ABSTRACTS

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Forecasting monthly road accidents in selected cities of wielkopolska using neural networks

(pages 115-128)

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Keywords: road accidents, neural networks, time series forecasting, forecast accuracy, urban traffic safety.
Abstract: Accurate forecasting of road accidents is essential for urban traffic safety management and preventive planning. This study uniquely integrates meteorological and accident data across five mid-sized Polish cities, providing city-specific forecasting insights. Findings suggest city-specific neural network models can guide targeted interventions, particularly in small vs. large urban areas. This study analyzes monthly road accident data from five cities in the Wielkopolska region of Poland—Piła, Konin, Leszno, Poznań, and Kalisz—covering the period 2018–2024, and evaluates the performance of neural network-based forecasts over 6- and 12-month horizons. The dataset includes meteorological variables (temperature, precipitation, snow cover, humidity, wind, sunshine) and detailed accident counts, distinguishing between minor, serious, and fatal accidents. Descriptive statistics reveal significant differences across cities: Poznań exhibits the highest average monthly accidents and variability, while Piła records the lowest mean with several months of zero accidents. Forecast accuracy metrics (MAE, RMSE, MAPE) indicate that neural network models provide reasonable predictions in absolute terms, particularly for larger cities, while relative errors are high in smaller cities due to low accident baselines. Extending the forecast horizon from 6 to 12 months generally reduces accuracy, although some medium-sized cities show minor improvements, likely reflecting annual seasonal patterns. The results highlight the importance of city-specific forecasting strategies, where absolute errors guide planning in large urban centers and relative errors are critical in smaller cities. The study demonstrates the practical applicability of neural networks in urban accident prediction, while also identifying limitations related to low-frequency events, model interpretability, and available predictors.

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Dynamic digital transportation on local government: a case study on the regional government of the special region of Yogyakarta 2005-2025

(pages 129-146)

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Keywords: digital government, e-government, digital transportation, local government.
Abstract: Bureaucratic reform and digital Transportation have become central to improving public service quality in Indonesia, particularly within the Special Region of Yogyakarta (DIY). Despite significant progress, challenges remain in institutionalizing digital governance as a sustainable agenda. This study formulates the problem of how digital Transportation has unfolded in DIY between 2005 and 2025, and what factors have influenced its dynamics. The objective is to describe and analyze the long-term evolution of digital Transportation in local government, highlighting the interplay of technological, organizational, and policy dimensions. Methodologically, the research adopts a qualitative exploratory approach using a single-case design, relying on in-depth interviews, document analysis, and secondary data to capture the longitudinal process of change. The findings reveal that DIY's Transportation journey progressed from early e-government initiatives under the Jogja Cyber Province Blueprint to the Smart Province framework, supported by regulatory reforms, leadership continuity under asymmetric decentralization, and institutional coordination through Diskominfo DIY. Results indicate that while digital infrastructure, human resource development, and regulatory frameworks have advanced, sustainability remains constrained by hierarchical bureaucratic culture, limited funding mechanisms, and uneven digital literacy. The study contributes theoretically by framing digital Transportation as a co-evolutionary process shaped by socio-technical interactions, empirically by providing a detailed case study of DIY, and practically by offering policy insights for embedding digital governance into long-term institutional frameworks. The discussion emphasizes the need for stronger institutionalization, sustainable funding, and citizen-centered approaches to ensure resilience and inclusivity in future digital governance.

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AI-driven adaptive free-space optical backhaul for secure and resilient 6G mobile

(pages 147-159)

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Keywords: free-space optical, ultra-dense, 6G network, AI-driven adaptive, radio-frequency.
Abstract: The rapid growth in ultra-dense mobile deployments in upcoming 6G networks requires high-capacity, low-latency and secure backhaul solutions as compared to conventional radio-frequency (RF) systems. The Free-space optical (FSO) communication has many promising features such as fast (multi-gigabit) data rates, unlicensed spectrum and immunity to electromagnetic interference, to address the above issues and ideal for next-generation tower-to-tower connectivity. But still there are some issues need to address such as FSO links suffer from severe atmospheric attenuation, beam misalignment and vulnerability to environmental disturbances. These issues limit their reliability for long-range mobile communication. In this paper we propose an AI-driven adaptive FSO backhaul architecture for secure and resilient 6G mobile networks. The proposed system integrates reinforcement learning-based beam alignment, weather condition

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based dynamic power control and incorporates anomaly detection method to maintain link stability under varying atmospheric conditions. A hybrid RF–FSO redundancy model is further used to enhance reliability during severe fading events. Security is strengthened through intelligent intrusion detection tailored for optical channel characteristics. The Simulation results show significant improvements in link availability, throughput stability and outage probability as compared to conventional static FSO systems. The proposed framework provides a scalable and energy-efficient solution for long-range tower-to-tower communication in 6G deployments.

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Evaluating the efficiency of shipping agencies: an analysis of exporters' opinions in Coimbatore district

(pages 160-168)

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Keywords: logistics, shipping agencies, exporters, cargo clearance, service quality and tiruppur.
Abstract: Logistics plays a pivotal role in ensuring the smooth flow of goods from production to consumption, particularly in a globalized economy. Shipping agencies act as key intermediaries in international trade, facilitating export and import processes. This study examines exporters' opinions regarding the performance of shipping agencies, focusing on operational efficiency, documentation, cargo clearance, and service quality in the Tiruppur region. A descriptive research design was adopted, and primary data were collected from 50 exporters using structured questionnaires. The findings highlight key issues such as delays, cost concerns, and documentation challenges, while also suggesting improvements for enhancing logistics service performance.

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Production and dimensional analysis of filament from recycled PLA material

(pages 169-175)

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Keywords: PLA material, recycling, extrusion, filament diameter.

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Abstract: This study focuses on the recycling of polylactic acid (PLA) waste generated during 3D printing using Fused Filament Fabrication (FFF) technology and its reuse to produce recycled filament. The main objective was to evaluate the dimensional accuracy of filament produced from recycled PLA material. The recycling process consisted of shredding printed PLA specimens, drying the resulting granulate, and subsequently re-extruding the material using a laboratory-scale filament extrusion system. During the extrusion process, the filament diameter was continuously monitored using an integrated optical sensor with a nominal target diameter of 1.75 mm. The dimensional stability of the produced filament was subsequently evaluated using descriptive statistical analysis. The results demonstrated that most of the measured diameter values remained within the predefined tolerance range of 1.65–1.85 mm, indicating a relatively stable and controlled extrusion process. The average filament diameter reached a value of 1.747 mm, corresponding to the nominal target value. Only a negligible exceedance of the upper tolerance limit was recorded, with the maximum measured diameter reaching 1.851 mm. Statistical analysis revealed slight variability in the diameter values, most likely caused by the inhomogeneity and varying granule size of the recycled material after the shredding process. The findings confirm that recycled PLA material can be successfully reprocessed into filaments suitable for FFF 3D printing applications. The study also highlights the potential of PLA recycling in supporting sustainable and environmentally responsible additive manufacturing while maintaining acceptable filament quality and dimensional stability.

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In vitro differentiation of chorionic mesenchymal stem cells for applications in biomedical engineering

(pages 176-180)

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Keywords: mesenchymal stem cells, differentiation, regenerative medicine, tissue engineering, in vitro.
Abstract: Mesenchymal stem cells (MSCs) are multipotent stromal cells with significant regenerative potential. This study evaluates the differentiation capacity of chorionic mesenchymal stem cells (CMSCs) into adipogenic, osteogenic, and chondrogenic lineages under in vitro conditions. Experimental results confirmed successful lineage specification using histological staining methods. Adipogenic differentiation was characterized by lipid accumulation, osteogenic differentiation by mineralized matrix formation, and chondrogenic differentiation by extracellular matrix production. The findings highlight the applicability of CMSCs in regenerative medicine and tissue engineering, particularly in scaffold-based systems and advanced therapeutic strategies. These findings contribute to the growing body of knowledge on MSC-based applications in biomedical engineering.

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Development of silicone anatomical facial models intended for surgical suturing training

(pages 181-189)

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Keywords: anatomical training model, surgical suturing, silicone casting, 3D printing, medical simulation.
Abstract: Simulation-based training plays an important role in surgical education by providing a safe environment for developing practical skills. However, commercially available suturing simulators are often expensive and offer limited possibilities for anatomical customization. The aim of this study was to develop a low-cost anatomical eyebrow model for surgical suturing training using three-dimensional (3D) scanning, additive manufacturing, and silicone casting technologies. A 3D scan of the facial region was acquired and processed to create a digital model of the eyebrow area. A simulated laceration was incorporated into the model using computer-aided design (CAD) tools. A two-part mould was designed and manufactured using fused deposition modelling (FDM) 3D printing. The final training model was produced by casting a two-component silicone elastomer into the printed mould. Manufacturing feasibility, production costs, and functional usability were evaluated. The proposed workflow successfully enabled the fabrication of an anatomically shaped silicone eyebrow model suitable for practising basic suturing techniques, including needle handling, wound-edge approximation, and knot tying. The prototype accurately reproduced the intended anatomical geometry and wound morphology. The total material cost of the first prototype, including mould fabrication and silicone casting, was approximately €4.89, while subsequent models can be produced at substantially lower cost due to mould reusability. Functional testing confirmed the suitability of the model for basic surgical skills training. The results demonstrate that the combination of 3D scanning, CAD modelling, additive manufacturing, and silicone casting provides a feasible and cost-effective approach for developing customized anatomical training models for surgical education.

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