HRV) is a key indicator of autonomic nervous system (ANS) function, playing a crucial role in assessing both cardiovascular and mental health. Traditionally, HRV is measured using electrocardiogram (ECG) devices which provide precise interbeat interval (IBI) detection but can be cumbersome for continuous use. Rapidly growing wearable devices equipped with photoplethysmography (PPG) sensors offer a more convenient and mobile solution for longterm monitoring. In this study, an algorithm is proposed for estimating IBI and HRV from a multichannel PPG-based wearable device, and its accuracy and reliability are evaluated against ECG-based measurements. Performance of the proposed algorithm is compared to that of the device's built-in algorithm. Data were collected from 15 healthy participants engaged in relaxing activities, including lying down, sitting, and walking. The proposed algorithm achieved mean absolute percentage error (MAPE) of 41%, while the device's built-in algorithm exhibited a higher MAPE of 216.6%. These results demonstrate the good accuracy and reliability of the proposed algorithm in estimating HRV. The overall results provide insight into the potential of PPG-based wearables for continuous HRV monitoring.

7B: Cybernetics and Information Management in Business

10:15 ***The Impact of User Generated Content (UGC) on Impulsive Buying in Live Streaming Marketing***

Manaek Mikael, Mohammad Alexander and Ilham Prabintang Setio (Bina Nusantara University, Indonesia); Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia)

The internet is growing, which affects the business industry's ability to keep up with its development by doing live streaming marketing. Live streaming marketing makes consumers make impulsive purchases because consumers can interact with sellers in real time and see people's reviews through comments, making consumers' buying intentions higher. The objective of this study is to explain how usergenerated content in live-streaming marketing acts as an impulsive buying factor. It can also be referred to as usergenerated content. Other consumers create user-generated content to give their honest review of a product in a video, photo, or other format. The data was collected through a questionnaire distributed in June-September 2024 to 154 customers who buy via live streaming. The data collection method used is purposive sampling; the data is then processed using Structural Equation Modeling (SEM) with Smart PLS as tool. There are six variables in this research, there are: user generated content, content authenticity, social interaction, emotional appeal, pleasure, and impulsive buying with seven hypotheses. The results showed that the value of user-generated content, social interaction, and content authenticity in live-streaming marketing has a significant effect on pleasure and emotional appeal so that it can impact impulsive buying for users.

10:30 ***Improving facility layout using genetic algorithm and Simulated Annealing***

Rahmanda Wulandari (Bina Nusantara University, Indonesia)

PT XYZ is a manufacturing company in the automotive field. Based on the current layout conditions, the metal division is not optimal, as it was not initially designed with proper layout planning,

particularly considering the proximity between workstations. As a result, the material flow is inefficient. This can be observed from the placement of several workstations that are still far apart, leading to long material transfer distances during the production process. Given this situation, it is necessary to improve the production floor layout by first calculating the initial material handling costs, and then determining a new production facility layout with a more optimal material transfer distance. Overall, the layout derived from applying the Genetic Algorithm (GA) based on Simulated Annealing (SA) as the initial design achieved an MHES cost of Rp 83,304,888.21. This reflects a cost difference of Rp 30,484,999.71 when compared to the initial layout, indicating a 23.40% reduction in MHES costs. In contrast, the difference in MHES costs between the Genetic Algorithm (GA) and the initial layout is Rp 27,172,147.68, representing a 20.86% decrease. Additionally, the difference between the Genetic Algorithm (GA) costs and those from the Simulated Annealing (SA) results is Rp 46,934,016.13, leading to a 36.03% cost reduction. Therefore, the optimal choice for the layout design in this study is the Genetic Algorithm (GA) based on the results of Simulated Annealing (SA) due to its superior MHES cost efficiency.

10:45 ***Analysis of Behavior and Acceptance of Biometric Authentication System on Students Using the UTAUT Model***

Reihan Syahfitra Wirawan and Rio Guntur Utomo (Telkom University, Indonesia)

This study explores the factors influencing Indonesian students' acceptance of biometric systems, using a modified Unified Theory of Acceptance and Use of Technology (UTAUT) model to structure the analysis effectively. Specifically, the study examines the impact of factors such as perceived ease of use, social influence, security, and privacy concerns on students' intentions to adopt biometric technology in an academic environment. A structured survey was administered to a representative sample of 479 students, and results demonstrated that the survey had high reliability and that the questions effectively captured the constructs being studied. Findings reveal that students are more inclined to use biometric systems if they perceive the technology to enhance academic performance, be user-friendly, and offer sufficient security. Additionally, social influence where expectations from peers, instructors, or institutional norms also positively affects their acceptance. Interestingly, privacy concerns were not a significant deterrent, suggesting students are less apprehensive about privacy risks than expected in this context. These insights emphasize the importance for educational institutions to have the appropriate technology and infrastructure to support biometric systems effectively. By addressing these key factors, institutions can encourage greater acceptance and utilization of biometric technology among students, thereby fostering a more secure and efficient academic environment.

11:00 ***LayOut Loud: An AI-Powered Augmented Reality and Mobile Application for Room Interior Design and Layout Optimization***

John Raphael G. Cuevas, John Kenneth R. Rili, Anny Neolicia G. Santillan, Vivien A. Agustin, Mary Grace N. Gonzales, Criselle J Centeno and Richard C. Regala (University of the City of Manila, Philippines)

LayOut Loud is an AI-powered augmented reality (AR) and mobile application designed to

revolutionize room interior design by offering tailored, real-time solutions for layout optimization. The primary objective of this tool is to design AI-powered features that analyze user-provided room dimensions, furniture types, and style preferences. By leveraging advanced algorithms, LayOut Loud generates personalized design suggestions that cater to the individual needs and aesthetic tastes of users, ensuring that each interior design experience is customized and unique. A key goal of the application is to enhance user experience and decision-making through a clustering algorithm. This algorithm categorizes furniture pieces based on their suitability and appearance in living spaces, streamlining the selection process for users. By enabling the visualization of these items in a 3D model, users can make informed decisions about their interior design choices, ensuring that each piece contributes to the overall aesthetic and functional harmony of the space. Additionally, LayOut Loud focuses on improving its AR capabilities by allowing users to capture their room layouts and view virtual furniture arrangements in real time. This feature provides practical, interactive design solutions, empowering users to experiment with different configurations and instantly see how potential changes would appear in their actual living environments. Ultimately, LayOut Loud offers a user-friendly, immersive platform that transforms the way individuals approach interior design.

11:15 ***Examining the Factors Influencing the Website Continuous Actual Usage of SME Owners in Indonesia***

Jennie Rowan, Christopher Suryadi and Christian Theddy (Bina Nusantara University, Indonesia);
Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia)

The technologies encourage SMEs to expand their market. Websites have developed into important tools for ensuring the continued existence of SMEs through customer loyalty. The research problem is that SME owners have not continued to improve their websites due to factors that influence continuing intention to use the website, such as cost, facilities, etc. This study aims to examine the factors that influence SME owners' decisions to continue using websites for their businesses. A purposive sampling strategy is used to determine the size of this study sample. It also used quantitative techniques and data collecting via a Google Form survey, which included 225 of 250 SME owner respondents from the JABODETABEK area of Indonesia. The data, collected between March and June 2024, is processed using SmartPLS-SEM. The research models used are Technology Acceptance Model and Technology Organization Environment by analyzing eight variables: Relative Advantage, Complexity, Perceived Cost, Facilitating Conditions, Security Concern, Perceived Trust, Continuous Intention to Use, and Continuous Actual Usage. There are eight hypothesis that are significant, Relative Advantage on Continuous Intention to Use, Complexity on Continuous Intention to Use, Perceived Cost on Continuous Intention to Use, Facilitating Conditions on Continuous Intention to Use, Facilitating Conditions on Perceived Trust, Security Concern on Perceived Trust, Perceived Trust on Continuous Actual Usage, and Continuous Intention to Use on Continuous Actual Usage. More research is needed to determine whether this is an effective strategy to improve the technological digitalization of SMEs in Indonesia.

11:30 ***Investigating OTT Subscription business in Indonesia: Analysis Perceived Value to Behavioral Intention trough mediator and moderator examination***

Rajiv Dharma Mangruwa, Shaomi Fujiyanti Amalia and Nurafni Rubiyanti (Telkom University,

Indonesia)

The Over-The-Top (OTT) streaming business involves providing streaming media services that foster business growth and innovation directly to viewers via the internet. The increasing demand for Over-The-Top (OTT) services in Indonesia has been propelled by advancements in internet infrastructure, cost-effective data plans, and the widespread adoption of smart devices. Through providing unlimited access to diverse content, Netflix firm growth by offering flexible and personalized viewing experience for media business sustainability. This study aims to examines how application-based OTT services, particularly Netflix, have transformed the entertainment industry in Indonesia. The research examines the leverage of perceived value on behavioral intention through social identity, considering age and gender as moderating factors. Using a quantitative approach with a sample of 250 Netflix users and Structural Equation Modeling (SEM) analysis via SmartPLS 3.2.9, the findings recommend that the industry implement advanced algorithms for personalized content and enhance social identity through interactive features. The study found that the substantial mediating effect of social identity (Z), with perceived value (X) exerts a significant influence on behavioral intention (Y) has significant impact. Surprisingly, the analysis found no significant moderating effects of age and gender on these relationships. Future research should focus on observing platforms to further understand user behavioral intentions.

11:45 ***Factors Affecting The Effectiveness Of Hospitality Information System***

Sherleen Daventa and Henkie Ongowarsito (Bina Nusantara University, Indonesia)

Tourism and hospitality are some of the most profitable industries in the global market. This industry can also determine the sustainability of a country's national economy, including that of Indonesia. Hospitality information system applications are used to support the effectiveness of hotel services in the hospitality industry. A good hotel system is expected to provide a competitive advantage for the hotel itself, so customers are more comfortable staying there. Rhapsody is a hotel information system application developed in 1988 and has served more than 500 hotels in Indonesia and 6 Asian countries. This application has experienced various problems often reported by users, resulting in dissatisfaction. These problems are in the form of requests for system modifications and UI and UX updates, which are considered unresponsive and unattractive to application brands discussed in this study. Until the latest version of this application, namely Rhapsody 10, users still often complain about it. This study combines the UTAUT, TTF, and IS Success Model models. Data was collected using a questionnaire. Thirty hotels use Rhapsody, with 46 users as respondents-data analysis using SEM-PLS. The results show that Rhapsody 10 is effectively used for hotel services because it has good performance, is easy to use, has available facilities that can be used to run applications with interrelationships between task characteristics and technology, and provides quality information.

12:00 ***Artificial Intelligence in Security Education, Training and Awareness: A Bibliometric Analysis***

Hasiva Amalia Dewi, Candiwan Candiwan and Puspita Kencana Sari (Telkom University, Indonesia)

In an era where digital threats are increasingly sophisticated, integrating Artificial Intelligence (AI)

in Security Education, Training, and Awareness (SETA) programs is essential to foster cybersecurity resilience. This research explores the integration of AI in SETA programs, an important area in improving cybersecurity resilience. Despite the advancement of AI for technical cybersecurity applications, there is a lack of research on how AI can improve cybersecurity education. The main objective of this study is to analyze current trends and identify gaps in the use of AI for cybersecurity SETA through bibliometric analysis. Using a dataset of 637 Scopusindexed articles published from 2019 to 2024, this study utilized VOSviewer software to map research trends and clusters related to AI, cybersecurity, education, training, and awareness. The analysis revealed six significant clusters, which address cybersecurity, application and education, artificial intelligence, cyber threat detection, security systems, and IoT and internet. Over the past few years, there has been a marked increase in research focusing on the use of AI in cybersecurity education, indicating growing academic interest in this domain. Key findings show that although AI is widely applied in improving cybersecurity defense mechanisms, its educational potential remains underutilized. This study concludes that future research should integrate AI into SETA programs that can enrich the learning experience and be tailored to different knowledge levels, ranging from the public to professionals. This enhanced approach could better prepare individuals to face real-world cyber threats and foster stronger cybersecurity resilience across user demographics.

7C: Cybernetics and Data Science

10:15 ***Time Complexity Optimization Of Data Sorting Using Super Sort Algorithm Method***

Raoda Raoda and Amil Ahmad Ilham (Universitas Hasanuddin, Indonesia)

Sorting algorithms are essential for organizing data in a specific order, making them a critical component of computing processes. Due to their significance, many researchers have developed various sorting techniques to improve both time and space complexity. Super Sort, introduced in 2018, is a hybrid algorithm that combines the processes of Merge Sort and Quick Sort, with the goal of outperforming both. However, further research revealed a weakness in Super Sort: it generates a large number of sublists, particularly when handling duplicate elements. This results in higher memory usage, as multiple small sublists must be combined during the sorting process. To address this issue, the present study introduces a method to reduce the number of sublists by grouping identical values and using a key-based approach to minimize the amount of data being sorted. The experimental results show that the modified Super Sort algorithm demonstrates improved time and space complexity compared to the original version.

10:30 ***Evaluating Vision Transformers Efficiency in Image Captioning***

Bintang Kevin Hizkia Samosir (Universitas Bina Nusantara, Indonesia); Sani M. Isa (Bina Nusantara University, Indonesia)

This study investigates the performance of Vision Transformer (ViT) variants-the Shifted Window Transformers (SWIN), Distillation with No Labels (DINO), and Data-efficient Image Transformers (DeIT)-in image captioning tasks using the Flickr8K dataset. While ViT architectures have shown promise in image classification, their effectiveness for image captioning, particularly with smaller

datasets, remains unclear. The models' performance was evaluated using BLEU metrics, while training efficiency was analyzed through Pareto front analysis of computational time and accuracy. Among the tested variants, SWIN Transformers demonstrated superior performance (BLEU-1: 64.4, BLEU-2: 33.9, BLEU-3: 17.1, BLEU-4: 8.4), followed by DINO (BLEU-1: 63.1, BLEU-2: 32.7, BLEU-3: 16.4, BLEU-4: 7.5), while DeIT showed the weakest performance (BLEU-1: 61.6, BLEU-2: 31.1, BLEU-3: 14.7, BLEU-4: 6.5). SWIN Transformers achieved the shortest training time at 3 minutes 31 seconds per epoch, making it the most efficient model among ViT variants based on Pareto front analysis. While ViT variants achieved competitive BLEU-1 scores comparable to previous top models, they struggled with generating coherent, longer sentences, as evidenced by suboptimal BLEU-4 scores. These findings provide empirical evidence of how the lack of inductive bias in transformer architectures affects their ability to capture complex scene relationships, despite their strong feature detection capabilities, contributing to the understanding of transformer models' limitations in vision-language tasks, especially with limited data.

10:45 ***Analysis of Stunting Prediction for Toddlers in Bekasi Regency Using the K-Nearest Neighbors and Random Forest Algorithms***

Kamelia Khoirunnisa and Putu Harry Gunawan (Telkom University, Indonesia)

Stunting, a condition where children are shorter than their age, is a serious nutritional issue in developing countries, including Indonesia. Research shows that Low Birth Weight (LBW) significantly affects children's growth. In Bekasi Regency, the stunting prevalence remains high at 17%, with a target reduction to 14%. Achieving this target requires prevention efforts focused on improving nutrition and regularly monitoring child growth. In such monitoring, innovative evaluation techniques using Machine Learning (ML) are needed to predict stunting potential. This study aims to develop a predictive model for early detection of stunting risks in Bekasi Regency, using machine learning techniques to analyze Low Birth Weight (LBW) and Low Birth Length (LBL) factors, which could potentially be integrated into the local health monitoring system for preventive intervention. RF excels in handling complex features and identifying important predictors, while KNN is effective at recognizing local patterns. The results show that RF achieved the best performance with 99.22% accuracy and an F1-score of 96.94%, compared to KNN with 96.19% accuracy and an F1-score of 87.16%, highlighting RF's greater stability and robustness over KNN in predicting stunting cases. This study is expected to provide an accurate predictive system that helps parents, health workers, and the government identify stunting potential early while also determining the appropriate ML algorithm for stunting case prediction in Indonesia. Future research is encouraged to test this model in other regions with different characteristics to ensure the generalizability and effectiveness of stunting prediction on a broader scale.

11:00 ***Web-based Application Predicting Cow Hoof Infections with 3D Modeling Scrapping Simulator and Treatment Recommendation***

Heart Angel J. Candelario, Tricia V. Cruz and Patricia Ann R. Gray (Pamantasan ng Lungsod ng Maynila, Philippines); Ariel Antwaun Rolando Sison (PLM, Philippines); Criselle J Centeno and Jetro L San Diego (University of the City of Manila, Philippines)

Veterinary students often face challenges in assessing cow's hoof health due to limited access to live animals and insufficient practical materials, which hinder hands-on experience and impact treatment outcomes. To address these gaps, this study developed WounderCow, a web-based application that integrates image processing, 3D modeling, and AI-driven treatment recommendations. The system allows users to predict cow hoof infections, classify lameness types, assess severity, and receive appropriate treatment recommendations. The development process followed the Agile Scrum framework, with iterative stages focusing on refining key components like image processing, 3D modeling, and AI-driven predictions. After system development, a survey was administered to 53 participants-veterinary students, farmers, and IT professionals-using a four-point Likert scale questionnaire. The results were analyzed to evaluate how well the system met the needs of users. To assess the system's accuracy, a confusion matrix was used to measure precision, recall, and overall accuracy in predicting lameness type, severity, and treatment recommendations. The system was also evaluated against ISO/IEC 25010 standards, ensuring that it met criteria for usability, performance, and reliability. The survey results showed significant satisfaction, with weighted mean scores ranging from 3.29 to 3.45, and 61.9% of respondents strongly agreed that the system improved their ability to assess and treat hoof health issues. The application enables early lameness detection and includes a 3D simulator with step-by-step guidance for hoof scraping and treatment. This study highlights the application's potential to bridge educational gaps while advancing diagnostic and treatment practices for cow hoof conditions.

11:15 ***Analyzing the Effect of NPL, Profitability, and Mobile Banking on Bank Stock Prices During COVID-19 and Normal Times: Evidence from Indonesia***

Rachel Angela Yaputra, Joni Suhartono and Toto Rusmanto (Bina Nusantara University, Indonesia)

This study aimed to analyze the effect of NonPerforming Loans (NPL), profitability, and the adoption of mobile banking on the stock prices of Indonesian banks during the Covid-19 pandemic and in normal times. The research employed a quantitative approach using secondary data, which were obtained from the financial statements of banking institutions listed on the Indonesia Stock Exchange (IDX) from 2019 to 2023. In this study, the effect of independent variables on dependent variables is analyzed by panel data. The independent variable utilized in this research is NPL, Bank's profitability, and mobile banking and the dependent variable used is stock price. The results of the analysis revealed mixed findings. Specifically, it was found that NPL and ROA do not have a statistically significant effect on stock prices. However, ROE, NIM, and Mobile Banking were found to significantly effect stock prices. This study's outcomes are expected to help investors and stakeholders understand banking stock market behavior during economic instability. The novelty of this research lies its investigation into the effect of the COVID-19 pandemic on bank stock prices over 5 years. Through this research, valuable insights are afforded to readers regarding the influence of mobile banking on financial performance and its consequential impact on stock prices.

11:30 ***Adaptive Lineup Recommendation System for Basketball Coaching Using Multi Linear Regression and Decision Support Techniques***

Riley Gem Adriano Faustino, Jomarie G. Cuenco, Marvin Ross S. Galang, Criselle J Centeno, Ariel

Sison and Benito Roger L De Joya (Pamantasan ng Lungsod ng Maynila, Philippines)

Data-driven analytics are rarely used in basketball coaching, leading to ineffective strategies and poor player selection. As a result, the HoopMaster, mobile Android application, is developed to address these challenges, wherein it utilizes advanced data analytics with interactive simulations to improve basketball coaching effectiveness. It uses Multi Linear Regression (MLR) to assess player performance metrics and determine the optimal starting lineup, equipping coaches with the insights necessary for making informed decisions. Additionally, it uses Decision Tree Algorithm to suggest play recommendations matching each player's strength and weakness, allowing for better strategic preparation. To further enhance the coaching experience, HoopMaster has an integrated animated digital court board on which basketball plays can be designed, animated and simulated for teaching or training purposes. This function allows for efficient collaboration and communication during practice and games. HoopMaster seeks to transform and revolutionize the manner of basketball coaching by applying technology in the basketball scene through the integration of Multi Linear Regression for lineup optimization, Decision Tree for strategic insights, and dynamic animation for visual play presentation. The system was applied and evaluated by basketball coaches, players and Information Technology professionals to check its adherence to the requirements set by the standards outlined in ISO 25010.

11:45 ***EmoShown: AI-Powered Emotional Wellness Hub with Sentiment Analysis, Anomaly Detection, and Collaborative Filtering***

Kiann A. Peñaredondo and Jaspher D. Camu (Pamantasan ng Lungsod ng Maynila, Philippines); Criselle J Centeno (Pamantasang ng Lungsod ng Maynila, Philippines); Mark Anthony S. Mercado, Vivien A. Agustin and Mary Grace N. Gonzales (Pamantasan ng Lungsod ng Maynila, Philippines)

An increasing global concern, mental health issues profoundly affect individuals' well-being and productivity, posing significant societal and economic challenges. This study introduces EmoShown, a mobile application that leverages artificial intelligence to enhance emotional wellness through sentiment analysis, anomaly detection, and collaborative filtering. EmoShown incorporates the VADER algorithm, achieving an accuracy of 85%, a precision of 0.86, and a recall of 0.85 for sentiment analysis. The anomaly detection feature, powered by Isolation Forest, identifies emotional pattern deviations with an accuracy of 92%, a precision of 0.74, and a recall of 1.0. The collaborative filtering system, utilizing matrix factorization, delivers personalized activity recommendations with an accuracy of 81%, and a precision and recall of 0.81. These results highlight the app's effectiveness in providing useful information and personalized support. The app fills the gaps in traditional emotional health tools, offering a comprehensive, data-driven approach to mental wellness. By integrating user mood journals, sentiment interpretation, and preference-based recommendations, EmoShown delivers proactive emotional insights and early detection of mental health concerns. Future work will focus on enhancing AI model performance, ensuring robust data privacy, and expanding features to cater to diverse user needs. EmoShown underscores the potential of AI-powered solutions in addressing global mental health challenges.

12:00 ***Classification of Apple Leaf Diseases Using a Modified EfficientNet Model***

Muhammad Abiya Makruf and Febryanti Sthevanie (Telkom University, Indonesia); Kurniawan

Nur Ramadhani (Universitas Telkom, Indonesia)

Plant disease identification is crucial for maintaining agricultural productivity, as early detection can mitigate crop losses and improve overall yield quality. This study explores using EfficientNet, both in its original and modified forms, for classifying apple plant diseases based on leaf images. EfficientNet was chosen due to its scalability and efficiency, making it well-suited for agricultural applications requiring accurate yet feasible solutions. The architecture was modified by removing specific blocks to improve computational efficiency while maintaining accuracy. Experiments using datasets with complex and simple backgrounds evaluated model robustness under varied conditions, such as different lighting, background noise, and natural clutter. The modified EfficientNetB0 variant demonstrated an optimal balance of training time, accuracy, and efficiency, achieving a training accuracy of 99.10%, validation accuracy of 97.40% and a test accuracy of 84.50%, with up to 50% fewer parameters. These findings suggest that the modified EfficientNet is promising for real-world agricultural applications, especially in resource- constrained settings where computational power is limited. It offers an accessible solution for early disease detection, benefiting small-scale farmers without advanced computing infrastructure. Future work involves expanding the dataset to other crops, testing additional disease types, optimizing the model further for edge devices, and integrating it into decision- support systems for real-time monitoring and analysis.

Wednesday, December 18 11:15 - 12:15

7D: Cybernetics and Data Science

11:15 ***Implementation of CNN Algorithm with ResNet-50 Architecture for Vehicle Image Classification***

Dilia Fadilah Mutmainah, Febryanti Sthevanie and Gamma Kosala (Telkom University, Indonesia)

Vehicles are essential transportation tools in our daily lives, serving a crucial role in facilitating mobility and commerce. However, with the rapid growth of the population and urbanization, Indonesia has witnessed a significant increase in the number of vehicles over the years. This surge has led to challenges in data management for government agencies, making it imperative to develop an efficient vehicle classification system. According to previous research, ResNet-50 has consistently shown superior accuracy compared to other neural network architectures. This study aims to design and implement a vehicle classification system utilizing a Convolutional Neural Network (CNN) with the ResNet-50 architecture. The dataset employed in this research comprises seventeen distinct vehicle types, ensuring a comprehensive evaluation of the model's effectiveness. The implementation was carried out using the Adam optimizer, with various hyperparameter settings tested to optimize performance. The evaluation results revealed that the model without pretrained weights yielded the lowest accuracy, as indicated by numerous prediction errors in the confusion matrix. Conversely, the model leveraging pretrained weights demonstrated significantly higher accuracy. Among the models tested, the third model, which incorporated pretrained weights, achieved the highest accuracy of 91.16%. This was followed by the first model with an accuracy of 87.55%. These results underscore the critical role of pretrained weights in enhancing the performance of classification models, particularly in complex tasks such as vehicle classification.

11:22 ***Cure-Sne Model Detects Outliers in Data to Optimize the Process of Clustering Using Representatives***

Dewi Sartika Ginting and Syahril Effendi (Universitas Sumatera Utara, Indonesia); Amalia Amalia (University of Sumatera Utara, Indonesia); Poltak Sihombing (Universitas Sumatera Utara, Indonesia)

Stunting is a problem that always appears in our midst. Stunting prevalence data is important for observing and monitoring the condition of stunting that occurs. However, data with bad values affects the accuracy of the data, so it has a big impact on the information that will be received when the data is processed. For this reason, stunting data is processed using the Cure-Sne model to group stunting prevalence which produces good information. With the Cure-Sne model, the processed dataset also detects a number of outiers that interfere with the values of other real data. In the Cure-Sne process, the amount of data used is 120K rows with 5 attributes which are processed with Cure-Sne to produce 4 Clusters. In Cluster 1, the predominant gender is male, and the nutritional status is classified as normal. Cluster 2 shows a predominance of females with a severely undernourished status. In Cluster 3, males dominate with a normal nutritional status, while Cluster 4 consists mainly of females, also with a normal nutritional status. From 120,000 rows in the dataset, many data were detected as outliers. There are 6,060 outlier data points identified from a total of 120,000 records with 4 attributes. This indicates that a significant portion of the data may not conform to the expected patterns or distributions, suggesting the presence of anomalies that warrant further investigation. Evaluation of Cure-Sne is carried out with the Sillhoute Score. The evaluation or accuracy of the Cure-Sne model in analyzing stunting data is determined to be 0.8450, equivalent to 84.50%.

11:30 ***Optimizers Comparative Analysis on YOLOv8 and YOLOv11 for Small Object Detection***

Marshaniswah Syamsul (Telkom University, Indonesia & Jl. Telekomunikasi No. 1, Terusan Buah Batu, Bandung, Jawa Barat, Indonesia); Suryo Adhi Wibowo (Telkom University, Indonesia)

Object detection has seen significant advancements due to deep learning, particularly in applications that require a balance between speed and accuracy. The YOLO (You Only Look Once) series has led developments in real-time object detection, with YOLOv11 offering the latest architectural enhancements for complex environments. While the model architecture is crucial, the choice of optimizer plays a critical role in determining model convergence, precision, and generalization-essential factors for challenging domains such as aerial imagery. In this study, we evaluate several optimizers-AdamW, SGD, Adam, AdaMax, Nadam, and RAdam-regarding their impact on YOLOv11's performance for small object detection in urban settings. Employing the VisDrone dataset, which is renowned for its densely populated urban imagery, we compare the optimizers based on key metrics: mean Average Precision (mAP), precision, recall, and training efficiency. The results reveal that YOLOv11, when paired with AdamW, achieves the highest mAP of 29.6%, precision of 98.1%, and recall of 68.1%, underscoring its exceptional accuracy in object detection. Furthermore, AdamW enables faster convergence, with a training time of 2.42 ms, making it well-suited for real-time UAV surveillance applications. In comparison, SGD demonstrates commendable performance but falls slightly short in precision and recall. This study offers valuable insights into optimizer selection, aimed at enhancing YOLO model performance, especially in demanding tasks involving small object detection.

11:37 ***Betweenness Centrality on Public Opinion in the 2024 Indonesia Presidential Election Discussion on YouTube***

Widha Dwiyanti, Putri Rizky Alifiya, Muhammad Fauzal Dwiansyah and Warih Maharani (Telkom University, Indonesia)

This research implements betweenness centrality in social media, especially YouTube. This research focuses on analyzing the most influential users in shaping public opinion based on interactions through comments and likes in the YouTube video "Anis vs Prabowo vs Ganjar - Epic Rap Battle of Presidency 2024". The betweenness centrality method connects various parts of the network, positioning influential nodes as centers. A node has a high betweenness centrality value when the node functions as the main path where other nodes interact. The results of this research showed that the most influential user in shaping public opinion on YouTube video is a User_5670_with 93.00 betweenness centrality value.

11:45 ***Hyperparameter Tuning to Improve Object Detection Performance in Handwritten Images***

Muhammad Haviz Irfani (University of Indo Global Mandiri, Indonesia); Samsuryadi Samsuryadi and Abdiansah Abdiansah (Universitas Sriwijaya, Indonesia); Rudi Heriansyah (Universitas Indo Global Mandiri, Indonesia)

Object detection in handwritten images is a complex challenge due to variations in writing styles, letter sizes, and environmental conditions when handwriting is created. The You Only Look Once (YOLO) method has shown promising results in detecting objects in real-time in various types of images. However, YOLO performance is highly dependent on optimal hyperparameter tuning for a specific detection task. Hyperparameter tuning is a crucial step in improving object detection performance, especially in the context of handwritten images. This research aims to optimize YOLO hyperparameters to increase the accuracy of object detection in handwritten images. Some tuned hyperparameters are momentum, weight_decay, learning rate, batch size, and epoch. This research was carried out for 49 training sessions using the YOLOv8 and CUDA version 11.8 frameworks with a primary dataset obtained of 44 pieces of diverse handwriting, including various variations of handwriting styles that were consistent in lighting conditions, type and size of paper and pen, form format, and healthy physical and psychological conditions. The results of this research show that hyperparameter tuning in experiment 34 with parameter lr0 of 6.879476049637327e-05, momentum of 0.963981540467, weight_decay of 0.00011207385, batch of 2, and imgsz of 480, obtained the model performance evaluation metric, namely F1-score is 35%, Recall is 52%, Precision-Recall is 36%, and MAP is 0.5. The temporary results of this research are still not good so there are still some improvements needed, such as annotating handwritten images with greater variations by using polygon types as bounding, changing parameters such as the number of epochs, and increasing the number of datasets. This research is useful for things like recognizing students' personalities, forensic identification, and also patient therapy using handwriting.

11:52 ***Driver Anger Expression Detection: A Review***

Ong Jia Xiang (Multimedia University, Malaysia); Sumendra Yogarayan (Multimedia University (MMU), Malaysia); Jashila Nair Mogan and Pa Pa Min (Multimedia University, Malaysia); Afizan Azman (Taylor's University, Malaysia); Avenaish Sivaprakasam (AceTeam Networks, Malaysia)

Road rage is increasingly becoming a serious problem on Malaysian roads, with the Malaysian Institute of Road Safety Research reporting that about 18% of registered drivers experience road rage. This issue is impaired by the daily pressures of heavy traffic, where prolonged exposure leads to elevated stress and frustration. These conditions can trigger emotional responses such as anger, aggression, and anxiety, which impair drivers' judgment and increase the likelihood of risky driving behaviors and accidents. The objective of this study is to provide a review of the current psychological and physiological mechanisms underlying driver anger, while mapping existing AI technologies designed to detect and mitigate these emotional responses. The review aims to identify challenges and gaps in current systems, as well as highlight future opportunities for improving road safety through anger detection. The literature was gathered from a comprehensive analysis of existing AI-based driver monitoring systems, focusing on physiological signals. Key findings suggest that AI systems can predict and manage driver anger effectively, offering a proactive approach to improving driver behavior and overall road safety.

12:00 ***Drunk Detection using Thermal-Based Face Images***

Lee Jian Seong (Multimedia University, Malaysia); Sumendra Yogarayan (Multimedia University (MMU), Malaysia); Siti Fatimah Abdul Razak and Jashila Nair Mogan (Multimedia University, Malaysia)

Driving under the influence of alcohol poses severe risk to road safety, substantially increasing the likelihood of accidents, injuries, and fatalities. Alcohol impairs cognitive functions, motor skills, and judgment, leading to compromised decision-making abilities that can result in dangerous driving behavior. n Malaysia, if caught driving under the influence of alcohol or drugs, offenders could face imprisonment for up to 12 months or a fine of up to RM6,000. Despite these penalties, the country continues to face a high incidence of drunk driving-related fatalities and injuries. The challenge of mitigating impaired driving and enhancing road safety remains persistent. To address the need for improved detection methods for drunk driving, this study introduces the face recognition for alcohol concentration (FRAC) tool. The FRAC system leverages facial recognition and thermal imaging technologies to assess a driver's level of intoxication. By focusing on facial regions such as the forehead, nose, and eyes, where variations in capillary concentration and temperature due to alcohol consumption are most noticeable, FRAC provides a thorough analysis of these physiological indicators. The system's non-invasive and real-time assessment capabilities offer an advancement over traditional breathalyzer tests. Preliminary research indicates that FRAC could serve as an alternative for evaluating intoxication levels, potentially improving road safety by providing accurate detection of impaired drivers. This tool represents a step forward in the search of safer driving environments and effective enforcement of drunk driving regulations.

12:07 ***Automated Tuna Freshness Assessment via Gas Sensors and Machine Learning Algorithms***

Nyoman Raflly Pratama, Ledya Novamizanti and Dedy Rahman Wijaya (Telkom University, Indonesia)

Ensuring the safety and quality of fish products is essential for public health, especially in countries like Indonesia, where tuna is a popular fishery product. Tuna freshness is a critical indicator of seafood

safety, directly influencing both its nutritional value and the risk of contamination. This study explores the application of machine learning models to accurately and efficiently classify tuna freshness based on gas emissions detected by an electronic nose (e-nose) system. The system employs MQ-135, MQ-9, and MQ-2 gas sensors, which are sensitive to spoilage-associated gases such as ammonia, methane, and alcohol. A dataset of 58,389 records was generated to capture the gas profiles released by tuna over time, creating a robust dataset for model training and validation. Three machine learning algorithms-K-Nearest Neighbors (KNN), Support Vector Machine (SVM), and Naive Bayes-were compared to evaluate classification accuracy and practical applicability. Results indicate that both KNN and SVM achieved high accuracy rates of 99%, while Naive Bayes reached 90%, underscoring the suitability of KNN and SVM for tuna freshness detection. These findings demonstrate the potential of integrating e-nose technology and machine learning to provide a rapid, reliable, and scalable solution for freshness assessment in the fishing industry, enhancing quality control from suppliers to retailers.

Wednesday, December 18 13:15 - 14:15

8A: Cybernetics and Information Management in Business

13:15 ***Mapping the Evolution of Tourist Clusters: A Dynamic Modularity Approach in Multi-Destination Travel Analysis***

Muhammad Afif Alfarouq Samsuri, Andry Alamsyah and Dian Puteri Ramadhani (Telkom University, Indonesia)

Understanding evolving tourist movement patterns is essential in multi-destination areas like Bali, where diverse attractions cater to a wide range of preferences. Traditional static analyses of tourism networks miss temporal shifts that reveal deeper trends in tourist behavior. Dynamic clustering is critical, especially in response to disruptions like the COVID-19 pandemic, which reshaped travel preferences globally. This study applies a dynamic modularity approach to map the evolution of Bali's tourism clusters from 2019 to 2024, addressing the need for adaptive tourism management. The analysis shows Bali's tourism network transitioned from a stable two-cluster structure in 2019 to fragmented clusters in 2020 due to pandemic restrictions, with domestic tourism dominance by 2021. As international tourists returned in 2022, Bali's network diversified into four distinct clusters, achieving maximum diversification by 2024. This shift illustrates Bali's resilience and adaptive recovery. Each year's network structure highlighted shifts in tourist demographics and preferences, with clusters showing balanced interest in nature, culture, recreation, and wellness. Dynamic clustering exposed Bali's capacity to adjust from a domestic-focused network to a diverse international tourism hub as conditions stabilized. This study emphasizes the importance of dynamic clustering in revealing evolving tourism trends, enabling Bali's tourism managers to create responsive strategies that cater to diverse tourist needs. These insights support sustainable tourism growth, ensuring Bali's competitiveness in a shifting global landscape.

13:30 ***Female Gen Z's Perspectives Toward Beauty Social Media Influencer Attributes Based on TEARS Model***

Adsina Fibra (Unversitas Bina Nusantara, Indonesia); Adisha Nurina Maharani Danoehoesodo

(Universitas Bina Nusantara, Indonesia)

When diving into social media marketing, businesses put effort into their online marketing strategy to be successful. This study aims to thoroughly understand the attributes or factors that influence female Gen Z's perceptions of beauty social media influencers and how these perceptions affect their desire to make purchases. This study was conducted through qualitative research, using in-depth interviews and open-ended questions, with ten female Gen Zs as the research participants to gain first-hand perspectives. The findings of this research highlighted that Trustworthiness, Expertise, Attractiveness, Respect, and Similarity (TEARS) model plays an essential and significant role in female Gen Z's purchasing intention when considering buying from a social media influencer. It was expressed that TEARS model components that matter most to female Gen Zs are indeed Trustworthiness, Expertise, and Similarity. This study's innovative results highlight the various and unique perspectives on female Gen Z and how beauty social media influencers' attributes influence their purchasing intentions, which provides new insight into the demographic. These findings are invaluable for marketers and businesses providing targeted strategies to engage efficiently with female Gen Z's, meanwhile, public relations, academics as well as society with a deep understanding of the digital consumption habits that might influence future communication practices.

13:45 ***User Acceptance and Behaviour Towards Tax Deduction Systems Adoption: An Integrated Technology Acceptance and Usage Model Perspective***

I Gusti Ayu Tresza Dharmayani (University of Bina Nusantara, Indonesia & Bina Nusantara University, Indonesia); I Gusti Karmawan and Levana Dhia Prawati (Bina Nusantara University, Indonesia)

The adoption of technology in the tax sector is increasing rapidly. The gaps in the technology infrastructure and information systems have led to a diverse perspective on user behaviour, with users holding various opinions on adopting technology. The study aims to evaluate user behaviour and the user acceptance in the information system called the e-Bupot unification to guide technology development in the tax sector, analyzing six factors: performance expectancy (PE), effort expectancy (EE), social influence (SI), hedonic motivation (HM), Habit (H), Personal Innovativeness (PI) that affect the behavioral intention and use behaviour. The surveys were conducted to 400 responses based in Indonesia area. The result reveals that effort expectancy, social influence, hedonic motivation, habit, and personal innovation have affected the behavioural intention and use behaviour of the technology adoption. The result shows the behavioural intention affects the use behaviour of technology adoption. The performance expectancy was found to have no significant impact on behavioural intention the behavioural intention. The findings show that improving the performance expectancy of its website by the evaluation from the user of this technology is required. By enhancing system usability and providing robust system support for future development to increase the user in the technology adoption. The study adds value to tax policy and technology acceptance literature by evaluating the user behaviour through the UTAUT-3 model showing the user acceptance of this technology adoption for promoting more effective adoption of future digital tax systems in deduction tax.

14:00 ***Evaluating Customer Satisfaction on Indonesian Banking Artificial Intelligence-Driven***

Chatbot Services

Michael Widjaja (BINUS Graduate Program, Bina Nusantara University, Indonesia); Nilo Legowo (Bina Nusantara University, Indonesia)

The rapid evolution of artificial intelligence (AI) has significantly impacted various industries, including the banking sector. AI-powered chatbots have emerged as a promising tool to enhance customer service and satisfaction. This research delves into the factors that influence customer satisfaction with banking chatbot services. Specifically, the study examines the impact of system quality, information quality, service quality, trust, and social presence on customer satisfaction. A purposive sampling technique was employed to collect data from fifty-one respondents who had prior experience utilizing banking chatbot services. Data analysis techniques were used to assess the relationships between the independent variables and the dependent variable, customer satisfaction. The findings in this study revealed that system quality, information quality, service quality, trust, and social presence exhibited positive impacts on customer satisfaction on using chatbot services. The results of this study can contribute to several practical implications for Indonesian banks. By understanding the factors that drive customer satisfaction, banks can optimize their chatbot systems to enhance user experience, build customer loyalty, and gain a competitive advantage. Specifically, banks can focus on improving system reliability, ensuring the accuracy and relevance of information provided by the chatbot, enhancing the chatbot's ability to understand and respond to customer queries, building trust through transparent communication and data privacy practices, and developing chatbots that can engage in natural and empathetic conversations. Furthermore, this research provides a foundation for future studies in the field of AIpowered chatbot services in the Indonesian banking sector.

8B: Cybernetics and Internet-of-Things (IoTs)

13:15 ***DMDA: A Computational Resource Allocation Approach for IoT Devices in Fog Computing***

Luthfan Hadi Pramono and Shan-Hsiang Shen (National Taiwan University of Science and Technology, Taiwan)

Fog Computing enables the efficient offloading of computational tasks from IoT Devices to Fog nodes, enhancing processing efficiency and reducing latency. This paper introduces the Dynamic Matching with Deferred Acceptance (DMDA) algorithm, designed to optimize the allocation of GPU and CPU resources within Fog Computing environments, specifically for smart city applications. The DMDA algorithm allocates resources to IoT Devices based on parameters such as data type, computational load, priority, and responsiveness. Devices processing image or video data are given priority for GPU allocation, while other devices are assigned to CPUs based on their cumulative performance scores. Devices with lower priority are reassigned to CPU resources or excluded when resource availability is exhausted, significantly enhancing performance under high-demand scenarios. The algorithm employs a Mixed-Integer Linear Programming (MILP) model to maximize the aggregate score of allocated devices while adhering to resource constraints. Experiments conducted with 50 to 1,000 devices demonstrate that both the total Device Score rate and Allocated Device rate reach 100%, indicating optimal allocation. Empirical findings show that the DMDA algorithm improves resource utilization, reduces processing times, and ensures effective workload distribution across large-scale IoT deployments.

13:30 ***The Cloud-Native Revolution: Microservices in a Cloud-Driven World***

Bindu Mohan Harve (Independent Researcher, USA); Darshan Mohan Bidkar (Netflix, USA); Manjunatha Sughaturu Krishnappa (Oracle, USA); Gokul Pandy (IEEE Senior Member, USA); Vivekananda Jayaram (Florida International University, USA); Prema K Veerapaneni and Gaurav Mehta (JPMorgan Chase, USA)

The rapid evolution of cloud computing has driven a shift from traditional monolithic architectures to cloud native applications that emphasize scalability, resilience, and flexibility. At the core of this transformation is the microservices architecture, which divides applications into smaller, loosely coupled services, each capable of independent deployment and scaling. This paper presents a comprehensive analysis of cloudnative applications powered by microservices, focusing on the architectural principles and technical enablers-such as containerization, service orchestration, and DevOps practices- that support this approach. Microservices provide key benefits, including enhanced scalability, faster deployment cycles, and resilience through service isolation. However, adopting a microservices architecture also introduces challenges. Increased complexity, security vulnerabilities, and the need for effective monitoring and observability require robust management solutions. This paper examines how industry leaders leverage microservices to enhance performance and agility within cloudnative environments, illustrated through case studies and benchmarking analyses. This research also explore emerging trends, including serverless computing, edge deployments, and the integration of AI and machine learning for automated service management, indicating future directions for cloud native architecture. By providing insights into the fundamentals, advantages, and obstacles of cloud-native microservices, this study serves as a valuable resource for researchers and practitioners. It highlights the strategic considerations essential for successful microservices adoption, offering a pathway for those seeking to design and manage resilient, scalable cloud-native applications.

13:45 ***Cybersecurity in the Cloud Era: Protecting Virtualized Environments Against Evolving Threats***

Manjunatha Sughaturu Krishnappa (Oracle, USA); Prema K Veerapaneni (JPMorgan Chase, USA); Bindu Mohan Harve (Independent Researcher, USA); Vivekananda Jayaram (Florida International University, USA); Darshan Mohan Bidkar (Netflix, USA); Gaurav Mehta (JPMorgan Chase, USA); Vedamurthy Gejjegondanahalli Yogeshappa (Medecision, USA)

Examining the cybersecurity challenges of cloud computing and virtualized environments reveals unique risks associated with shared infrastructures and multi-tenant architectures. As organizations increasingly adopt cloud solutions, they face evolving threats such as data breaches, insider risks, and advanced persistent threats (APTs) that exploit cloud-specific vulnerabilities. Traditional security approaches often prove inadequate in addressing these risks, emphasizing the need for adaptive solutions that align with the dynamic nature of cloud environments. This study analyzes critical security measures including encryption, Identity and Access Management (IAM), intrusion detection systems (IDS), and the shared responsibility model. These combined elements form a robust defense strategy for cloud and virtualized systems. Additionally, a layered security framework is proposed to enhance protection, supported by case studies and benchmark analyses demonstrating its effectiveness in improving data integrity, confidentiality, and availability. Further exploration into

future trends, such as quantum-resistant cryptography, machine learning for advanced threat detection, and Zero Trust architectures, highlights promising directions to strengthen cloud security. This research underscores the importance of continuous adaptation in cybersecurity practices to remain resilient against emerging threats in cloud environments. Balancing sophisticated security mechanisms with performance considerations and regulatory compliance is essential for maintaining secure, scalable cloud infrastructure capable of meeting modern demands.

14:00 ***Implementation of Multi-Hop Mesh Networking using ESP32 for IoT Communication***

Saufik Ramadhan, Infall Syafalni, Nana Sutisna and Trio Adiono (Bandung Institute of Technology, Indonesia)

Today, the demand for reliable and efficient communication systems is more critical than ever, especially with the rapid growth of IoT applications. In this paper, we propose the implementation of a multi-hop network using ESP32 modules, aiming to address the challenges of long-range communication while maintaining stable data transmission. The network design consists of several ESP32 devices placed at various distances to simulate a real-world scenario where connectivity can be challenged by distance and environmental factors. We also incorporated antennas into the setup to enhance the transmission power and ensure reliable communication across multiple hops. Our experimental results show that multi-hop networks, which consist of four hops, achieve a maximum data rate of 13 Mbps and a minimum data rate of 5.9 Mbps. These results demonstrate the network's ability to maintain consistent performance even as the data travels through multiple relays. Additionally, the network successfully covered a distance of up to 198 meters, proving the feasibility of using ESP32-based multihop networks in large-scale IoT deployments. The findings of this study are particularly valuable for IoT applications in areas such as agriculture, manufacturing, and smart cities. In these sectors, where devices often need to communicate over long distances or in environments with obstacles, the multi-hop network can provide a reliable communication solution. By extending the range of the ESP32, this work opens new possibilities for building scalable, efficient, and robust IoT networks capable of handling large volumes of data in diverse environments.

8D: Cybernetics and Internet-of-Things (IoTs)

13:15 ***Comprehensive Review of Penetration Testing Approaches on Internet of Things (IoT) Devices***

Amni Bazilah Husna Nazarudin (Multimedia University, Malaysia); Sumendra Yogarayan (Multimedia University (MMU), Malaysia); Siti Fatimah Abdul Razak and Mohd Fikri Azli Abdullah (Multimedia University, Malaysia); Afizan Azman (Taylor's University, Malaysia); Daneshver Kumar (AceTeam Networks, Malaysia)

With the increasing integration of smart technology into daily life, securing interconnected Internet of Things (IoT) devices have become a critical concern for cybersecurity professionals. Penetration testing serves as a proactive approach to identify and exploit vulnerabilities within these devices, emphasizing the urgent need for developers to address and patch potential security flaws. IoT devices, ranging from wristwatches to vehicles, communicate autonomously, enhancing their functionality while also

exposing them to significant cybersecurity risks due to their reliance on Internet connectivity. This study investigates existing research on the security features and potential vulnerabilities of IoT devices, focusing on the types of attacks commonly employed by malicious actors and the primary concerns highlighted in the literature. The findings provide valuable insights into the current state of IoT security and reinforce the necessity of protective measures to prevent cyberattacks.

13:30 ***IoT-Driven Soil Moisture Monitoring for Optimizing Irrigation***

Dharwin Varathaiah (Multimedia University, Malaysia); Sumendra Yogarayan (Multimedia University (MMU), Malaysia); Ee Mae Ang and Pa Pa Min (Multimedia University, Malaysia)

As the global population continues to rise, the demand for higher food production exerts increasing pressure on traditional irrigation systems, which often lack the precision and efficiency required to meet modern agricultural demands. This growing challenge imposes innovative solutions, such as the integration of Internet of Things (IoT) technology into agriculture, which has led to the creation of smart irrigation systems. These advanced systems utilize IoT-enabled soil moisture monitoring sensors to collect real-time data on key environmental variables such as soil moisture, temperature, humidity, and other atmospheric conditions. Through this data, farmers gain actionable insights that allow them to automate and optimize irrigation, eliminating the need for manual intervention. This study explores into the benefits of IoT-based soil moisture monitoring systems, focusing on the capabilities for remote management, automation, and adaptability to climatic conditions. Key features include real-time data for ondemand and timed watering, as well as the simulation of rainfall patterns, which ensure optimal soil moisture levels. These technologies do not only help conserve water resources and reduce labor requirements but also promote sustainable farming practices by minimizing resource wastage. By improving irrigation efficiency and enhancing crop growth reliability, IoT-driven systems contribute to addressing global food security challenges, ensuring the sustainability of agricultural practices in the face of population growth.

13:45 ***IoT Based Forest Fire Detection: Conceptualization and Implementation***

Rahkaesh Nair Uthaiya Nair (Multimedia University, Malaysia); Sumendra Yogarayan (Multimedia University (MMU), Malaysia); Mohd Fikri Azli Abdullah and Ee Mae Ang (Multimedia University, Malaysia)

Forest fires pose severe threats to both human life and the environment, often leading to catastrophic consequences. Traditional methods of forest fire detection, such as human observation or satellite-based systems, are limited in terms of response time, coverage, and accuracy, making them inadequate for effective management of forested areas. With the rapid advancement of Internet of Things (IoT) technology, an efficient and scalable solution has emerged to address this pressing issue. This study presents a proof-of-concept IoT-based forest fire detection system specifically designed to demonstrate its potential for large-scale forest applications. The proposed system consists of two zones equipped with interconnected sensors that continuously monitor critical environmental parameters, including temperature, humidity, flame presence, and smoke levels. By utilizing real-time data transmission and analysis, the system ensures early fire detection and provides instant alerts to relevant authorities and emergency services. These notifications facilitate the efficient allocation of

resources, potentially reducing the extent of damage caused by forest fires. While this implementation serves as a proof of function, it effectively illustrates how scalability can be achieved to cover extensive forest areas, making the system adaptable to various types of forested regions. By enhancing public safety and protecting ecosystems, this IoT-based system has the potential to mitigate economic losses associated with forest fires.

14:00 ***Teaching Gamified Cybersecurity Using the Metaverse: Challenges and Opportunities***

Erald Troja (St Johns University, USA); Joan E DeBello and Laura Truong (St. John's University, USA)

The COVID-19 pandemic brought significant changes to how educational institutions deal with instructional strategies. While some found platforms like Zoom, WebEx, and Google Classroom adequate, others sought solutions that could facilitate hands-on interactions typically found in physical classrooms, while minimizing distractions and engagement issues associated with traditional remote meeting tools. In response, the paper introduces and assesses a method for delivering gamified Cybersecurity courses through an escape-the-classroom model in a blended physio-digital environment inspired by the Metaverse. The paper begins by examining the latest developments in virtual learning ecosystems and outlining the rationale for a proposed Metaverse classroom. Our focus is on a specific model designed to enhance Cybersecurity education through gamification within the Metaverse. The paper also provides detailed evaluation metrics addressing immediate challenges related to this approach and suggest future research directions aimed at transforming conventional Cybersecurity classrooms into engaging, gamified remote learning experiences in the Metaverse.

Wednesday, December 18 14:15 - 16:15

9A: Cybernetics and Internet-of-Things (IoTs)

14:15 ***GLCM-based Texture Features and Artificial Neural Network (ANN) for Accurate Detection of Melanoma and Basal Cell Carcinoma***

Satria Mandala (Universitas Telkom, Indonesia); Eva Krishna Sutedja (Padjajaran University, Indonesia); Nyoman Gunantara, Gun (Universitas Udayana & Unud, Indonesia)

Existing studies on image-based detection of melanoma and Basal Cell Carcinoma (BCC) using artificial intelligence (AI) have shown suboptimal detection results due to limitations in feature extraction techniques and classifier algorithms. This research addresses these challenges by developing an Artificial Neural Network (ANN) model that utilizes Gray Level Co-occurrence Matrix (GLCM) features. Dermoscopic images of melanoma, BCC, and normal skin were processed to extract texture features using GLCM. The performance of the proposed model was evaluated using key metrics, including accuracy, sensitivity, specificity, and F1- score. The results demonstrate that the ANN model incorporating GLCM features exhibits strong potential for accurately classifying melanoma, BCC, and normal skin. During the training phase (GLCM with d=2), the model achieved an average performance of 83.33% accuracy, 83.07% sensitivity, 91.54% specificity, and 83.10% F1-score. On the testing dataset (GLCM with d=5), the model achieved 82.22% accuracy, 82.22% sensitivity, 91.11% specificity,

and 82.22% F1-score, respectively. These findings highlight the effectiveness of GLCM features in enhancing the ANN model's classification performance and its potential application in clinical settings.

14:30 ***Comparative Analysis of ResNet Architecture Enhanced with Self-Attention for Colorectal Cancer Detection***

Yonathan Fanuel Mulyadi and Fitri Utaminingrum (Universitas Brawijaya, Indonesia)

Colorectal cancer is a malignancy that arises in the colon or rectum, which is the key component of the large intestine and terminal part of the digestive system, and typically originates from benign cell clusters called polyps. Over time, these polyps may progress into cancer. Given the prevalence of this condition, early detection is crucial for achieving favourable treatment outcomes. Conventional diagnostic approaches, such as colonoscopy, often fail to identify early-stage lesions due to their subtle presentation. However, advancements in machine learning, particularly deep learning, offer promising avenues for improving diagnostic accuracy. This study provides a detailed evaluation of the ResNet deep learning model, specifically focusing on its performance in distinguishing classes within the CRC-5000 dataset. This dataset comprises 5,000 colonoscopy images categorized into eight distinct classes: Tumor, Stroma, Complex, Lympho, Debris, Mucosa, Adipose, and Empty. The research compares the performance of ResNet architectures (ResNet-50, ResNet-101, and ResNet-152) in two configurations: with and without the addition of Self-Attention layers. The results are significant, showing that ResNet-50 with Self-Attention achieved an accuracy of 92.13%, ResNet-101 with Self-Attention achieved an accuracy of 92.94%, and ResNet-152 with Self-Attention achieved an accuracy of 92.74%, while without Self-Attention ResNet-50, ResNet-101, and ResNet-152 demonstrated a lower accuracy of 89.51%. These findings highlight the considerable potential of enhancing ResNet with Self-Attention mechanisms to improve the early detection and treatment of colorectal cancer. Furthermore, this approach could significantly streamline clinical workflows, providing pathologists with robust tools for early diagnosis.

14:45 ***Analyzing Key Predictors of Language Anxiety: Machine Learning Models for ELAS Prediction***

Alfian Akbar Gozali (Telkom University, Indonesia); Iis Nurhayati (Telkom University & Padjadjaran University, Indonesia); Gartika Rahmasari and Rian Andriani (ARS University, Indonesia)

This study investigates the use of machine learning techniques to predict English Language Anxiety Scale (ELAS) levels among university students, motivated by the significant impact of language anxiety on educational outcomes. The research aims to enhance predictive accuracy by analyzing diverse demographic, academic, and linguistic features. The dataset from two Indonesian universities includes 292 students' educational and demographic profiles. The analysis involved three experimental phases: parameter quality assessment, feature importance evaluation, and model performance testing. Initial feature analysis identified the English Proficiency Test (EPrT), GPA, and High School Province as significant predictors of ELAS scores, with EPrT showing the highest correlation across various ELAS components. Further, evaluating feature importance across ELAS components revealed EPrT as a consistently influential factor, highlighting its central role in language-related anxiety. In the predictive modeling phase, multiple machine learning models were tested, including Gradient Boosted Trees

(GBT), Support Vector Machine (SVM), and Generalized Linear Model (GLM). GBT and SVM achieved the highest accuracy (0.843), while GLM provided a balanced trade-off between accuracy and computational efficiency. Naive Bayes, though less accurate, offered computational advantages for quick, baseline predictions. These findings underscore the relevance of EPrT and other academic indicators in predicting ELAS scores and suggest that targeted interventions based on these features could mitigate language anxiety. The study's results provide a basis for integrating machine learning in educational psychology, enhancing the potential for timely and personalized support for students facing language learning challenges.

15:00 ***Self-Driving Vehicles: Exploring Preferred Adoption Scenarios - A Preliminary Study***

Michael Khoyudia and Leonardo Iskandar (Bina Nusantara University, Indonesia); MInsani Mariani (Binus Business School, Bina Nusantara University, Indonesia)

This initial research study examines the preferences of the general public concerning the adoption of various scenarios associated with self-driving vehicles (SDV). This study aimed to evaluate the readiness of one hundred volunteers to employ self-driving vehicles (SDVs) in fifteen scenarios. The simulations included highway driving with options for human intervention and autonomous public transportation systems. We conducted descriptive and cluster analyses to identify significant patterns and classify comparable scenarios. Participants exhibited a moderate to high desire to employ autonomous vehicles in different scenarios. People expressed a strong willingness to use these technologies in settings such as universities and airports and for daily life. However, there was an apparent hesitation regarding the acceptance of autonomous vehicles for long trips and the concept of self-driving taxis operating without any human supervision. The findings reveal four distinct preference clusters: 'Highway Focus' (highway driving with manual control option), 'Safety Conscious' (hesitant toward full automation), 'Convenience Seekers' (specific situations such as traffic congestion), and 'Enthusiastic Adopters' (high overall acceptance). These clusters show various attitudes toward adopting self-driving vehicles (SDVs) and the importance of developing tailored strategies to tackle specific challenges and improve overall acceptance. There is a general openness to autonomous vehicles, particularly in specific scenarios or regulated settings. However, safety concerns and the need for control still pose major challenges to widespread use. Public acceptance will likely take time and depend on how well these issues are addressed. Further research and development are needed to improve safety, reliability, and public trust in driverless technology.

15:15 ***Exploring Cloud Accounting Adoption Readiness Among Indonesian Small-Medium Enterprises***

Anderes Gui, Kevin Sierrano, Dea Novantia, Trinity Loren and Ridho Bramulya Ikhsan (Bina Nusantara University, Indonesia); Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia)

The purpose of this research is to determine the use of cloud accounting by Micro, Small, and Medium Enterprises (MSMEs) in Indonesia and the strategies for its implementation. With the rapid growth of digital transformation worldwide, using the cloud for financial management offers many benefits, including better master data management, more efficient operational control, and improved

business processes. Factors such as perceived benefits, ease of use, and suitability to the company's technical needs are components assessed in this research using quantitative methods. The research approach used included an empirical survey in the form of well-structured questionnaires distributed to business owners and managers from various industries. The study concludes that the Technology-OrganizationEnvironment (TOE) Framework has a substantial impact on MSMEs' decisions to embrace cloud accounting. The findings of this study provide excellent recommendations for technology service providers and government authorities in formulating strategic initiatives to facilitate broader acceptance of cloudbased financial solutions within Indonesia's MSME ecosystem. The research findings provide a better understanding of the dynamics of digital change in Indonesia's business environment, particularly the usage of financial technology by small enterprises. This knowledge base can be utilized to develop policies and plans for technology advancement that aim to increase digital use among MSMEs.

15:30 ***Social Network Analysis and PowerBI Dashboard to Determine E-Wallet Marketing Strategies***

Rita Rita (Binus University, Indonesia); Sheila Monica, Miracle Aurelia, Abba Suganda Girsang and Virienia Puspita (Bina Nusantara University, Indonesia)

The rapid growth of digital payment platforms like OVO, ShopeePay, and GoPay in Indonesia has driven the need for businesses to optimize marketing strategies by analyzing customer interactions through social media. This study leverages Social Network Analysis (SNA) and Power BI to extract insights from Twitter data, offering a comprehensive view of how these platforms engage with consumers and shape brand perceptions. By applying sentiment analysis and classification using IndoBERT results, this study aims to identify key influencers, assess the sentiment around these brands, and visualize marketing communication patterns. The integration of SNA and BI tools provides a detailed, data-driven approach to improving business decision-making in the competitive digital payment market, by utilizing them to evaluate e-wallet tweet activity and user interactions in Indonesia and identifying key periods and regions for targeted marketing. Strategies like loyalty programs and segmented campaigns are recommended to enhance user engagement, address security concerns, and maximize market reach during culturally significant periods such as Eid and the holiday season.

15:45 ***Propositions to Analyse the Application of Intelligent Systems in Health Care Social Organisations***

Ari Margiono (Binus Business School, Bina Nusantara University, Indonesia)

Organizations in the social sector, among others in health care, are increasingly adopting intelligent systems as part of their digital transformation efforts. Although there is a substantial body of literature on digital transformation processes in commercial sectors, research on the application of intelligent systems within social sector organizations remains underexplored. Intelligent systems offer significant promises in enhancing service delivery, improving operational efficiencies, and amplifying social impact. However, these organizations often encounter multi-dimensional challenges in implementing digital transformation, such as resource constraints, integration complexity, and data management

issues. This paper synthesizes insights from current research using an integrative literature review approach and develops a preliminary framework that addresses these challenges. This framework aims to support social sector organizations, particularly in healthcare, in strategically deploying intelligent systems.

16:00 ***Parkinson's Tremor Suppression: A Spring-Based Passive Attenuator System***

Abdullah Kassim and Krittika Vasudevan (Kent and Medway Medical School, United Kingdom (Great Britain)); M A Hannan Bin Azhar and Soumya Kanti Manna (Canterbury Christ Church University, United Kingdom (Great Britain))

Parkinson's disease (PD) is a neurodegenerative disorder often associated with tremors, which negatively impact the quality of life. While medications such as levodopa are commonly used to manage these symptoms, they come with side effects such as nausea and vomiting in the short term whereas abnormal involuntary movement in the long term. This paper explores an alternative approach through a biomechanical passive orthosis to suppress tremors. A comprehensive review of existing designs including fluid-based, balloon-based, magnet-based, and spring-based systems, highlights their limitations in terms of mobility, comfort, and usability. To address those issues, a novel spring-based passive attenuator system is proposed through a comprehensive systematic investigation of user needs. The user's criteria and design criteria are mapped together to develop the structural framework of the orthosis that can support full wrist joint movement and has the potential to offer tremor suppression for both flexion-extension and radial-ulnar deviations for PD patients. The proposed device can also emphasize comfort, ease of use and affordability targeting PD patients who experience action and rest tremors. The prototype is produced through 3D printing of acrylonitrile butadiene styrene (ABS) material and preliminary investigation shows that the device allows for a full range of motion, better wearability, and is lightweight, thus improving the daily functionality and quality of life for users.

9B: Cybernetics and Data Science

14:15 ***Parameter Optimization for Long Short-Term Memory (LSTM) and Bi-LSTM in Netflix Recommendation System***

Mohamad Irfan Nafiyanto and Erwin Budi Setiawan (Telkom University, Indonesia)

Watching movies is a popular activity enjoyed by many individuals. Netflix is a leading entertainment platform that offers a vast selection of movies. This research aims to enhance the recommendation system by integrating ContentBased Filtering (CB) with Long Short-Term Memory (LSTM) and Bidirectional Long Short-Term Memory (Bi-LSTM) to assist users in discovering movies that align with their preferences. Additionally, three algorithms were used to optimize each method with the most suitable parameter to determine the appropriate method for this data. This research aims to evaluate the optimization's performance using the optimal parameter for each method. Several scenarios have been run using 854 movies and 34,086 movie reviews provided by 44 active Twitter users. The study's results indicate that the movie recommendation system that utilizes CB with LSTM classification, applying SMOTE and SGD optimization, achieves the highest accuracy of 87.28%. This represents

an increase of 13.88% over the baseline. Additionally, the highest accuracy of 87.28% was achieved through Bi-LSTM classification using SMOTE and SGD optimization, representing a significant increase of 13.99% over the baseline. This demonstrates that CB can be combined with LSTM and BiLSTM to achieve high accuracy and improved results.

14:30 ***Improving Offline Handwritten Text Recognition Accuracy with ADAM and SGD Optimizers and Convolutional Neural Networks Models***

Sarwo Sarwo (Binus Online Learning, Bina Nusantara University, Indonesia)

Offline Handwritten Text Recognition (OHTR) is a challenging topic in pattern recognition and computer vision due to the variability and complexity of handwriting styles. This study explores the effectiveness of Convolutional Neural Networks (CNN) in improving the accuracy of OHTR systems. Specifically, this study evaluates the performance of ADAM and Stochastic Gradient Descent (SGD) optimizers in training a CNN model. The experiments were conducted on a public handwritten dataset to assess the impact of optimizers on the convergence speed, stability, and overall accuracy of the model. The results show that although both optimizers have advantages, the SGD optimizer performs superiorly in terms of faster convergence and higher accuracy in most scenarios. However, ADAM shows better generalization under certain dataset conditions, indicating that the choice of optimizer may depend on the dataset's characteristics and the specific model's requirements. In this study, it was concluded that using the SGD CNN model gave better results. From 5 experiments with SGD, 5 correct results and 1 incorrect result were obtained, while using ADAM, 2 correct results, and 3 incorrect results were obtained. The researcher realized that things could change based on different CNN conditions and parameters.This study contributes to the development of a more accurate OHTR system by providing a deeper understanding of the effectiveness of optimizers in CNN training. The results of this study are expected to be a guide in choosing the right optimizer for future OHTR systems, with the hope of improving the accuracy and reliability of handwritten text recognition.

14:45 ***Social Network Analysis of Presidential Candidates: A Case Study of Prabowo-Gibran in Indonesia***

Yuko Gibran Crevila, Andry Alamsyah and Eva Nurhazizah (Telkom University, Indonesia)

In 2024, Indonesia faces a pivotal year marked by a presidential election, which has triggered significant polarization. The election has led to societal divisions, penetrating social and political dynamics. Differences in presidential candidate preferences and media influence on public sentiment are key factors contributing to this polarization. As a social media platform, X plays a crucial role in shaping the national conversation, 103,611 data collected from this conversation. The study seeks to measure the level of polarization during the Indonesian presidential election by analyzing conversations on X. To enhance the analysis, a polarization index quantifies the level of polarization, while social network analysis examines the connectivity within the discourse network among X users. Research findings show that the presidential candidate duo Prabowo-Gibran is a central point of polarization on X. The X community has split into two distinct groups: a pro group engaging in positive conversations and offering full support for the candidate duo, and an antigroup expressing opposition through negative comments and hate speech. While many studies have comprehensively

explored political polarization, this research focuses specifically on the polarization surrounding one presidential candidate. The study aims to provide insights into polarization and enable proactive measures to prevent further escalation.

15:00 ***Temporal Sentiment Analysis of Politician XYZ on Social Media X Using FastText Word Embedding and Graph Neural Network Model***

Nurul Aini Afiqah, Fitriyani Fitriyani and Toufan Tambunan (Telkom University, Indonesia)

Social media has become a primary platform for the public to express their opinions. Since 2023, politician XYZ has been one of the most widely discussed figures, particularly on Social Media X. Several political events between 2023 and 2024 make the public sentiment toward this figure interesting to analyze. This study conducts a temporal sentiment analysis of public opinion on politician XYZ from August 2023 to March 2024, using FastText word embeddings and a Graph Neural Network (GNN) model. The approach involves data collection, text processing, and sentiment classification, utilizing FastText to capture the semantic relationships between words and a Graph Neural Network (GNN) to model sentiment dynamics over time. The focus of this study is to explore the temporal aspect of sentiment shifts, providing insights into how public opinion evolves over time in response to political events, in contrast to static sentiment. The temporal sentiment analysis reveals that the public's perception of politician XYZ initially began with positive sentiment but shifted to negative sentiment in the following months, influenced by key political events. With an accuracy of 72%, this study highlights the potential of integrating FastText and GNN for capturing complex and evolving political sentiments. The findings offer practical implications for political communication strategies, enabling stakeholders to better understand and anticipate shifts in public opinion during critical political moments.

15:15 ***Optimizing Menu Bundling Strategies through Apriori Algorithm in Sales Analysis***

Ahmad Sambang Setya Tama, Faqih Hamami and Taufik Adi (Telkom University, Indonesia)

Indonesia, as one of the largest coffee producers and exporters in the world, has experienced significant growth in the number of coffee shops, driven by increasing consumer demand for ready-to-drink coffee. This study aims to enhance sales performance at Authen Café and Space through the implementation of a menu bundling strategy. By utilizing data mining techniques and the Apriori algorithm, customer purchasing patterns were analyzed to identify optimal menu combinations. The data was collected directly at Authen Cafe during the period from April to August 2028. The analysis revealed that bundling strategies, such as combining Ayam Rica-Rica with Es Kopi Susu Karamel, are effective in increasing sales volume and product popularity among consumers. Furthermore, this study evaluated the impact of offering discounts on bundled packages on the café's profitability, demonstrating that this approach can boost net profit without sacrificing profit margins. This research provides significant insights into the application of data-driven marketing strategies within the café industry and offers guidance for more effective managerial decision-making.

15:30 ***Comparison of machine learning classifiers on low birth weight in Indonesia: Study from Indonesia Demographic and Health Survey***

Muhammad Luthfi Setiarno Putera, Muhammad Norhadi and Ajeng Hijriatul Aulia (Institut

Agama Islam Negeri Palangka Raya, Indonesia)

The prevalence of low birth weight has increased, from 5.4% in 2007 to 6.2% in 2017. The purpose of this study is to examine the classification of infants' birth weight Indonesia, relies on 2017 Demographic and Health Survey. Machine learning classifiers, such as logistic regression, decision tree, naïve Bayes, random forest, support vector machine, and neural network, were used to model the classification of birth weight infants. This study also employed three scenarios of training-testing on the dataset. The training scenario giving the best performance was 90% ratio. In terms of accuracy, the best machine learning model on training dataset is the support vector machine. For testing dataset, random forest produces the highest accuracy for classifying the birth weight of infants in Indonesia, for the 10% and 30% scheme. The difference lies in 20% scheme where the highest accuracy was produced by decision tree. In whole testing scenarios, naïve Bayes produced the highest sensitivity, while the highest specificity is achieved by neural network. Considering the accuracy yielded by random forest model, mother's age at first birth, number of antenatal visits, number of family members, birth order (parity), and mother's occupation have a higher contribution to the class target of birth weight.

15:45 ***Sentiment Analysis on Disco Elysium Video Game Reviews from Steam Using K-Nearest Neighbor Method and Chi-Square Feature Selection***

Rizka Marina Dewi, Mahendra Dwifebri Purbolaksono and Utami Kusuma Dewi (Telkom University, Indonesia)

Steam is a platform that provides services for purchasing video games digitally. It also offers features for users to share video game reviews with each other. These reviews reflecting the players' experiences and opinions. However, these reviews do not reveal the main issues reported by the reviewers or their changing perceptions over time. Contradictions between the reviews users write and the labels they provide can also occur. Therefore, the reviews written by users will be classified through sentiment analysis. This study conducts a sentiment analysis on Disco Elysium video game reviews from Steam using K-Nearest Neighbor (KNN) method and Chi-Square feature selection. There are five scenarios in this study, first is to compare the impact of using stemming process in the preprocessing stage, second is to measure the effect of applying Grid Search for hypermeter tuning, third is to compare the effects of data splitting with a ratio of 80:20 and 50:50, fourth is to compare the results of Euclidean Distance and Manhattan Distance in KNN classification, and fifth is to compare the result of using KNN method and SVM method. The result indicates that using stemming in the preprocessing stage, not applying Grid Search hypermeter tuning, data splitting with a ratio of 80:20, and KNN with Euclidean Distance provides the best performance. The best performance results achieved are 79.76% precision, 75.24% recall, and 75.21% F1-Score.

16:00 ***Data-Driven Telecommunication Infrastructure: AI Clustering and Geodesic Measurement for Strategic Tower Optimization***

Sadam Al Rasyid (Telkom University, Indonesia & Jl. Telekomunikasi. 1, Terusan Buah Batu, Bandung, Jawa Barat, Indonesia); Suryo Adhi Wibowo (Telkom University, Indonesia)

The optimization of Base Transceiver Station (BTS) location is a major challenge in current urban areas,

owing to fast population increase and rising need for high-performance communications networks. This paper describes a revolutionary strategy to BTS deployment that employs advanced clustering algorithms to improve network performance and coverage in densely populated urban locations. Four clustering algorithms are assessed, including K-Means, DBSCAN, Hierarchical Clustering, and K-Medoids, while taking into account urban variables such as housing density, land use, and geographic distribution. The paper makes two major contributions: dynamic change of the K-Means algorithm's cluster count and efficient centroid initialization using real-world urban data. Geodesic distance measures are used to examine the spatial relationships between BTS locations, resulting in more accurate and efficient tower deployment. Experimental results show that the modified K-Means algorithm beats the other techniques, with a Calinski-Harabasz index of 1662.46 and a Davies-Bouldin index of 0.868, showing improved cluster cohesiveness and separation. This technique lowers deployment costs while improving network coverage, resulting in more precise BTS placement and better resource use. These findings fill a gap in the literature by providing vital insights into data-driven urban optimization methodologies. They also have substantial implications for the planning and development of smart city infrastructure, furthering the future of wireless network architecture in urban contexts.

9C: Cybernetics and Information Management in Business

14:15 ***Object-Driven Fuzzy Decision Model for Assessing the Employees' Work from Home Eligibility***

Ditdit Nugeraha Utama (Bina Nusantara University, Indonesia); Christiawan Immanuel (BINUS University, Indonesia)

Work from Home (WFH), especially in the post-pandemic era, has emerged as an alternative work system adopted by many companies. Efficiency and effectiveness are the two main reasons why WFH is favored. In addition, the implementation of the WFH system in conducting business processes within the company allows for greater flexibility in work methods. For certain types of jobs or specific industry domains, this WFH system can be quite reliable. Workers can perform their tasks from anywhere and at any time. Also, monitoring systems enable employees to be remotely tracked by the company. However, the question remains: is an employee's work environment suitable enough to ensure the successful implementation of WFH? To answer this, a standardized model is needed to assess the level of eligibility for WFH implementation. This study aims to develop a fuzzy-based decision model to evaluate the eligibility of an employee's work environment for implementing WFH. An object-oriented approach is used to describe the design of the decision model, while fuzzy logic serves as the primary method for building the model. The model successfully simulated 24 raw employee data points, yielding a highest eligibility score of 88.61 with a similarity index of 0.78 when compared to the model proposed in previous research.

14:30 ***Implementation of Risk Assessment Analysis on Financial Technology Performance by SLR Method***

Gabriela Athena Juventeen (Bina Nusantara University); Heri Harjono Muljo (Bina Nusantara University, Indonesia); Drajad Wiryawan (Bina Nusantara University & PT. Kemuning Tours and

Travel, Indonesia)

The application of risk assessment to an entity is critical to do. It ensures that an organization or project can operate effectively and efficiently without being disturbed by unwanted risks. Risk assessment is critical for an entity because it can help protect various assets, finances, employees, and performance parameters of an entity in today's competition against various threats or vulnerabilities that can disrupt the smooth operation and sustainability of the entity in the future. This study discusses the application of risk assessment to an entity that includes private companies, government, health, developers, and technology. The method used in this study is a qualitative method with a systematic literature review (SLR), which connects the risk assessment framework with the entity's performance measures, including the entity's financial side, entity performance indicators, entity assets, employees, and competitors. Based on the results of the study show that of the 136 articles obtained, only 21 articles specifically discuss the five entity performance indicators used as the main scope of entity performance, where it shows that private companies conduct more risk assessments compared to government companies, health, developers, and technology itself. In addition, related entities more often carry out quantitative risk assessments. It shows that many entities still need to conduct risk assessments and explicitly discuss how to conduct existing risk assessments. Researchers hope this study can clarify matters related to risk assessment and how to apply them to an entity.

14:45 *Online Travel Agencies (OTA) Marketing Strategy: Lesson Learn From Hotel Business Performance During The Covid-19 Pandemic*

Rajiv Dharma Mangruwa (Telkom University, Indonesia); Akbariah Mahdzir (Universiti Teknologi Malaysia, Malaysia); Nur Naha Abu Mansor (Sohar University, Oman)

The COVID-19 pandemic has ended despite the worldwide crisis that has affected the hospitality industry. Most of the hotel industry partnering with online travel agencies (OTAs) faced critical conditions. Although substantial research has examined the post-COVID-19 effects on the hospitality industry, little is known about the perspectives of OTA businesses within Indonesia's hotel sector during the crisis. Similarly limited is the empirical evaluation of OTA business practices in regard to marketing strategy plan. According to stakeholder theory, the organization's external challenges can be described by the macroenvironmental component, which includes politics, economics, society, and technology (PEST). This study also examined how macroenvironmental concerns in the hotel sector affect the OTA industry. Using the marketing strategy model as a mediator, the effects of OTA business performances were investigated in detail. This study employed a quantitative research platform in which 150 hotel representatives in Indonesia were selected by simple random sampling and given questionnaires from 2021-2023. This study examined the probable consequences of the marketing mix model's mediating effect on the causal route linking PEST factors, namely politics, economics, society, and technology. For data analysis, Smart PLS3 was utilized. Political, economy, social, and technological factors were found to significantly influence OTA business performance, while economic factors showed negligible impact. Marketing strategies played a crucial mediating role, buffering the negative impacts of macroenvironmental challenges on OTA performance during the pandemic. For instance, targeted promotional efforts and flexible pricing strategies enabled OTAs and their hotel partners to sustain operations amid fluctuating demand. This study offers novel lesson learned based on the Indonesian hospitality industry through its numerous theoretical and empirical contributions.

Prior to making a determination, the problem of OTA business continuity is explored, and various potential proposals for government laws and the hotel industry are identified.

15:00 ***Analysis of the Facebook Ads Influences Google Analytics 4 Ads on a Landing Page***

Riyan Leandros, Silvia Ayunda Murad, Jullend Gatc, Dina Fitria Murad, Dfm, Ilham Syahru Ramadhan and Bambang Wijanarko (Bina Nusantara University, Indonesia)

Facebook and other social media platforms could be said to be important for product or service advertisers to campaign/promote and get impacts from the products, such as high website traffic, more engagement, brand awareness, more application installation, collect lead generation, more video views and conversion. However, understanding how Facebook contributes to achieving those impacts is one of the challenging things. Facebook encourages users to see campaigns data in its metrics, while Google Analytics 4 (GA4) informs users from a different side using GA4 data based on the last click. This study will review and analyze quantitatively how Facebook ads influences GA4 to increase the performance impact on a landing page. The method used is to make Facebook campaign by FB Ads and setup GA4 to one of the landing pages by entering the Google tag (GA4 tracking code) and running a campaign on Facebook by publishing ads according to the targets needed based on the products marketed through the landing page with 2 split ads within 12 days. The data obtained with result of 274.210 reach, 490.733 impressions, 22.273 interactions with page, 8.457 click link, 1.7 CTR (Click-Through Rate), 131 CPC (Cost Per Click), and 40.032 video display playing which taken from Facebook metrics, which is analyzed to perceive the effect to GA4 that can improve campaigns and are expected to be a reference for appropriate advertising re-targeting on Facebook.

15:15 ***Mapping Research Blockchain Trends on Halal Supply Chain in Indonesia: a Bibliometric Analysis***

Rajiv Dharma Mangruwa and Akhmad Yunani (Telkom University, Indonesia); Muhamad Fauzan Nugraha, Fatimah Tuzzahra and Fitria Nasywa Syadira (School of Economics and Business Telkom University, Indonesia); Han Foon Neo (Multimedia University, Malaysia)

The Indonesian government, under Law Number 33 of 2014 on Halal Product Assurance, mandates halal certification for all products, creating a significant opportunity to enhance transparency and traceability within the halal supply chain. This study explores the potential of blockchain technology to meet these regulatory requirements by improving the integrity and consumer confidence in halal-certified products. Blockchain's integration into the halal supply chain could provide a reliable solution for traceability and transparency, essential for compliance and consumer trust. To investigate this, a bibliometric analysis is conducted, using Microsoft Excel for statistical data analysis and VOS viewer for network mapping. Key focus areas include traceability, transparency, and regulatory compliance, which are highlighted as crucial for strengthening consumer trust in halal products. As the halal market in Indonesia expands, blockchain presents a promising approach to reinforce supply chain integrity and enhance product credibility. This study highlights the need for continued development of frameworks that strengthen transparency and uphold halal integrity within a wider socio-economic context. These recommendations aim to support a resilient and compliant halal ecosystem in Indonesia, advocating models that align blockchain applications with the quality and

regulatory standards crucial for the sustained growth of the halal sector

15:30 ***Streamlining ERP Implementation: Leveraging the ERP-T Model for Corporate Needs Analysis***

Yumna Zahran Ramadhan, Luthfi Ramadani, Muharman Lubis and Asha Sembiring (Telkom University, Indonesia); Fahdi Saidi Lubis (Universitas Telkom, Indonesia); Ni Ketut Mega Diana Putri (Telkom University, Indonesia)

Enterprise Resource Planning (ERP) systems are pivotal in modern businesses, enhancing operational efficiency, reducing costs, and supporting global operations through diverse functionalities in accounting, financial management, manufacturing, and more. Despite their extensive capabilities, many organizations underutilize ERP systems due to inadequate understanding and application. To bridge this gap, the ERP-T Model is proposed as a structured, user-friendly framework designed to facilitate effective ERP system implementation and usage. This model integrates four core components: Software, Process Flow, Customer Mindset, and Change Management, linked through a fifth element, Methodology. By providing a holistic approach that encompasses not just technology but also strategic alignment and user engagement, the ERP-T Model aims to optimize ERP functionality and improve overall business performance. The model emphasizes careful planning, customized implementation, and ongoing support to ensure the ERP system meets organizational needs and delivers significant benefits. Through its structured phases-pre-implementation, implementation, and post-implementation-the ERP-T Model addresses common challenges in ERP adoption, ensuring a smoother transition and better alignment with business objectives. This framework offers valuable insights for organizations seeking to maximize the impact of their ERP investments.

15:45 ***Accelerating and Improving Public Services Through Village Digitalization***

I Nyoman Karmani Kaynanda and Muhammad Zarlis (Bina Nusantara University, Indonesia)

This study investigates the impact of implementing a village digitalization app called Simpledesa on the acceleration and improvement of public services in Baturinggit Village, Karangasem, Bali, Indonesia. The study employs a mixed-methods approach, combining qualitative interviews with village officials and a quantitative survey of 111 villagers who used the Simpledesa app. The data were analyzed using Structural Equation Modeling (SEM) to examine the influence of service improvement, efficiency, effectiveness, and functionality on village digitalization and the quality of public services. The results reveal that all hypothesized relationships, except for the link between service efficiency and village digitalization, were statistically significant. The findings suggest that village digitalization apps can enhance public service delivery by improving service quality, effectiveness, and functionality, even in resource constrained rural contexts. The study contributes to the literature on e-government and public service innovation in developing countries and offers practical implications for village governments seeking to leverage digital technologies for better governance and service delivery.

16:00 ***Clustering of Medical Hospitals Listed on the Stock Exchange in Indonesia and Malaysia Based on Efficiency Performance Using Data Envelopment Analysis and Cluster Analysis***

M Agis Maulana (Telkom University, Indonesia); Nora Amelda Rizal (Telkom University Bandung

& School of Business and Management, Institut Teknologi Bandung, Indonesia); Fajra Octrina and Almi Jamilah (Telkom University, Indonesia)

Measuring the efficiency performance of hospitals listed on the stock exchange is very important to determine how efficiently hospitals utilize available resources. The high population in Indonesia and Malaysia creates opportunities for hospitals to compete for large market segments by showing their best performance, resulting in intense competition between hospitals. This study employs Data Envelopment Analysis (DEA) using a multi-stage input-oriented method to measure the efficiency of six hospitals listed on the stock exchanges in Indonesia and Malaysia from 2018 to 2023. The variables include four inputs (hospital beds, hospital staff, number of hospitals, and operating expenses) and two outputs (outpatient visits and inpatient). The results show variations in efficiency scores. HEAL and KPJH consistently achieved maximum efficiency scores, indicating the best performance. On the other hand, SAME and TDMS showed lower efficiency, highlighting areas needing improvement. Cluster Analysis using K-Means grouped the hospitals into two clusters based on performance. Cluster 0 includes hospitals with higher efficiency, namely SILO, MIKA, HEAL, and KPJH. Meanwhile, Cluster 1 consists of SAME and TDMS, indicating the need for strategic improvements. This study provides insights into the performance of hospitals listed on the stock exchanges in Indonesia and Malaysia, aiding policymakers and hospital management in optimizing resource management.

9D: Cybernetics and Data Science

14:15 ***Lifestyle to Sleep Health: A CNN-LSTM Approach for Predicting Sleep Quality and Disorders***

Cherie Vartika Stephen and Tasmina Islam (King's College London, United Kingdom (Great Britain))

This paper explores the impact of lifestyle factors on sleep patterns, highlighting its public health significance. By integrating online and real-life data, the paper investigates how lifestyle elements such as physical activity, stress, and health conditions influence sleep quality and the prevalence of sleep disorder. Using statistical analysis, the study identifies key predictors of sleep quality. It reveals that Sleep Duration and Stress Level are the strongest factors associated with sleep quality, while elements like Daily Steps and Blood Pressure contribute minimally. This study proposes a predictive model based on a hybrid Convolutional Neural Network (CNN) and Long ShortTerm Memory (LSTM) architecture, optimized via hyperparameter tuning. This model achieves an initial accuracy of 86% in detecting sleep disorders and a mean squared error (MSE) of 0.77 for sleep quality prediction. These results underscore the importance of modifiable lifestyle behaviours in influencing sleep, suggesting strategies to improve sleep hygiene. The model features a user-friendly interface where users input their lifestyle details. It processes this information to predict sleep quality and disorder status, then provides personalized recommendations for improvement. The study demonstrates how machine learning and statistical analysis can provide insights into sleep health, offering a foundation for future interventions aimed at optimizing sleep quality through lifestyle changes.

14:30 ***Feature Selection for Multilabel Classification of Student Feedback Using Filter and Metaheuristic Methods***

Hamzah Setiawan (Institut Teknologi Sepuluh November, Indonesia & Universitas

Muhammadiyah Sidoarjo, Indonesia); Chastine Fatichah and Ahmad Saikhu (Institut Teknologi Sepuluh Nopember, Indonesia)

This study enhances multilabel classification of student feedback using both filter-based and metaheuristic feature selection methods. Student feedback offers crucial insights into educational services, covering areas like course quality and facility satisfaction. While previous research has focused mainly on sentiment analysis, this study categorizes multiple aspects of educational services in each feedback entry, providing a more comprehensive view for institutional improvement. The study uses BERT (Bidirectional Encoder Representations from Transformers) to transform feedback text into numerical vectors, leveraging BERT's ability to capture contextual meaning for accurate classification. A Random Forest Classifier, combined with a Multi Output Classifier, is used to manage the multilabel data structure. Filter-based methods tested include Variance Threshold, ANOVA, ReliefF, Mutual Information, Fisher Score, Pearson Correlation, Mean Absolute Difference, Dispersion Ratio, and Recursive Feature Elimination (RFE). Metaheuristic methods include Particle Swarm Optimization (PSO) and Grey Wolf Optimizer (GWO). Among filter-based methods, Variance Threshold achieved the highest accuracy 0.973, with Fisher Score and ReliefF maintaining high performance with fewer features. PSO demonstrated strong performance, achieving an accuracy of 0.960, with high precision 0.909 and an F1 score of 0.837, and surpassing GWO in precision. In conclusion, feature selection via filter-based or metaheuristic methods significantly improves classification accuracy, enhancing institutions' ability to analyze student feedback effectively and improve service quality.

14:45 ***Identification of Lung Disease via X-Ray Images Using Knowledge Distillation and Vision Transformer***

Brilliant Syifaa Nang Galih and Ledya Novamizanti (Telkom University, Indonesia); Fityanul Akhyar (Universiti Tunku Abdul Rahman, Indonesia)

Lung disease is a widespread health concern affecting millions of people worldwide. Accurate diagnosis is essential for effective treatment, yet it often requires expert interpretation of chest X-rays to identify specific disease types. Unfortunately, many healthcare facilities, particularly in remote or resource-limited areas, lack access to skilled radiologists, leading to delayed diagnoses and potentially poor patient outcomes. To address this gap, this research introduces an automated lung disease classification system that leverages knowledge distillation for accurate and efficient diagnosis. The proposed system employs the Vision Transformer (ViT) architecture as the teacher model and MobileNet as the student model, aiming to classify chest X-ray images into five categories: normal, COVID-19, viral pneumonia, bacterial pneumonia, and tuberculosis. Knowledge distillation enables the student model to learn critical diagnostic features from the teacher model, resulting in a compact, high-performing model suitable for real-world deployment in settings with limited computational resources. Experimental evaluation on an original dataset of X-ray images demonstrated a classification accuracy of 93.07%, with high precision, recall, and F1-score, indicating robust performance across multiple disease types. This system holds promise as a valuable tool for assisting healthcare providers in making quick, accurate diagnoses, potentially improving treatment timelines and outcomes for patients in underserved regions.

15:00 ***Enhancing Node Classification: Integrating Particle Swarm Optimization with Graph***

Convolutional Networks

Maulin Nasari, Rilo Chandra Pradana, Gabriel Asael Tarigan, Nikita Ananda Putri Masaling and Jeffrey Junior Tedjasulaksana (Bina Nusantara University, Indonesia)

The effectiveness of Graph Neural Networks (GNNs) in processing graph-structured data gained widespread recognition, and these models have applications in a wide range of fields. Even though GNNs have a lot of potential, optimising GNN models for particular tasks is still challenging. Within the scope of this research, a method is presented that combines Particle Swarm Optimization (PSO) and Graph Convolutional Networks (GCN) to enhance the performance of node classification. Using the Amazon Computers and Amazon Photo datasets, which are both made up of product nodes that are connected to one another. The methodology includes data preprocessing with PyTorch Geometric, strategic data partitioning, and a robust hyperparameter optimization process using PSO. The modification was able to achieve an accuracy of 88.7% on the Amazon Computers dataset and 94.9% on the Amazon Photo dataset, which is higher than the traditional GCN baselines. Our GCN-PSO model demonstrated significant performance enhancements. These findings highlight the effectiveness of PSO in fine-tuning GCN hyperparameters, which ultimately results in outcomes that are more accurate and efficient. When it comes to improving graph-based data analysis, the research highlights the potential of combining GCNs with optimization techniques such as PSO. This method could be extended to other graph learning challenges in subsequent research, and alternative optimization strategies could be investigated to further push the limits of GNN performance.

15:15 ***NeuroSignal Precision: A Hierarchical Approach for Enhanced Insights in Parkinson's Disease Classification***

Kazi Shaharair Sharif (Oklahama State University, USA); Mohammed Majbah Uddin (Emporia State University, USA); Md Abubakkar (Midwestern State University, USA)

Parkinson's disease (PD) is a progressive neurological disorder that affects movement, posture, handwriting, and speech. Parkinson's disease is challenging to diagnose early due to subtle symptoms that often go unnoticed, necessitating reliable and accurate classification models to aid clinical decision-making. This research introduces a comprehensive benchmarking of nine unified models, and a unique contribution of this research is the adaptation of the Tabular Transformer model for structured medical data, achieving an unprecedented accuracy of 99.49%, setting a new benchmark for Parkinson's disease classification. The proposed approach provides an advanced, adaptable framework that supports clinicians in making early, accurate diagnoses, ultimately improving patient care. In contrast to previous studies that predominantly emphasize traditional models, this research employs attention-based deep learning to capture complex feature interactions, achieving substantially higher accuracy. The study evaluates nine models: SVM, Decision Tree, Random Forest, AdaBoost, Gradient Boosting, XGBoost, KNN, CNN, and Tabular Transformer, achieving improved accuracy across all models compared to previous studies, marking a notable advancement in Parkinson's disease classification performance. The Transformer's attention mechanism captures intricate data patterns, providing clear advantages over traditional approaches and improving diagnostic precision for early-stage Parkinson's detection. Data preprocessing included the Synthetic Minority Over-sampling Technique for class balancing and feature standardization, with each model, from SVM and Decision Trees to CNN and XGBoost, optimized through Optuna for optimal

performance. This research offers the medical field a versatile, high-accuracy framework that aids clinicians in timely and reliable PD diagnosis, potentially improving patient outcomes and advancing Parkinson's diagnostic tools for future clinical use.

15:30 ***Customer Loyalty Prediction and Customer Segmentation: A Random Forest Prediction and PCA-Integrated K-Means++ Approach***

Geovanny Cellyn Natalia and Ririn Desanti (Universitas Multimedia Nusantara, Indonesia)

This research discusses the prediction of company loyalty. Every company typically has a loyalty program in place. Customer loyalty is a key driver of business success, especially in competitive retail environment. Understanding the condition of customer loyalty presents a unique challenge for companies. It is also crucial for companies to understand the characteristics of their loyal customers. This research proposes a predictive model to assess the loyalty of a company's customers and builds a clustering model from the predicted loyal customers. Using the company's transaction data from January 1, 2023, to September 31, 2024, a predictive Random Forest model is developed. The Random Forest model is evaluated using ROC-AUC, accuracy, F1 Score, and Recall, showing ROC - AUC 0.93, accuracy of 87%, a F1 Score of 91%, and a recall of 92%. performance. The Random Forest model will generate customers predicted to be loyal and those predicted to churn. K-Means++ clustering will be built using the data of customers predicted to be loyal by the Random Forest model. Clustering is implemented by PCA (Principal Component Analysis) to reduce data dimensionality. Loyal customers are divided into 3 clusters, each displaying its distinct characteristics. This research identifies customers who have the potential to become loyal, and the clustering results reveal the characteristics of each cluster. Companies can leverage the findings of this research to develop better strategies to enhance customer loyalty.

15:45 ***Activity Management System with Automatic Priority Adjustment using Simple Multi-Attribute Rating Technique***

Monica Widiasri, Susana Limanto and Jordan Valentino Lomanto (University of Surabaya, Indonesia); Liliana Liliana (Universitas Surabaya, Indonesia); Maya Louk (University of Surabaya, Indonesia)

Activity management is needed to increase a person's productivity in arranging a more efficient activity schedule. To help organize activities, especially for workers or students who have many activities, the use of a planner is very necessary. However, the determination of inappropriate priorities in scheduling activities and diffic ulties in rescheduling are obstacles in using the planner. Therefore, this study aims to create an activity management system that is able to calculate the priority of each user activity and provide automatic rescheduling recommendations. The system implements the Simple Multi-Attribute Rating Technique (SMART) method for the priority configuration process. If the system's priority order does not match the user's priority order, then the weight changes for each criterion are carried out by a learning process. The resulting replacement priority is used as a limitation in generating new schedule recommendations. Based on the experiments, it can be concluded that the system has succeeded in helping to determine activity priorities automatically using the SMART method. From the validation results, the average value of the suitability of the ranking between the

SMART calculation results and the user was 63.84%, indicating that the automatic ranking system has met the average expectations of respondents, although it is not yet optimal. The reschedule feature in the system based on a survey conducted resulted in a usability value of 68.75%, which means that on average this feature can help facilitate rescheduling.

16:00 ***Performance Analysis of Random Forest Algorithm for Customer Churn Prediction in the Telecommunications Sector***

Fathan Zhafiri Arshimny and A Adiwijaya (Telkom University, Indonesia)

In response to increasing competition and rising demands for digital services, telecommunications companies face heightened challenges in managing customer retention and reducing churn. Customer churn prediction has become crucial, as retaining existing customers is more cost-effective than acquiring new ones. This study investigates the effectiveness of machine learning algorithms, with a specific focus on the Random Forest model, in predicting customer churn within the telecommunications sector. Using the Telco Customer Churn dataset from Kaggle, the study performs extensive data preprocessing, including handling missing values, encoding categorical variables, scaling numeric features, and balancing data through the Synthetic Minority Oversampling Technique (SMOTE) to enhance model accuracy and interpretability. A comparative analysis of multiple algorithms, including Random Forest, Logistic Regression, K-Nearest Neighbors, Support Vector Classifier (SVC), and Gradient Boosting, is conducted based on ROC-AUC scores and additional classification metrics to evaluate predictive performance. Results indicate that Random Forest achieved the highest accuracy, with a ROC-AUC score of 0.85, underscoring its robustness and suitability for handling complex, high-dimensional datasets often encountered in churn prediction. Feature importance analysis highlights critical predictors, such as Total Charges, customer tenure, and Monthly Charges, providing actionable insights for developing targeted customer retention strategies. Moreover, incorporating cost-benefit analysis demonstrates the financial advantages of reducing churn rates, emphasizing the practical implications for telecommunication companies in designing effective retention strategies. This study highlights the efficacy of the Random Forest algorithm in telecommunications churn prediction, offering model-driven insights that support data-informed practices to enhance customer loyalty and optimize retention strategies.

Wednesday, December 18 16:25 - 17:40

10A: Cybernetics and Data Science

16:25 ***Evaluating Human-Machine Interaction Paradigms for Effective Human-Artificial Intelligence Collaboration in Cybersecurity***

Masike Malatji (University of South Africa SBL, South Africa)

This paper examines the efficacy of various Human-Machine Interaction (HMI) paradigms in enhancing cybersecurity practices through human-artificial intelligence (AI) collaboration. As cyber threats grow increasingly sophisticated, organisations are turning to AI to bolster their defence mechanisms, threat detection, incident response, and overall security management. Six HMI

paradigms are analyzed: Humans in the Loop (HITL), Humans on the Loop (HOTL), Humans out of the Loop (HOOTL), Humans alongside the Loop (HATL), Humans-in-command (HIC), and Coactive Systems. HITL is about active direct human intervention while HOOTL emphasises autonomous AI operations. HOTL balances AI autonomy with human oversight. In HATL, AI and humans work simultaneously on different tasks, whereas in Coactive Systems, humans and AI collaborate equally and interdependently. Lastly, in HIC, humans are the final decision- makers and can override AI decisions. The strengths and weaknesses of the six HMI paradigms are determined by evaluating their key components against high-level cybersecurity practices, leveraging the advanced capabilities of ChatGPT-4o. The findings underscore the need for a hybrid approach that flexibly integrates multiple paradigms to optimize performance. Recommendations for practical implementation are provided, along with an outline of areas for future research, including real-world testing and the exploration of emerging AI advancements.

16:37 ***The Impact Of Self-Efficacy, Perceived Stress, And Herd Behavior On Mobile Phone Addiction***

Fenfen Huang (Asia Eastern University of Science and Technology, Taiwan)

This study takes Taiwanese people as the research object and uses a Google form to prepare a questionnaire. It uses convenience sampling to conduct a questionnaire survey through the Google online platform. Through the questionnaire survey, this study can learn about the influence of Taiwanese people's self-efficacy, herd behavior, perceived stress, and mobile phone addiction. The questionnaire administration period was from August 1, 2023, to September 30, 2023, and a total of 300 questionnaires were collected. Regression analysis results show that the explanatory power of the regression model is mobile phone addiction = 1.101-0.147 *self-efficacy +0.489*perceived stress+0.546*herd behavior. After controlling other variables, self-efficacy, perceived stress, and herd behavior explain 30.9% of mobile phone addiction; perceived stress has a positive and significant relationship with mobile phone addiction, with a standardized beta coefficient of 0.267; herd behavior and mobile phone addiction have a positive and significant relationship with a standardized beta coefficient of 0.495. The research results show that perceived stress has a low positive correlation with mobile phone addiction, and herd behavior has a moderate positive correlation with mobile phone addiction. The results show that the higher the perceived stress, the more mobile phone addiction The higher the chance of addiction, the higher the herd behavior, the higher the chance of mobile phone addiction. Perceived stress and herd behavior have a significant impact on mobile phone addiction. The research suggests that people can self-manage the time they use their mobile phones, and they can also plan to relax during their breaks, such as outdoor sports, camping and hiking. Isolate various apps that people feel are disturbing, delete the social media settings on people's mobile phone, and switch to running social media on people's computer.

16:50 ***A Qualitative Study on Business Resilience and E-commerce Growth in Oman SMEs Context***

Ruksana Banu and Gopalakrishnan Soundararajan (Muscat College, Oman); Mohamed Salman (University of Auckland, New Zealand); Manal Khalfan Said Al Busaidi (Muscat College, Oman)

The recent pandemic has impacted numerous aspects of business, including Small-Medium

Enterprises (SMEs') operations, growth, and sales. This study aims to show that SMEs need capabilities and strategies with resilience and ecommerce growth to respond to crises, particularly in the Oman context. This study argues that resilience is a process and growth strategy changes, particularly during the post-pandemic period. A snowball sampling method was used, and 11 participants joined the focus group discussion via an online platform (MS Teams). Through a thematic analysis, this inductive study examines business resilience and e-commerce growth strategies in response to economic crises. The study's findings demonstrated that resilience and e-commerce growth are essential, and entrepreneurs could use them to avoid misleading strategies that could lead to failure. Moreover, the digital imperatives could speed up business resilience and growth processes in the emerging digital economy. A conceptual model based on resilience and e-commerce growth for business sustainability is developed based on qualitative analysis. The model's uniqueness is that developing resilience is a bottom-line strategy for business sustainability, meaning businesses must develop a resilience strategy for digital transformation (ecommerce). Thus, researchers claim resilience is the first step in building business sustainability. In future, an empirical study can be conducted to test the influence of business resilience strategy on business sustainability via e-commerce by applying a quantitative approach. The study's contribution is that resilience and e-commerce growth for Oman SMEs can be described as an adaptation strategy for business sustainability.

17:02 ***Integrating Accessibility Features and Usability Testing for Inclusive Web Design***

Herlina Herlina (Universitas Atma Jaya Yogyakarta, Indonesia)

This study examines the intersection of accessibility, usability, and inclusive design in web development, focusing on accommodating users with color blindness. Utilizing principles from User Interface (UI) and User Experience (UX) design, the research highlights the significance of intuitive, high-contrast, and user-friendly interfaces that align with the Web Content Accessibility Guidelines (WCAG). The experimental design involved a usability evaluation of a colorblind-friendly e- commerce website, testing the success rate and time-based efficiency with a total of 10 respondents who have varying degrees of color blindness. Results demonstrated a 94.44% success rate and efficient task completion times, showcasing the effectiveness of high-contrast color schemes, adaptive layouts, and user-centric design elements. Recommendations for improvement emphasize the use of strategic animations, clear call-to-action elements, labeled color swatches, and accessible error indicators. This approach promotes inclusivity by facilitating the effective access and navigation of digital content for individuals with visual impairments. The findings advocate for web developers to integrate accessibility-focused strategies, ensuring equitable digital experiences across diverse user groups. Future research should expand the scope to encompass broader demographics and disabilities, advancing inclusive web design practices.

17:15 ***Mobile-Based SMS Gateway Application using Cloud Computing Services***

Kristian Adi Nugraha (Duta Wacana Christian University, Indonesia)

Short Messaging Service, or SMS, is a communications service still in use today. Despite more advanced text-based communication technologies like chatting apps (e.g., WhatsApp, Line, Telegram) or social media apps, SMS remains essential for various purposes, such as account verification

(OTP), emergencies, or advertising. An SMS gateway service is a technology that can handle its implementation related to sending SMS. However, the cost of such services using third-party SMS providers is relatively high because they use international rates. So, only large-scale companies can afford them. There is a cheaper solution, which is to build an SMS gateway independently. There is a cheaper solution, such as building an SMS gateway independently. However, there are difficulties in building our SMS gateways due to the limited availability of devices necessary for any implementation. This study created a mobile-based SMS gateway application using a low-cost smartphone, allowing any person or company to implement it at an affordable price. Test results show that the application can send an entire SMS without failure, with an average SMS delivery time of 5,999.28 milliseconds, or around six seconds. These results are similar to those of other third-party SMS services, so it can be a cheaper solution for implementing SMS services.

17:27 ***Harnessing Content, Social Presence, Interactivity, and FOMO to Drive Purchase Intention in Live Shopping Experiences***

Vicky Vicky (Bina Nusantara Uninversity, Indonesia); Irsyad Nuryatama and Danindra Rasyad Rabbani Hanartyo (Bina Nusantara University, Indonesia); Erwin Halim (Bina Nusantara University & School of Information Systems, Indonesia)

In this modern world there are many options to sell, right now the popular one is live stream shopping. Lots of sellers who use live streaming as their selling method are mostly Small Medium Enterprises (SMEs). SMEs are confused and do not know what strategy they want to use for selling to attract more people. This study aims to see how the influence of psychological elements such as content type, social presence, and interactivity can be involved and affect consumers' sense of FOMO which ultimately impact purchase intention. It explored some variables which drive purchase intention in live shopping experiences. Data was gathered from 340 people who have experience to purchase products via live shopping in April to June 2024 in JABODETABEK area (Jakarta, Bogor, Tangerang, Depok, Bekasi, and several cities) in Indonesia using Purposive sampling method. It processed using Structural Equation Modeling (SEM) with smart PLS SEM 4.0 as tool for the respondents who have experience live streaming shopping and live in Indonesia. This research tests six hypothesis to see the impact of social presence of viewers, social presence of live streaming, perceived interactivity, professional content and humorous content to Fear of Missing Out (FOMO) buying then the impact of FOMO buying to purchase intention in live shopping. The data show that four of six hypotheses have significant impact.

10B: Cybernetics and Internet-of-Things (IoTs)

16:25 ***ROS-Based Multi-Quadcopter System for Enhancing Crowd Surveillance***

Setyawan Ajie Sukarno, Pipit Anggraeni and Mikhael Milianka (Bandung Polytechnic for Manufacturing, Indonesia)

Traditional survey methods often struggle with inefficiencies, limited coverage, and a high risk of human fatigue and error, particularly during prolonged or complex surveillance tasks. These constraints underscore the need for an autopilot system capable of real-time crowd monitoring with

enhanced accuracy, speed, and reduced human intervention. To address these limitations, this study presents a multi-quadcopter system developed using the Robot Operating System (ROS) aimed at significantly improving the efficacy of crowd surveillance. This system leverages coordinated multi-drone operation, real-time video processing, and precise trajectory control, enabling synchronized monitoring that achieves comprehensive area coverage and reliable crowd detection. Through rigorous experimental testing, the ROS-based multi-quadcopter system achieved a crowd detection accuracy of 93.93% while reducing survey duration by 60.12% compared to single-quadcopter configurations. This notable improvement demonstrates the system's capacity to streamline operations and provide timely, accurate surveillance across extensive and complex environments, minimizing the need for human involvement. Ultimately, this multi-quadcopter system delivers a scalable and efficient approach to crowd monitoring, with promising applications in public safety, disaster response, and urban monitoring, where real-time, high-quality data is crucial. The ROS-based platform represents a significant step forward in photographic aerial surveillance, offering a versatile and robust solution for advancing intelligent monitoring capabilities.

16:40 ***Optimizing IoT Scalability and Resource Management Using Proof of Work-Directed Acyclic Graph: A Decentralized Approach***

Ayat Nadhum (University of Babylon, Iraq); Ahmed Mahdi Al-Salih III (University of Babylon & College of IT, Iraq)

The Internet of Things (IoT) has seen phenomenal interest and growth since it connects billions of devices to extend applications like smart grids and wearables. The IoT also face vulnerabilities of centralization, scalability, and security issues. Traditional blockchain solutions have slow transaction processing and scalability challenges. This paper proposes a system by combination of Proof of Work (PoW) and Directed Acyclic Graph (DAG) to overcome these limitations and support the efficient structure of bandwidth for parallel processing to improve transaction throughput and reduce validation time; hence, it is better suited for high-volume environments in IoT. It also discusses a DAG framework for processing data from multiple IoT devices in a manner that their integrity and security are ensured through distributed consensus without overloading the devices. These results indicate that the system has a stable transaction processing rate for increasing loads in those cases that lead to variable CPU and memory demands. For instance, the time to validate a single transaction was around 0.0022 to 0.0072 seconds at an average throughput of approximately 139 to 531 transaction per second for three different difficulty levels. This research, in essence, demonstrates huge potential in improving IoT security and its scalability, thereby making the blockchain technologies robustly integrated into IoT networks.

16:55 ***Hybrid Optimization of MAC Features to Address Hidden Node Problems in 802.11ah Networks***

Muhammad Imam Sofwan Sofyan and Intan Sari Areni (Hasanuddin University, Indonesia); Wardi Wardi (Universitas Hasanuddin, Indonesia)

IEEE 802.11ah is an ideal technology for enabling connectivity for Internet of Things (IoT) devices operating at 900 MHz. This protocol offers advantages such as excellent scalability, low power

consumption, and long-range communication up to 1 kilometer. However, these benefits come with notable challenges in large-scale networks, primarily interference and contention. One common issue in IEEE 802.11 networks is the hidden node problem, where nodes interfere with each other outside the channel sensing. The range of the server can significantly increase collision and energy consumption. This paper quantifies the maximum transmission range of the node utilizing a rate control algorithm, wherein the mobile node transmits traffic away from the access point, subsequently forming the framework for a hidden node scenario via comprehensive NS-3 simulations. A series of configuration steps and trials were conducted to assess the specific performance of the system under various scenarios and parameters. These scenarios were designed to replicate dense traffic intervals and contention in network environments. In this study, we propose Hybrid Optimization of Medium Access Control (MAC) Feature to solve the inherent hidden node problems with random grouping. The proposed scheme results in marked improvements compared to default scheme, reducing the packet loss ratio and collision by 64% and 89%, respectively.

17:10 ***IoT-Enabled Asthma Risk Prediction: Advancements and Challenges***

Chuah Cheng Liang (Multimedia University, Malaysia); Sumendra Yogarayan (Multimedia University (MMU), Malaysia); Siti Fatimah Abdul Razak and Sharifah Noor Masidayu Sayed Ismail (Multimedia University, Malaysia); Afizan Azman (Taylor's University, Malaysia); Kavilan Raman (AceTeam Networks Sdn Bhd, Malaysia)

Asthma affects an estimated 262 million people globally, with air pollution identified by the World Health Organization (WHO) as a major trigger for asthma attacks. Despite this, current solutions for monitoring air quality are often costly and not widely accessible, leaving individuals vulnerable and dependent on personal risk assessments. The integration of Internet of Things (IoT) technology offers a promising alternative by enabling real-time monitoring of environmental conditions through devices equipped with microcontrollers and sensors. These devices capture and report air quality data, offering users timely insights to evaluate their surroundings. Furthermore, the application of machine learning (ML) algorithms to the data collected can enable predictive analysis, estimating the probability of an asthma attack based on current and historical air quality readings. This paper examines recent advancements in IoT-based air quality monitoring systems and predictive models for asthma risk assessment. By reviewing current methodologies and innovations in this domain, the paper seeks to clarify how IoT and ML technologies can be applied to support asthma management, bridging gaps in accessibility and empowering individuals with actionable health information. Ultimately, this research aims to demonstrate the potential for IoT to enhance the quality of life for asthma patients worldwide through affordable, data-driven environmental monitoring.

17:25 ***Evaluating DETR, RetinaNet, and RTMDet Models for Object Detection in Rural Drone Imagery***

Luiz Eduardo A. Nora, Rafaella Laureano Dias and Felipe Augusto Pereira de Figueiredo (INATEL, Brazil); Samuel Mafra (Inatel, Brazil); Hugerles S. Silva (University of Brasilia, Brazil)

This study compares real-time object detection models-RetinaNet, DETR, and RTMDet-focusing on their effectiveness in analyzing aerial images of rural landscapes. The research examines each model's

performance in detecting objects within rural environments. Rural areas present unique challenges for object detection due to scale variations, environmental obstacles, and potential obstructions that obscure objects of interest, all of which require robust, adaptive detection capabilities. In particular, the study addresses real-time processing demands critical for applications like agricultural monitoring, wildlife tracking, and rural infrastructure assessment. Transfer learning with pre-trained models is employed to tailor these models to the complex visual characteristics of rural aerial imagery, allowing for efficient adaptation and enhanced accuracy. This approach leverages prior knowledge to overcome data scarcity. Through testing and evaluation, this study aims to provide insights into the strengths and limitations of RetinaNet, DETR, and RTMDet in supporting practical applications where rapid, reliable object detection is essential. The findings contribute perspectives on optimizing object detection systems for aerial surveillance in rural settings, advancing research and practical deployments.

10C: Cybernetics and Information Management in Business

16:25 ***An Object-Driven Fuzzy Decision Model for Determining Fuel in Boiler Machines***

Ditdit Nugeraha Utama (Bina Nusantara University, Indonesia); Jeremia Widyanto (BINUS University, Indonesia)

There are many alternative fuel types that can be used by a particular type of engine. Determining which fuel alternative is optimal for an engine presents its own challenges. This is especially true in an industrial setting, where certain standards are necessary to select the best fuel alternative to be used and operated. This study aims to develop a decision model for selecting a fuel type for boiler engines based on specific parameters or criteria. The decision model is designed using an object-oriented approach, utilizing three types of diagrams: object, activity, and sequence. An object-oriented model design approach allows for the decision model to be depicted transparently and very close to reality. Additionally, the analytical hierarchical process (AHP) and fuzzy logic are the core methods employed in constructing the decision model. Then, in developing this decision model, four main criteria or parameters are considered: cost, heating value, safety, and emissions. These four parameters were derived from a literature review and interviews with experts. Among the three evaluated fuel types (i.e., natural gas, industrial diesel oil or IDO, and coal), coal received the highest decision score of 0.78. Thus, based on this decision value-the outcome of the model's recommendation-it can be concluded that coal remains an objective choice as a fuel for use in boiler engines.

16:40 ***Indirect Effect of Transformational and Transactional Leadership Toward Information Security Compliance Behavior: A Conceptual Approach in Healthcare***

Widia Maharani, Puspita Wulansari, Puspita Kencana Sari and Candiwan Candiwan (Telkom University, Indonesia)

The high frequency of cybersecurity incidents underscores the importance of strong compliance among employees, where the human factor is one of the main causes of data breaches. Thus, it highlights the importance of establishing information security compliance behavior among employees, especially in the healthcare sector, to protect patient data and maintain the security of

organizational systems. This study aims to analyze the impact of transformational and transactional leadership on Information Security Compliance Behavior (ISCB) in the healthcare sector, mediated by Self-Efficacy (SEF), Attitude (ATT), and Peer Influence (PIN), and examine the moderating effects of Demographics (DEM) and Workload (WRK). A conceptual model is proposed to explore and visualize the relationships and influences among these key variables. Through this research, the healthcare sector applies the appropriate leadership style to encourage employee compliance with information security policies (ISCB) and promote a sustainable compliance culture. Future research will involve empirical testing of the conceptual model on selected healthcare organizations in Indonesia, especially focusing on hospitals.

16:55 ***The influence of ChatGPT (Open AI) on Customer Satisfaction in Higher Education***

Adriel Jonathan (Bina Nusantara University, Indonesia); Wahyu Sardjono (BINA NUSANTARA University, Indonesia)

The use of ChatGPT as a tool has recently increased in higher education due to its numerous benefits. However, its positive and negative impacts have been debated by several experts. Therefore, it is necessary to measure user satisfaction when using ChatGPT in higher education. User Information Satisfaction (UIS) will be measured in this study. The study utilizes a modified model based on previous research that centers around seven important factors that influence effective use of ChatGPT. The model aims to guide educators and learners in overcoming common challenges such as plagiarism and ensuring ethical use of AI. The study employed a structural equation model to test the UIS, using Partial Least Squares and SmartPLS 4 software. The study reveals that there are four independent variables: completeness, precision, timeliness, and convenience, and one dependent variable: satisfaction. The results indicate that completeness, precision, and convenience are the primary factors that influence customer satisfaction. This differs slightly from previous research, which did not find timeliness to be a significant factor in customer satisfaction. These findings suggest a need for a cautious approach to integrating ChatGPT into higher education to avoid compromising the quality and integrity of education. These insights underscore the importance of ensuring that ChatGPT-generated content is not only accurate and relevant but also delivered promptly.

17:10 ***Ensuring Accountability of Waqf Management Systems Using A Systematic Literature Review Method***

Heppy Purbasari (Universiti Tun Hussein Onn Malaysia, Malaysia & Universitas Muhammadiyah Surakarta, Indonesia); Siti Asiyah Salim and Eta Wahab (Universiti Tun Hussein Onn Malaysia, Malaysia); Andy Dwi Bayu Bawono (Universitas Muhammadiyah Surakarta, Indonesia)

The organisation's objectives are achieved through the implementation of the waqf management system, which is a form of control. The objective of this study was to elucidate the literature review's support for the significance of financial performance in waqf management systems within waqf institutions. The analysis encompassed publications from Scopus and Emerald's databases from 2015 to 2020. Keywords associated with the research theme were employed to identify articles, which were then selected through a selection process. Duplicate entries were eliminated from the initial dataset to prevent duplication. The final dataset from the categorisation scheme was composed of 24 articles,

which were categorised into two categories. The first group consisted of articles that were specifically concentrated on waqf management systems, while the second group contained articles about waqf framework. This research demonstrated that the majority of cited articles on waqf concentrated on the accountability of waqf institutions to both waqif and society. This was achieved through the development of integrated procedures, transparency, and the provision of financial and non-financial information. Additionally, the research on waqf has identified the most fundamental characteristics of the emerging field, such as the motivation for utilising management systems, the open challenges that impacted their utilisation, and the recommendations for expanding such management systems in the existing literature.

17:25 ***How Privacy and Security Concerns Impact the Intention to Engage with Personalization Using Cookies and Collected Data***

Jason Matthew (BINUS University, Indonesia); Wahyu Sardjono (BINA NUSANTARA University, Indonesia)

The ubiquitous nature of online platforms has fostered the proliferation of personalization technologies. These technologies, powered by the collection and analysis of user data through cookies, are employed by organizations to enhance user experience by tailoring content and recommendations. While personalization offers the potential to improve user satisfaction and engagement, it also raises significant privacy and security concerns. This research delves into the intricate relationship between perceived privacy and security risks and user intentions to engage with personalized services. Drawing upon the dual-factor theory, this study posits that individuals' perceptions of privacy and security risks associated with data collection act as inhibitors, while the perceived benefits of personalization serve as enablers. To empirically examine these relationships, a comprehensive survey was conducted. The findings underscore the significant impact of privacy and security concerns on users' willingness to embrace personalized experiences. As individuals become increasingly aware of the potential risks associated with data sharing, organizations must adopt strategies to mitigate these concerns and foster trust. The implications of this research are far-reaching. By understanding the factors that influence users' decisions to engage with personalized services, organizations can develop effective strategies to balance the benefits of personalization with the need to protect user privacy and security. This research contributes to the growing body of knowledge on the intersection of technology, privacy, and consumer behavior, providing valuable insights for both academic researchers and industry practitioners.

10D: Cybernetics and Biomedical Engineering

16:25 ***Development of a Combined Fabry-Perot and Fiber Bragg Grating Sensor for Accurate Temperature and Concentration Detection in Biological Applications***

Mohammed Raqeeb Thabit Mohammed Qaid (Kazan National Research Technical University Named After A. N. Tupolev, Russia & Başkent University, Turkey); Alaa Naji Alhussein, Timur Agliullin and Bulat I Valeev (Kazan National Research Technical University named after A. N. Tupolev - KAI, Russia); Roman Makarov (Kazan National Research Technical University Named After A. N. Tupolev-KAI, Russia); Shamil Khastiev (Kazan National Research Technical University

Named After A. N. Tupolev, Russia)

Accurate monitoring of temperature and concentration changes in biological samples is crucial for biomedical diagnostics and environmental monitoring. The development and mathematical modeling of a novel combined fiber-optic sensor integrating a Fabry-Perot interferometer (FPI) and a fiber Bragg grating (FBG) within a single-mode optical fiber are presented in this paper. This integration enables simultaneous and precise measurements of temperature and refractive index changes in biological applications. The sensor's performance was modeled using transfer matrix methods and reflection/ transmission coefficients to simulate spectral responses under varying conditions, including external refractive index, cavity length, grating period, induced refractive index change, and temperature effects. Results demonstrate that the combined sensor exhibits high sensitivity to temperature changes, with a temperature sensitivity of approximately 15-16 pm/°C, significantly surpassing traditional quartz-based sensors. It effectively detects minute variations in the refractive index of the external medium, such as changes in blood composition, allowing for distinction between healthy and diseased states. The enhanced capabilities of the combined FPI-FBG structure provide selective and improved detection compared to conventional sensors. The sensor can be interrogated using both spectral analysis and radio-photonic methods, contributing to increased precision and reliability in biomedical diagnostics, biochemical analysis, and environmental monitoring.

16:40 ***Strategy of Customer Goods Company Through Instagram in Dealing With BDS Actions (Boycott, Divestment, Sanction)***

Amila Nafila Vidyana and Martha Tri Lestari (Telkom University, Indonesia)

The crisis experienced by Customer Goods Company was caused by the rampant boycott actions carried out on social media against brands or companies suspected of being affiliated with Israel. The list of brands suspected of being affiliated with Israel immediately spread quickly and affected several companies whose brand names were mentioned there. Customer Goods Company is the company whose brand name is most often mentioned on the list. Customer Goods Company tried to create a strategy to overcome this through digital content uploaded on Instagram social media because Customer Goods Company is a multinational company, the company is not free to issue statements or clarifications regarding this because many aspects must be maintained, through content that contains implied and implicit meanings This study aims to determine the strategies used by customer goods companies in dealing with BDS actions. This study uses qualitative methods. Customer Goods Company can slowly change public sentiment through uploading interesting content, carried out consistently by paying attention to every feedback given in the form of comments on Customer Goods Company's Instagram to create a more effective next strategy plan, using the NVivo data mining application, researchers get a detailed picture of the key factors in the success of the strategy carried out by the Company through digital content.

16:55 ***An Evaluation of Institutional Web Page Profile Based on Eye Tracker***

Dino Caesaron and Farell Ardani (Telkom University, Indonesia)

A website enables a corporation to present its profile, thereby enhancing user confidence and trust. The complexity of a website affects its usability and user experience. Thus, an organization must

convey its message using a highly usable design. Using an eye tracker to collect objective data and support subjective data is an effective method for website development because it provides critical insights into user navigation and focus points through heatmaps. By tracking gaze points, the eye tracker reveals user focus areas, the duration on specific elements, and navigation patterns, offering precise behavior analysis to improve usability and design effectiveness. This study used an experimental approach with seven participants following a user-centered design (UCD) methodology. The steps included problem identification, analyzing user behavior and experience on the existing website, redesigning the website, and evaluating outcomes. Success was assessed through the satisfaction from the Website Usability Evaluation (WEBUSE) questionnaire and the website's task effectiveness and time efficiency. Developing a website can enhance user satisfaction, increase effectiveness by 9.53%, and improve efficiency by 81%. The study's findings can help institutions meet user needs more effectively, leading to higher satisfaction and business success.

17:10 ***Deep Learning-Based Exploration of YOLOv8 for Acne Vulgaris Type Classification and Lesion Counting***

Anaz Akbar Azhar (Telkom University, Indonesia); Ida Ayu Manik Partha Sutema (Bali International University, Indonesia); Putu Harry Gunawan (Telkom University, Indonesia)

Acne vulgaris is a prevalent skin disorder that considerably affects teenagers and young adults worldwide. The condition is characterized by various lesion types, including papules, pustules, and nodules, each requiring specific treatment approaches. Conventional methods of acne assessment are often inconsistent, subjective, and labor-intensive, making it challenging for dermatologists to provide accurate and timely diagnoses. This study utilizes the You Only Look Once (YOLO) version 8 (YOLOv8) deep learning architecture to develop an automated and objective system for categorizing acne lesions and evaluating acne severity. Renowned for its speed and accuracy in object detection, this model processes facial images through resizing, normalization, and augmentation to maintain data consistency and boost detection precision. Lesions are categorized into papules, pustules, and nodules. The model achieved 80% precision, 81% recall, and a 78% F1-score, illustrating its effectiveness in detecting and classifying acne lesions while minimizing diagnostic delays. Future efforts should address dataset imbalances by integrating underrepresented classes, exploring class-weighted training, and applying advanced augmentation techniques to further enhance performance. This study underscores the potential of AI-powered tools like YOLOv8 to advance dermatological practice, improve patient care, and contribute to public health progress.

17:25 ***The Role of News Sentiment in Predicting the Jakarta Composite Index Using Long Short-Term Memory***

Zadosaadi Brahmantio Purwanto (Telkom University, Indonesia); Narita Aquarini (École Doctorale Science Economics Université de Poitiers Intervenant Finance, France); Indwiarti Indwiarti and Putu Harry Gunawan (Telkom University, Indonesia)

This paper investigates the integration of sentiment analysis and historical data to enhance the accuracy of Jakarta Composite Index (JCI) stock return predictions using a Long Short-Term Memory (LSTM) model. The dataset spans January 3, 2014, to August 6, 2024, consisting of 2,647 daily

observations enriched with sentiment scores derived from over 10,000 Kompas.com news articles. Sentiment analysis, performed using a Large Language Model (LLM)-based ChatGPT model, classified sentiment into Positive, Neutral, and Negative categories, which were then integrated as predictive features. Five scenarios for incorporating sentiment data were evaluated, with Scenario 2 (sequence of past sentiment scores) yielding the best performance. Specifically, it achieved the lowest Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) across various metrics: 36.4570 and 47.5527 for Absolute Return prediction, 0.005209 and 0.006804 for Relative Return prediction, and 50,725 and 65,653 for Close Price prediction. These findings underscore the significant role of sequential sentiment data in improving prediction accuracy, offering practical recommendations for investors to leverage sentiment analysis in making more informed decisions in the JCI market.

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Integration of Bundling Product Recommendation System and Stock Management in Fast Fashion Retail Business

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***Abstract*— Fast fashion presents products with designs that change quickly according to trends but at lower prices. This condition forces fast fashion business actors to update their stock quickly. However, uncertain public demand often results in piles of stock in the warehouse. One way to overcome this is to provide discounts through bundling product sales. In order for bundling product recommendations to be right on target, it is necessary to consider the level of complementarity of product combinations with public interest. The complementarity level of product combinations by public interest can be obtained by analyzing sales data. In this study, a bundling product recommendation system was developed and integrated with the purchasing and sales information system. Bundling product recommendations are carried out using the apriori algorithm. The recommendation system was applied using sales data from the information system between December 27, 2023 and January 2, 2024. The minimum support used was 0.1, and the minimum confidence used was 0.4. The system produces three bundling product recommendations within 30 seconds and showing that most consumers are inclined to buy a cloth set (tops and pants) and prefer neutral colors, namely white and black. The time required by the system to generate recommendations is 97.6% faster than if done manually. In addition, four fashion store owners validated the developed information system and the recommendation results. The validation results stated that the system facilitates business administration, monitors stock, analyzes consumer behavior, and develops marketing strategies with bundling promos. Finally, integrating the information and recommendation systems can increase data consistency and reduce data input time by 50% compared to systems developed separately.**

Keywords*— bundling product, apriori algorithm, fast fashion, integration, information systems

I. INTRODUCTION

Fashion combines styles, designs, and motifs that people of various ages, genders, and social statuses have widely sought after and used [1]. In advancement, fashion is no longer just a body covering; it has become a symbol that reflects a person's self-image through outward appearance [2]–[5]. The clothes worn by a person can show the personality, profession, and social status of that person. Currently, the textile and fashion industry is growing rapidly [2]. To anticipate these rapid changes, businesses in the fashion sector must be able to adjust the fashion products they sell to trends that are adjusted to people's preferences to stay competitive. The high level of competition motivates fashion business actors to produce products at more economical prices. Fast fashion is a concept used in the fashion industry to present products with designs that change according to trends but at low prices [6]–[9].

In the fast fashion business, updating product stock to meet public trends is essential [7], [10]–[12]. However, rapid stock updates and unstable public demand caused products not yet sold out to pile up [13]. Stock accumulation causes losses for business actors because it incurs storage costs. In addition, stock that is stored for too long is susceptible to damage, such as fading color, being eaten by moths, and being out of trend. Therefore, fashion business actors should make efforts to finish existing stock.

One efficient way to finish product stock is by giving discounts [13], [14]. In addition to finishing stock, discounts are another factor that can increase public purchasing interest [15]. One discount-giving strategy is product bundling. The product bundling strategy involves two or more product combinations in one package to attract consumer interest to buy it [16]. The product bundling strategy is an effective marketing tool to increase consumer demand for discount prices [17]–[20] or to influence consumer interest in buying [21], [22]. In addition to increasing sales, the product bundling strategy can also help companies finish products that are not selling well or introduce new products. However, in implementing a product bundling strategy, it is necessary to carefully consider the level of complementarity of the product combination and the price differences when sold separately so as not to cause losses for the company [17], [23].

There have been many studies on product bundling recommendations developed by researchers in various fields. Reference [24] developed a product bundling strategy for IndiHome products. The product combination was compiled using the Apriori Algorithm. The study results showed that the association rules formed can be used to develop a product bundling sales strategy and demonstrated the effectiveness of each channel location so that they can be used to create a marketing strategy that should be implemented. Reference [22], [25], [26] also used the Apriori algorithm to develop a product bundling strategy to increase retail sales. The marketing strategy through the sale of bundling products in the agricultural sector was developed by [27] using the FP-Growth algorithm and [18] using the heuristic algorithm. The study's weakness is that the data used to develop a product bundling strategy is stored separately from the system that produces the data (data source). Every time the product bundling recommendation system is run, data must be transferred from the data source to the recommendation system.

Reference [28] developed a fashion product purchasing and sales information system using the SDLC methodology. This research was conducted to facilitate data collection and

report generation. Similar research was conducted by [29] and [30]. The development of a fashion product information system with the aim of expanding the marketing area was conducted by [31], [32]. Various studies related to fashion product sales management produce a lot of data. However, the produced data were not utilized optimally because it is only used to generate routine reports.

In this study, a system was developed that integrates the fashion product management process with the promo bundling recommendation system. This research is expected to help business actors develop marketing strategies to compete by utilizing the recommendations' results using data from information systems so that there is no need to input data twice.

The rest of this paper is structured into three sections. Section II will discuss methods used to build the model. Section III explores the application of this method in recommending bundling products. Finally, Section IV presents conclusions and potential avenues for future development.

II. Research Method

This study conducted a system analysis with four fashion business actors in Surabaya using qualitative methods, namely interviews and field observations so that the research could run according to real conditions and be utilized by fashion product business actors.

The first business actor sells various daily wear tops, such as t-shirts, polos, and hoodies. The tops sold are fast fashion items, basic fashion items, and custom orders. The first business actor has made sales of more than 12,000 transactions through Shopee. The second business actor sells women's fashion products in the categories of tops, bottoms, outerwear, and dresses. The products sold are fast fashion items and basic fashion items. The target consumers of the second business are women aged 20-35 years who like to mix and match clothes. This business actor has made sales transactions of more than 500 transactions through Shopee.

The third business actor sells fashion products in the shoe, top, bottom, and accessories categories. The products sold are sportswear and daily wear products. This business actor has made over 400 sales transactions through Tokopedia and WhatsApp. The fourth business actor sells accessories and bags. The target market for the fourth business is women aged 15-40 years old. This business actor has made over 600 sales transactions through Shopee and Whatsapp.

The analysis results will be used to develop a fashion product purchasing and sales information system equipped with a promo bundling recommendation feature. The promo bundling feature was implemented using the Apriori algorithm and three evaluation metrics. The Apriori algorithm was chosen in this study because this algorithm is one of the most powerful machine learning algorithms for identifying relationships [33], easy to understand and implement [34], and requires less memory than the FP Growth algorithm [34]. The three-evaluation metrics were:

1. Support

The support of an itemset A is the probability of the occurrence of itemset A in sales transactions [35]–[37]. The support value of an itemset A can be calculated using (1), while the support value of an itemset consisting of two items can be calculated using (2).

$$support\ (A) = \frac{N(A)}{N} \quad (1)$$

$$support\ (A,B) = \frac{N(A \cup B)}{N} \quad (2)$$

where:

$N(A)$ = the number of transactions containing itemset A.

$N(A,B)$ = the number of transactions containing itemset A and B.

N = the number of transactions.

2. Confidence

Confidence is a value that states how often itemset B appears in transactions that contain itemset A [38]. Equation (3) is used to calculate the confidence value [35], [36].

$$confidence(A \rightarrow B) = \frac{support(A \cup B)}{support(A)} \quad (3)$$

3. Lift

Lift is a value that shows the correlation of random events from itemsets A and B [35], [36], [39]. The lift value between itemsets A and b can be calculated using (4). If $P(A \cup B) = P(A) * P(B)$ then the occurrence of itemset A is independent of the occurrence of itemset B. A lift value of less than one indicates that the occurrence of itemset A is opposite to the occurrence of itemset B in the sense that the occurrence of itemset A causes the non-occurrence of itemset B and vice versa.

$$lift(A,B) = \frac{P(A \cup B)}{P(A) * P(B)} \quad (4)$$

where:

$P(A \cup B)$ = the probability of the occurrence of both itemsets A and B in sales transaction

$P(A)$ = probability of the occurrence of itemset A in sales transactions.

$P(B)$ = probability of the occurrence of itemset A in sales transactions.

The Apriori algorithm is characterized by its iterative approach, known as a level-wise search. This approach involves using k-itemsets to explore $(k + 1)$-itemsets, and the process is repeated until no more-itemsets can be found [36], [39]. Fig. 1 shows the stages of the Apriori algorithm.

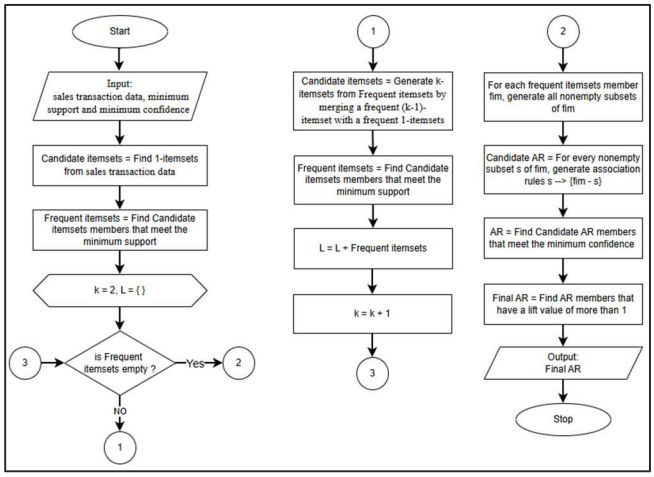

Fig. 1. Apriori algorithm stages.

The working process of the Apriori algorithm consists of two stages, namely obtaining frequent itemsets and forming association rules. The steps to obtain frequent itemsets are:

1. Determine the minimum support value and minimum confidence value.
2. Search for 1-itemsets that meet the minimum support requirements (L_1). Next, L_1 is used to find 2-itemsets that meet the minimum support requirement (L_2). This step is repeated until no more k-itemsets can be found.

After obtaining all k-itemsets that meet the minimum support of the Apriori algorithm, the k-itemsets are then used to form association rules. Association rules are formed by:

1. For each k-itemsets l, generate all nonempty subsets of l.
2. For each nonempty subset s of l, form a rule with the format $s \rightarrow \{l - s\}$
3. Delete rules from step 2 that do not meet the minimum support and minimum confidence values.

Next, look for all rules that have a lift value of more than one, namely rules that have a positive correlation.

III. RESULTS AND DISCUSSIONS

So far, to finish excess stock or out of trend, the four respondents have given price discounts. Respondents analyzed sales data to determine which products will be discounted by looking at the best-selling products this month, less popular products, high-profit margins, and products that have excess stock or are deadstock. However, respondents complained about this analysis method because it was tiring and took a long time, but they stated that they had yet to find a system to help them determine promo products. The second and third respondents tried to create bundling promos several times, but many of the bundling promos that were made did not provide satisfactory results. This is because the two respondents had difficulty finding complementary product pairs in high customer demand.

The purchasing and sales information system is developed with four roles: admin, cashier, warehouse, and employee. The admin has full access rights to all menus. The menus that the admin can access after logging in are product data management, sales transactions, purchase transactions, and reports (purchases, sales, turnover, list of products that are out of stock or will be out of stock, bundling promo recommendations). The cashier can access the sales menu and view product data. The warehouse section can access the menu to add products and input purchase data. While other employees only have access to the profile page and product list. The main admin page display after logging in can be seen in Fig. 2. On this page, the admin can see the number of sales transactions, turnover obtained, and the amount of expenses made today. In addition, the admin can also see a list of products with less than the minimum stock so that they can consider reordering or not and can see a list of new employees.

Sales input can be done through the Purchase & Sale menu. The sales feature display can be seen in Fig. 3. The sales data entered will be stored in the database and used as a data source to make bundling product recommendations.

The Recommendation feature can be run through the Reports menu. The Recommendation feature page display can be seen in Fig. 4. When using the Recommendation feature, it's important to note that the admin can specify the sales period for data analysis. The period can be filled in according to the trend change period. The admin can also limit the product variants for bundling promos. The system will then automatically use the sales data from this period, which is stored in the database, to generate bundling product recommendations. The presence of product variant input allows shop owners to get particular bundling product recommendations for certain products.

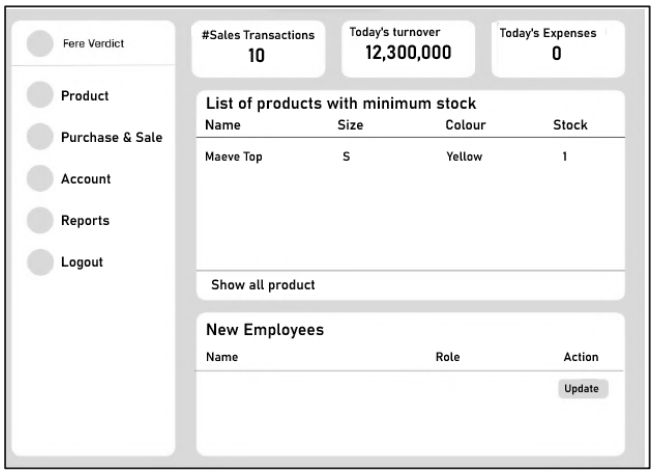

Fig. 2. Admin dashboard.

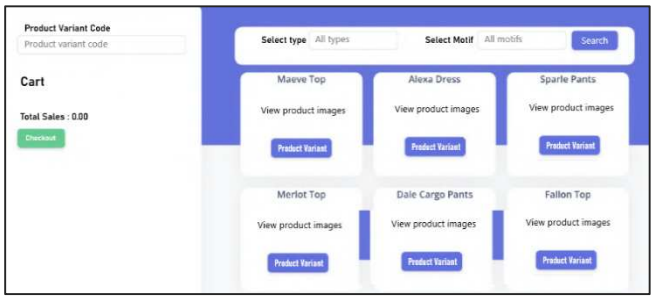

Fig. 3. Sales page.

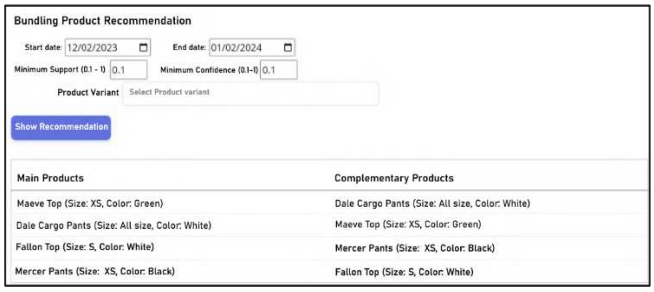

Fig. 4. Recommendation page.

In this study, the bundling product recommendation feature trial was carried out using sales data between December 27, 2023, and January 2, 2024. The minimum support value used was 0.1 and the minimum confidence was 0.4. The reason for taking the minimum support and minimum confidence values was that the sales transaction collection period was only one week, so the data collected was not much. In addition, the number of fashion products sold for each variant was not large. In contrast, the fashion products used to generate recommendations were differentiated by size and color. Hence, the possibility of each fashion product appearing in a sales transaction was insignificant. Bundling product recommendations will be searched for all product variants. The database has stored 25 sales data, as shown in Table I. Tabel II shows the combination of recommended product variants and consumers' buying habits. Consumers habitually

buy clothes in one set: tops and pants. At the same time, the preferred colors are neutral colors: black and white.

TABLE I. SALES DATA USED FOR RECOMMENDATIONS

Transaction ID	Sales Date	List of Purchased Items
1	30/12/2023	Maeve Top (XS-Green)
2	01/01/2024	Merlot Top (S-Black), Dale Cargo Pants (All Size-White)
3	01/01/2024	Alexa Dress (S-Black)
4	31/12/2023	Maeve Top (XS-Green), Dale Cargo Pants (All Size-White)
5	01/01/2024	Maeve Top (XS-Green), Dale Cargo Pants (All Size-White)
6	02/01/2024	Maeve Top (XS-Green), Dale Cargo Pants (All Size-White)
7	02/01/2024	Maeve Top (XS-Green), Beau Top (All Size-Red)
8	27/12/2023	Maeve Top (XS-Green), Dale Cargo Pants (All Size-White)
9	27/12/2023	Maeve Top (XS-Green)
10	27/12/2023	Maeve Top (XS-Green), Lexy Bodysuit (S-Black)
11	28/12/2023	Maeve Top (XS-Green)
12	29/12/2023	Maeve Top (XS-Green), Mercer Pants (XS-White)
13	30/12/2023	Maeve Top (XS-Green)
14	02/01/2024	Maeve Top (XS-Green), Fallon Top (S-White)
15	02/01/2024	Maeve Top (XS-Green), Mercer Pants (XS-White)
16	02/01/2024	Fallon Top (S-White), Mercer Pants (XS-Black)
17	27/12/2023	Fallon Top (S-White), Mercer Pants (XS-Black)
18	28/12/2023	Fallon Top (S-White), Beau Top (All Size-White)
19	29/12/2023	Fallon Top (S-White)
20	30/12/2023	Fallon Top (S-White), Mercer Pants (XS-Black)
21	01/01/2024	Fallon Top (S-White), Mercer Pants (XS-Black)
22	31/12/2023	Alexa Dress (S-Black), Fallon Top (S-White)
23	31/12/2023	Fallon Top (S-White), Mercer Pants (XS-Black)
24	29/12/2023	Sparle Pants (XS-Grey), Fallon Top (S-White)
25	01/01/2024	Fallon Top (S-White)

TABLE II. PRODUCT BUNDLING RECOMMENDATION RESULTS

Fallon Top (S-White), Mercer Pants (XS-Black)
Dale Cargo Pants (All Size-White), Maeve Top (XS-Green)
Mercer Pants (XS-Black), Fallon Top (S-White)

Validation was carried out to ensure that the developed system can help handle the administration of purchasing and selling fashion products and provide recommendations for developing bundling promo strategies. Two types of validation are carried out: by conducting interviews with the four business actors who were research respondents and by comparing the manual calculation time with the time required by the system to provide recommendations. The interview results showed that respondents were greatly helped by the presence of:

1. The sales recording system uses barcodes to speed up the recording process and reduce input errors.
2. The automatic stock update process when recording purchases and sales simplifies stock management and mitigates the risk of fraudulent activities.
3. The routine reports provided make it easy for business actors to monitor and analyze the business conditions they manage.
4. Bundling product recommendation features extensively helps respondents determine product combinations to increase sales, finish stock, and understand consumer behaviors. Consumer behaviors are critical parameters in determining the purchase of fashion products.

The comparison between the manual calculation time and the time required by the system to provide recommendations showed that the manual calculation took 21 minutes to produce recommendations, while the system developed in the study took 30 seconds. The comparison results showed a reduction in processing time of 97.6%.

In addition, integrating the purchasing and sales information system and the bundling product recommendation system eliminates the sales transaction input process required by the recommendation system. Sales transaction data needed by the recommendation system will be taken automatically from the purchasing and sales information system. Table III compares the results of this study with previous studies that developed a recommendation system that was separate from the data source system. The comparison result shows that integration will reduce one input process (reducing data input time by 50%) and increase data consistency because the data comes from the same source.

This study uses the apriori algorithm to obtain bundling product recommendations. The apriori algorithm has advantages in memory usage but lacks processing time [34]. In addition, bundling product recommendations are only based on the frequency of a set of products appearing together without considering other things such as product type (fast fashion or timeless fashion), gender, and different consumer interests. Therefore, there is still the possibility of development for further research.

TABLE III. COMPARISON OF RESEARCH RESULTS WITH PREVIOUS RESEARCH

Aspects	Research Results	Previous Research
Sales transaction input	Sales transaction data input is done once through the purchasing and sales information system.	Sales transaction data input is done twice: when a sales transaction occurs and in the recommendation system.
Data consistency	The data used for recommendations is consistent with the purchasing and sales information system data.	Due to certain reasons, such as input errors, there is a possibility of data inconsistency between the data during the sales transaction and that entered into the recommendation system.

IV. CONCLUSION

The product bundling recommendation system developed is integrated with the purchasing and sales information system to help with business administration and stock management, analyze business conditions, and understand consumer behavior, which will help develop marketing strategies and procure fashion products in the future. Integrating the recommendation system with the information system can improve data consistency and reduce the recommendation process time.

Currently, recommendations are made based on sales history. However, in reality, each consumer's interest in fashion products is different. The difference in interest from each consumer can be seen from the sales history or searches conducted by a consumer. Therefore, there is still an opportunity to develop this research so that the bundling product recommendations given to a consumer can be adjusted to the consumer's interests.

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