KICLS 2025
Track on Information Science & AI

PRESENTATIONS

EEG-Based Classification of Induced Tongue Protrusion Using CSP and CNN on Frequency-Band Topographic Features

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Abstract

Tongue movement plays a critical role in the oral stage of swallowing, particularly in bolus preparation, transport, and propulsion. Modern models of oral ingestion describe distinct stages, emphasizing the importance of voluntary tongue activity before swallow reflex initiation. Biomechanically, the tongue facilitates bolus manipulation and transit through coordinated movements, supported by synchronized jaw and hyoid actions. Functionally, it acts both as a lingual delivery pump, with the anterior tongue functioning like a piston, and as a glossopharyngeal propulsion pump driven by the tongue base. Understanding these phases is essential for characterizing both normal and disordered swallowing.

In this study, cortical activity during induced tongue protrusion was examined via EEG, and a deep learning framework was proposed to classify tongue motor imagery from rest using features extracted from specific EEG frequency bands. EEG data were recorded from 30 healthy adults during 15 trials comprising alternating rest and imagination tasks. Sixteen electrodes (10–20 system) captured data segmented into rest (0–2 s) and protrusion imagination (2.75–4.75 s) intervals. Common Spatial Pattern (CSP) analysis enhanced condition discriminability. Power Spectral Densities (PSD) were computed across five frequency bands (Delta, Theta, Alpha, Beta, Gamma) using Welch's method, and average band-specific topographic maps were generated.

Topographic EEG images were classified using a custom convolutional neural network (CNN) with leave-one-subject-out cross-validation. The Delta band yielded perfect classification performance (Accuracy, F1-score, AUC = 1.000 ± 0.000), while the Theta band also showed strong results (Accuracy = 0.960 ± 0.041, AUC = 0.989 ± 0.016). Higher frequency bands exhibited lower performance (e.g., Gamma: Accuracy = 0.546 ± 0.065, AUC = 0.569 ± 0.074), consistent with motor-related activity being predominantly represented in lower frequencies.

These findings demonstrate that tongue protrusion can be robustly identified using EEG-based frequency-topographic representations, particularly in lower frequency bands. This approach offers a novel, non-invasive method for assessing motor tasks related to swallowing, with potential applications in dysphagia rehabilitation and neuromotor evaluation.

Evaluation of Machine Learning Models for Automated Segmentation of SPECT MPI Scans

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Abstract

Aim/Introduction: SPECT MPI is vital for diagnosing coronary artery disease (CAD), with accurate myocardial segmentation critical for assessing left ventricular function. Manual methods are time-consuming and variable. This study evaluates five U-Net–based deep learning models with different encoder backbones; CNN, MobileNet, VGG with attention, Inception, and ResNet50 with attention, for automated segmentation.

Materials and Methods: Two MPI datasets were used: a small set (609 images) and a large set (5169 images), both labeled with ground truth masks. Images were preprocessed to 64×64 pixels and augmented with flipping, distortion, noise, and contrast adjustments. All five U-Net variants were trained using identical hyperparameters and assessed via mean Intersection-over-Union (mIoU), Dice coefficient, pixel accuracy, and AUC. An ensemble model was also developed using weighted averaging of the five networks.

Results: Across both datasets, the Inception-based U-Net achieved the highest individual performance (Dice: 0.9656 and 0.9538; mIoU: 0.9358 and 0.9197). However, the ensemble model outperformed all with Dice scores of 0.9679 and 0.9544, and mIoU scores of 0.9398 and 0.9205. MobileNet U-Net offered the fastest training time but slightly lower accuracy. Inception struck the best balance between segmentation quality and clinical relevance, despite higher computational demands.

Conclusion: Our results demonstrate that deep learning, especially ensemble U-Net models, enables accurate and reproducible segmentation of cardiac SPECT MPI images. The image quality was comparable to that generated by clinical software (Myovation®, GE Healthcare). This reduces dependence on manual interpretation and supports more efficient nuclear cardiology workflows. Future work will focus on real-time deployment, clinical integration, large-scale studies, and radiomics applications.

Robotics in Modern Surgery:
Revolutionizing Precision, Efficiency, and Patient Outcomes

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Abstract

This research explores the transformative role of robotics in modern surgery, examining its historical evolution, technical foundations, clinical applications, global adoption trends, and future prospects. From its early roots in the 1980s with devices like the PUMA 560 and ROBODOC, robotic surgery has matured into a cornerstone of contemporary operating rooms through systems such as the da Vinci Surgical System (Figure 1). Key components—including surgeon consoles, patient-side carts, and vision systems—enhance precision, visualization, and control, enabling minimally invasive procedures with reduced complications and improved recovery.

Figure 1**:** da Vinci Surgical System. (Marcus et. al. 2015)

The integration of computer-assisted technologies and artificial intelligence (AI) has further advanced the capabilities of surgical robotics. Preoperative planning, intraoperative guidance using augmented reality and navigation systems, and postoperative data analytics form a comprehensive digital ecosystem that supports clinical decision-making and improves patient outcomes. AI-driven applications, including surgical workflow recognition, skill assessment, and intraoperative decision support, highlight the shift toward intelligent, semi-autonomous systems.

Robotic systems have been successfully deployed across multiple surgical domains, including urology, cardiothoracic, gynecologic, colorectal, neurosurgical, and general procedures. Their adaptability allows for enhanced dexterity in confined anatomical spaces, better ergonomics, and superior visualization, especially valuable in complex and reconstructive surgeries. Despite their high costs and logistical demands, robotic platforms are increasingly adopted worldwide, with significant growth in North America, Europe, and emerging economies like India, Brazil, and China.

The research also discusses ongoing innovations in miniaturization, flexible robotics, enhanced haptics, and telesurgery enabled by 5G. As the field evolves, future surgical robots are expected to integrate seamlessly with personalized medicine and training platforms powered by AI and simulation. While challenges remain in cost, accessibility, and training, the trajectory of robotic surgery points toward a paradigm shift in precision, efficiency, and global surgical care delivery.

AI-Powered Skin Cancer Detection: From Deep Learning to Dermatological Revolution

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Abstract

Skin cancer is among the most prevalent forms of cancer globally, and early detection is vital for improving survival outcomes. This research presents a comprehensive exploration of how artificial intelligence (AI), particularly deep learning (DL) and convolutional neural networks (CNNs), is transforming the landscape of skin cancer detection and diagnosis. It begins by outlining the biological mechanisms and clinical challenges associated with the three main types of skin cancer—basal cell carcinoma, squamous cell carcinoma, and melanoma—highlighting why early detection is often difficult and yet critically important.

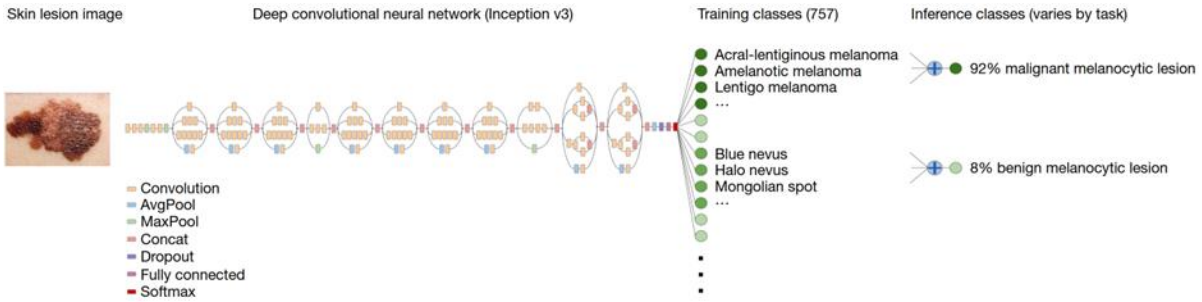

Figure 1: The Deep CNN Classifier Architecture.

The research then delves into the role of AI in improving diagnostic accuracy, scalability, and accessibility, showcasing landmark studies where CNNs have achieved dermatologist-level performance. These include Esteva et al.'s work on large-scale image classification and Haenssle et al.'s comparative study of CNNs versus human experts. Real-world applications, such as mobile diagnostic apps (SkinVision, Miiskin) and ensemble models combining handcrafted and deep features, are discussed to illustrate practical deployment. Key datasets (ISIC, HAM10000, BCN20000) and preprocessing techniques (segmentation, augmentation, GANs) are reviewed as foundational tools enabling AI model development. The research also examines critical challenges, including dataset bias, interpretability, ethical concerns, and regulatory hurdles. To address these, future directions are proposed, including integration with wearable devices for real-time monitoring, explainable AI (XAI) for clinician trust, and personalization through genomic data. Overall, this work provides a forward-looking synthesis of technological innovations, real-world use cases, and emerging trends. It underscores AI's potential to democratize access to dermatological care, particularly in underserved regions, and lays a foundation for the next generation of personalized, scalable, and equitable skin cancer detection systems.

Predictive Modeling of Multi-Class Urban Crime Patterns Using Machine Learning on Spatiotemporal Data

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Abstract

This paper presents a comprehensive study on multi-class crime classification using machine learning, focusing on analyzing and predicting crime types within the City of Chicago, utilizing a dataset that covers incidents from 2001 to 2023. The objective is to develop predictive models capable of classifying crimes into categories such as Theft, Assault, and Narcotics based on temporal and spatial features, thus supporting proactive policing and optimized resource allocation.

The dataset comprises approximately 2 million records extracted from the Chicago Police Department's CLEAR system, including attributes such as primary crime type, location descriptions, arrest status, date, and geographic coordinates. Rigorous data preprocessing was conducted to address challenges posed by missing values, outliers, and class imbalance. K-Nearest Neighbors (KNN) imputation was employed to handle missing geographic information based on proximity to the district, while outliers were identified and removed using Z-score techniques. Class imbalance, particularly significant for minority classes like Narcotics, was mitigated using the Synthetic Minority Oversampling Technique (SMOTE), ensuring balanced representation during model training.

Exploratory data analysis revealed significant temporal and spatial patterns of crime. Temporal analysis identified peaks in crime frequency during late-night hours and specific months, notably April to June, suggesting seasonal and social activity influences. Spatial analysis using Folium-based mapping highlighted district-level crime hotspots, confirming that geographic features, including district and location category, are critical predictors in crime classification. Correlation analysis indicated moderate relationships between crime types and features such as location description (correlation coefficient ≈ 0.31) and 6-hour time intervals (≈ 0.22), validating the inclusion of both spatial and temporal features in modeling.

Three machine learning algorithms were evaluated: Logistic Regression, Decision Tree, and Random Forest. Logistic Regression, despite its interpretability, achieved a relatively low accuracy of 45% and struggled with non-linear feature interactions. The Decision Tree model improved classification performance, achieving an accuracy of 68.73%, due to its ability to effectively model complex, non-linear relationships and categorical variables (Agarwal et al., 2013). The Random Forest model demonstrated superior performance, achieving 77.22% accuracy after hyperparameter tuning via Grid Search, with precision and recall values exceeding 0.79 across all classes (Kiani et al., 2015). The ensemble nature of Random Forest contributed to reduced variance and robust handling of class imbalances, making it the most suitable approach for this multi-class problem. Similar studies have also shown that integrating clustering and data mining enhances

predictive crime modeling (Sathyadevan & Gangadharan, 2014). The study highlights the feasibility of utilizing machine learning for crime classification tasks, providing practical benefits for law enforcement, including predictive policing and the strategic deployment of resources. However, limitations remain, particularly regarding the computational demands posed by the large dataset and constraints in spatial resolution due to address redaction at the block level. Future work will explore expanding the classification to encompass additional crime categories, incorporating features related to urban demographics and seasonality, and applying advanced explainability techniques, such as SHAP values, to enhance model transparency for operational deployment.

AUK Chatbot: An IT-Support AI-Based Virtual Assistant

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Abstract

This work presents the development and implementation of an AI-driven chatbot aimed at enhancing technical support services at the American University of Kuwait (AUK). Leveraging advanced machine learning techniques, natural language processing (NLP), and deep neural networks, our work involves creating two distinct chatbots: one utilizing the Azure OpenAI service (Microsoft Azure, 2024a, and 2024b), and another built in-house using Python libraries such as pandas (Pandas, 2024) and spaCy (spaCy, 2024). The primary objective is to provide an intelligent and responsive system capable of addressing a wide array of technical queries from students, staff, and faculty, thereby alleviating the workload of the existing IT helpdesk.

Our work encompasses several key phases including data collection, pretraining, deployment, and user interaction. Data collection involved aggregating diverse textual sources to form a comprehensive knowledge base. Pretraining focused on equipping the deep neural network with foundational knowledge, enabling it to generate accurate and contextually relevant responses. Deployment was conducted on Microsoft Azure (Microsoft Learn, 2024) to ensure scalability, reliability, and performance, while the in-house chatbot was developed to provide a comparative analysis while testing the performance and accuracy of the chatbot.

The results demonstrated that while the in-house chatbot exhibited faster response times due to its simplicity and localized processing, the Azure chatbot provided superior accuracy and a broader scope of functionalities. This comparative study highlighted the advantages of using Azure's robust infrastructure for implementing scalable and high-performance AI solutions.

In conclusion, our work signifies a major advancement in the university technical support infrastructure, offering a blend of human expertise and artificial intelligence to create a seamless and efficient support system. The insights we provide from developing both chatbot tools provide valuable lessons to similar academic environments for future implementations and underscore the potential of AI-driven solutions in their environments.

Intelligent Energy Management System for Hydrogen-based Hybrid Vehicles Using AI Control Strategies

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Abstract

The global transition to sustainable mobility needs intelligent control techniques to maximize the efficiency and environmental effectiveness of hybrid powertrains. This research is providing the design and simulation of an Intelligent Energy Management System (IEMS) for hydrogen-powered hybrid electric vehicles using machine learning (ML) and artificial intelligence (AI) techniques to allocate power dynamically between fuel cells, batteries, and supercapacitors.
The IEMS is integrated in a top-level MATLAB/Simulink platform, connecting subsystems for fuel cell systems, electric machine, internal combustion engine, DC–DC converter, transmission, suspension, and thermal management. The model simulates real-world interactions between vehicle dynamics, driver input, and ambient conditions and enables realistic closed-loop testing. The system suggested employs fuzzy logic and rule-based neural networks as the adaptive control, which is aided by predictive ML algorithms trained over driving behavior to forecast future energy demand.

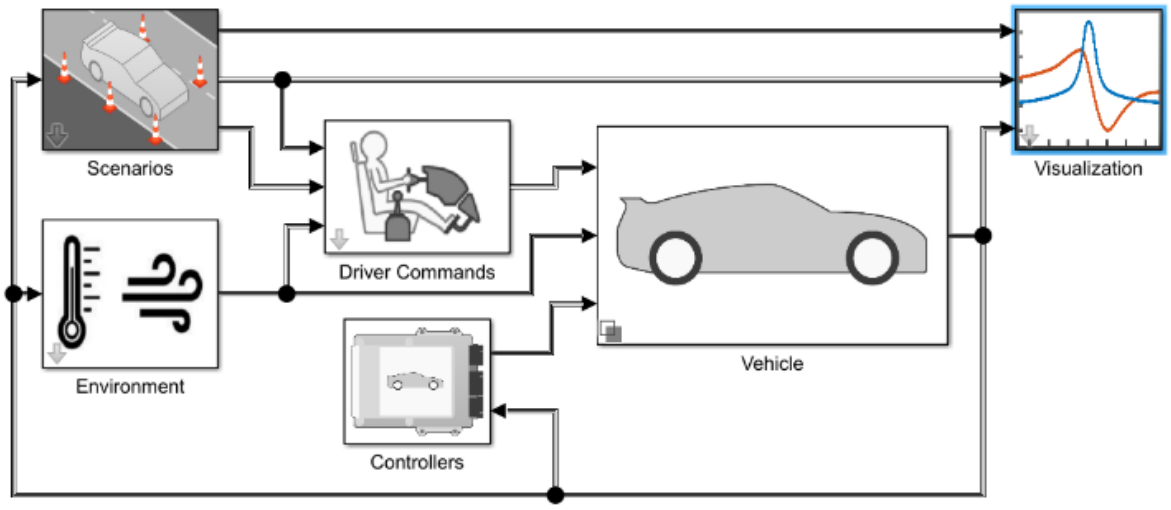

Figure 2: Simulink Environment for Intelligent Hybrid Vehicle Simulation.

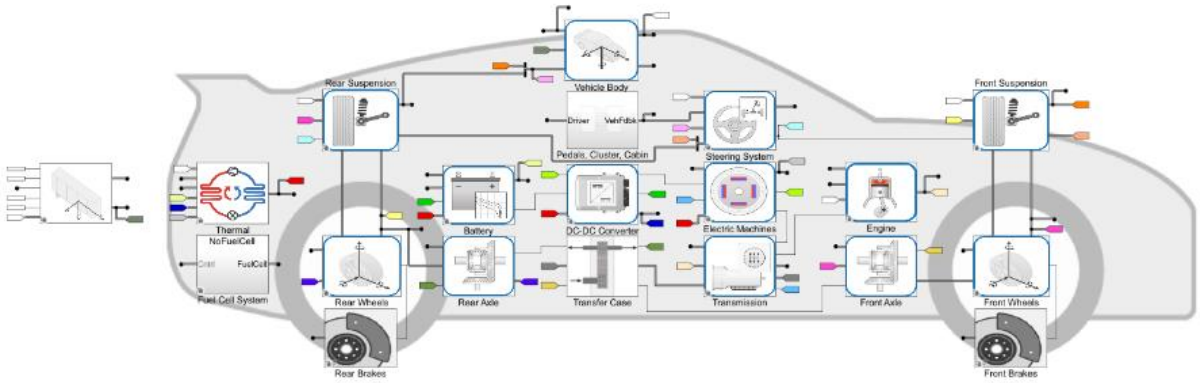

Figure 3: Integrated Vehicle Model for Hydrogen Hybrid Simulation.

Simulation results indicate accurate velocity tracking, better torque coordination, and well-controlled battery State of Charge (SOC) stability. The system achieved measurable fuel economy improvements (MPGe) and reduced hydrogen consumption while maintaining high-response transient dynamics across different driving modes. Visualization outcomes confirm robust hybrid energy coordination and efficient power transitions among sources.

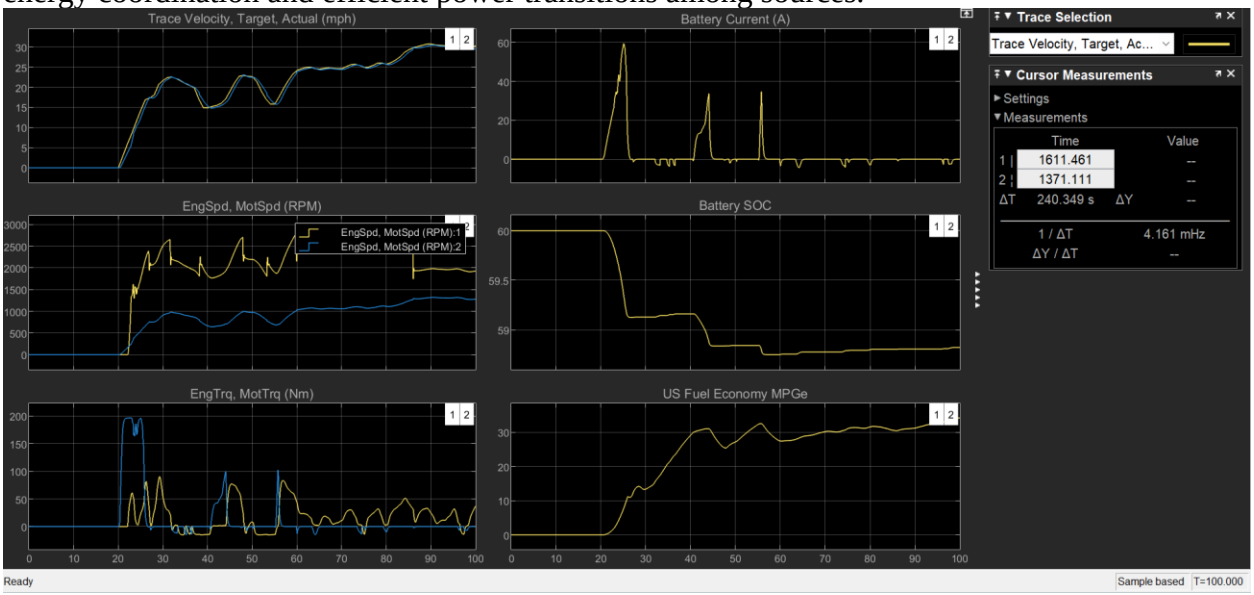

Figure 4: Dynamic Performance of Hydrogen Hybrid Vehicle under Intelligent Energy Management.

This study contributes a scalable and intelligent framework for AI-driven energy management in hydrogen-based hybrid vehicles. By combining predictive analytics and adaptive control, the proposed IEMS supports global goals for zero-emission transportation, energy sustainability, and the broader digital transformation of automotive engineering.

Assessing the Use of Generative AI in Relational Database Schema Generation

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Abstract

Generative AI tools that are concerned with text generation have recently become very common in many areas. They are based on Large Language Models (LLMs) that have the ability to understand text requests and respond in human-like text. Many computing related areas, such as programming and software projects developments, have utilized the area of Generative AI to help the computing specialists in their development and analysis jobs. We consider the problem of relational database schema generation from user data requirements using Generative AI LLM tools. We base the study on two well-known tools, namely ChatGPT by OpenAI, and Gemini by Google. We run the tools on a number of sets of data requirements. We evaluate the generated schemas using a number of schema testing criteria such as the correctness of the generated relations, attributes, referential integrity, etc. Results show that the tools require only minimal expert attention to be used effectively.

An Assessment of ChatGPT in Performing Software Refactoring

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Abstract

Generative AI (Gen AI) tools can be utilized in various areas related to software development. One of these areas is software refactoring. Our research assesses the applicability of ChatGPT in performing software refactoring. It focuses on three widely used refactoring techniques, namely rename method, move method, and extract method refactoring.

The assessment is carried out by comparing the performance of ChatGPT with NetBean across 130 test cases. These test cases are designed to cover multiple refactoring scenarios and applied to five different open-source JAVA applications varying in sizes and domains. We also design a general prompt that can be used in code refactoring using gen AI.

Results show that general models like ChatGPT cannot fully automate code refactoring. Human verification is essential to ensure the correctness of the generated code. However, ChatGPT seems to work successfully only in small environments with a relatively small number of lines of code (LOC), where parsing the code into an Abstract Syntax Tree (AST), as compilers do, is not strictly required.

A Software Tool to Analyze and Predict Student Performance via Artificial Intelligence Models

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Abstract

Classical approaches to exam score analysis, such as computing the average score of a student on an exam, tend to confound the student's ability with the question's difficulty, making it hard to ascertain the true skill of a student or the difficulty of a question. Statistical models that dissociate these two factors have been developed but those are usually to be difficult to use and many existing software packages that implement them lack important features, such as determining the concepts required by each question, providing uncertainty around predictions, and extracting useful insights. We addressed these problems by creating interpretable models that can automatically discover the associations between questions and learning outcomes, and which can generate useful insights and predict the results of new questions.

To validate the developed models, seven real-world datasets from Kuwait University courses were collected. Each dataset consists of three tables: questions, grades, and partial question-outcome assignments. To discover the full assignments, a large language model was used to extract fixed-length representations of question and outcome texts. These representations were then fed into an integer linear program (ILP) to automatically assign questions to outcomes, such that the overall cosine similarity between questions and their outcomes is maximized. Bespoke Bayesian models were constructed to model the collected datasets, given the full assignments. The models consist of two components: a knowledge tracing (KT) component, and a cognitive diagnosis model (CDM). The KT component models the evolution of the student's unobserved knowledge of the outcomes over the course duration. It is based on well-known Bayesian Knowledge Tracing (BKT) model and assumes that outcomes are independent and that a student has a probability of learning and forgetting an outcome from one exam to the next. The CDM specifies how the student's knowledge translates into observations. Two CDMs from the literature were considered: Deterministic Input Noisy And (DINA) and Noisy Input Deterministic And (NIDA). The full model was trained via Markov Chain Monte Carlo.

The DINA models performed well on the collected datasets when generalizing to new students, supporting the trustworthiness of their insights. When generalizing to new questions, the performance was dataset- and exam-dependent as some exams contained questions that are too different from what has been encountered previously. The models were wrapped in an easy-to-use web-based interface that lets users upload data, view question-outcome associations, evaluation results, model parameters, and several key insights.

Advancing Urban Governance and Smart City Development with Innovative Blockchain - Integrated Civil and Vital Registration System (CVRS)

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Abstract

In contemporary discussions on urban governance, digitization emerges as a dominant trend. Urbanization is achieved only if the citizen centric data has been digitized. Hence, there is a need for efficient and effective civil registration and vital statistics systems that are interoperable with various other public services. This study proposes a novel blockchain based integrated CVRS system which integrates the vital statistics like the birth and death registration with the benefits availed by the citizen from the public authority using block chain and smart contracts. The system is built based on the "Ten CVRS registration Framework" [1]. Incorporating blockchain technology into the system enables a secure, decentralized, transparent and automated system with safe verification done using smart contracts. The proposed system used proof of Stake for the consensus. A Zero-Knowledge-Proof protocol-based consensus verification is carried out before attaching the block to the existing chain structure. Integrating this system with other public authorities paves a way to address the long-standing issues with corruption and security

The proposed system is a permissioned blockchain model, where only authorized entities can validate the transaction. The Key component of the system are birth registrations, Death registrations, Marriage and Divorce registration and mitigation registration. The Block chain model consists of a Blockchain Network, Smart contracts, Identity Management System, APIs and Integration layers and User interfaces [2,3].

A permissioned blockchain provides security, trust, and efficiency in civil registration. By using smart contracts, decentralized identity (DID), and interoperability APIs, governments can create a tamper-proof, scalable, and citizen-friendly CVRS.

Developing a Web-based Application to Assist Decision Makers of Charitable Organizations in the State of Kuwait
Phase I: Direct Aid Association

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Abstract

With the growing scope of humanitarian efforts led by the Government of Kuwait, especially in the charitable sector, the need for informed and strategic decision-making has become increasingly critical. This is particularly evident in organizations such as the Direct Aid Association (DAA), which operates through a network of regional and field centers. As the number and complexity of charitable projects increase, ensuring the optimal allocation of resources and addressing project-related challenges require a shift toward more intelligent and scientific decision-making processes. Such processes must account for spatial relationships, geographic factors, and analytical methods that enable more precise planning and execution.

The Kuwait Institute for Scientific Research (KISR) is developing web-based applications incorporating Geographic Information Systems (GIS) to support decision-makers in the charitable sector. The project aims to create an integrated spatial system that enhances various charitable initiatives, particularly those by the Direct Aid Association (DAA). A key component is the development of a spatial database mapping the DAA's projects and facilities across multiple cities and regions to optimize resource allocation and coordination

The proposed system aims to deliver actionable spatial intelligence that facilitates strategic decision-making by visualizing, analyzing, and managing geospatial data for current and future initiatives. It will improve operational efficiency within organizations like the Direct Aid Association (DAA) and enhance coordination across the charitable sector. Integrating Geographic Information Systems (GIS) will strengthen quality assurance and inform long-term strategic planning, ensuring optimal resource allocation. Ultimately, the project aspires to advance charitable work in Kuwait using advanced spatial technologies and data-driven methodologies [1].

Sustainable and AI-Driven Digital Transformation of Ethical Review Processes in Higher Education Institutions

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Abstract

The rapid growth of scientific research has created a need for more efficient, transparent, and traceable ethical review processes in universities and academic institutions. Traditional paper-based systems are often slow, prone to errors, and lack the necessary audit trails, which can hinder sustainable and accountable operations. This study describes the development of a digital, sustainable online ethical review system rooted in management information systems principles and enhanced with artificial intelligence, aiming to tackle these challenges.

This system modernizes the ethical approval process by bringing together functions such as application submission, document uploads, status tracking, and evaluation into a single digital platform. Built by using an iterative, user-driven development approach, the system has been continuously improved based on feedback from ethics committee members and administrative staff, ensuring it meets real-world needs.

A central feature is the decision support module, which uses a set of predefined rules to assist in the initial review of applications. By automating certain checks, the system can quickly identify incomplete, risky, or non-compliant applications and notify the relevant parties. This not only speeds up decision-making but also reduces errors and improves the quality of evaluations. Looking ahead, plans include integrating machine learning and natural language processing models trained on labeled data, enabling the system to provide intelligent, pattern-based recommendations that go beyond simple rule enforcement—creating a more dynamic, smart decision support environment.

The system enforces role-based access controls, allowing researchers to view only their own submissions while committee members and administrators have broader evaluation and management rights. User-friendly interfaces simplify the submission and monitoring process, and seamless integration ensures the system remains secure and sustainable over time.

This approach shows how AI-powered decision support can help make ethics review processes more sustainable, scalable, and transparent within higher education institutions. It also exemplifies how digitalization and AI can support sustainability goals by making resource use more efficient and enhancing accountability. Ultimately, this system can serve as a model for digital governance and illustrates the potential for AI-driven solutions to transform institutional workflows toward smarter, more sustainable practices.

The Development of Halal Ingredient Scanner App by Using AI for Enhanced Consumer Trust and Compliance

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Abstract

This study focuses on the integration of Artificial Intelligence (AI) in verifying halal compliance of food ingredients and its impact on consumer trust. The study aims to develop and evaluate a smart halal scanner application that utilizes AI for ingredient detection and verification. This research encompasses a detailed analysis of halal certification processes, common critical ingredients, and AI-based image and text recognition techniques for ingredient verification. The study also assesses the accuracy and effectiveness of the developed application in improving consumer trust and compliance with halal standards. While the research primarily targets Brunei's halal certification framework, its findings may be applicable to other countries with similar regulatory environments. Thus, this study has significant implications for various stakeholders in the halal food industry, including consumers, regulatory bodies, halal certification authorities, and food manufacturers. By integrating AI technology into halal verification, it aims to enhance consumer confidence by providing a more reliable and real-time verification tool. The findings of this study also provide valuable insights for policymakers and halal regulatory bodies in strengthening halal verification frameworks and enhancing transparency within the halal supply chain. Overall, the research serves as a bridge between technology and religious compliance, fostering greater trust and reliability in halal food products.

Key words: Artificial Intelligence (AI), Halal Scanner Application, Image and Text Recognition Techniques, Ingredient Verification.

Guided vs. Prohibited AI Assistance in Higher Education: Psychological and Ethical Implications

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Abstract

The rise of AI tools has reshaped many aspects of our lives, especially in education. Tools like ChatGPT, DeepSeek, and others have become part of many students' learning journeys. While some use them to better understand course material or help with assignments, others rely on them more heavily. These tools are powerful, and students are constantly finding new and creative ways to use them. However, this wide adoption met significant resistance. Many instructors have chosen to ban AI altogether, often out of concern for academic integrity, learning outcomes, or fairness. Others take a different approach, guiding students on how to use AI responsibly and ethically instead of banning it altogether. This research explores how students react psychologically and ethically to the way instructors handle AI in the classroom. It examines whether the forbidden fruit effect applies in this context and how instructor policies impact student comfort, confidence, and academic behavior. To investigate this, we surveyed 150 university students who had experienced either guided AI use or strict bans in their courses. Their responses offered insight into how these different teaching approaches influenced students' academic mindset, emotional well-being, and ethical considerations. This data serves as the foundation for evaluating the real-world effects of instructor attitudes toward AI and whether support, rather than restriction, fosters a healthier learning environment.

Key findings:

- 70% of the students reported having at least one instructor who encouraged or guided AI use, while 30% said their instructors discouraged or completely banned AI tools.
- Among the students who had AI ban, when asked whether the AI ban helped them act more ethically or responsibly, 43% were unsure, 34% said yes, and 23% said no.
- In addition, when asked if the AI ban affected their usage, 64% said their usage increased, while 12% said it decreased.
- Amongst students who had AI guidance, when asked whether this guidance helped them use AI more ethically or responsibly, 55% said yes, 31% were unsure, and only 13% said no.
- Finally, 69% said their AI usage increased with instructor guidance, 26% said it stayed the same, and only 5% reported using it less.
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Our findings highlight the importance of ethical guidance over strict prohibition and show how ethical guidance promotes responsible behavior and improves student performance and morale. Moreover, the results also show how restricting or banning AI can result in encouraging unethical and unhealthy behavior among students, as well as unintentionally increasing students' reliance on AI. This suggests that supportive, guidance-based policies may work better than bans for helping students use AI responsibly in higher education.

Enabling Factors to Harness the Full Potential of Artificial Intelligence in the Circular Bioeconomy

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Abstract

Artificial Intelligence (AI) is increasingly recognized as a transformative force in advancing the Circular Bioeconomy (CBE), offering solutions that improve efficiency, enable intelligent resource use, and support sustainable innovations. Yet, the successful implementation of AI in the CBE is not solely a technical challenge, it depends on a complex interplay of enabling factors spanning infrastructure, economic capacity, regulatory readiness, social acceptance, and human capital.

This study explores these enabling factors through a comparative analysis of New Zealand and the United States, two economies with markedly different scales and capabilities. Using a multi-dimensional framework, we assess critical enablers such as AI infrastructure, investment models, public trust, workforce development, and dynamic business models, with insights drawn from policy documents, case studies, and relevant literature.

Findings reveal that smaller economies like New Zealand benefit from agility, localized innovation, and strong environmental values but face limitations in infrastructure and investment capacity. In contrast, larger economies such as the United States possess greater technical and financial resources but encounter challenges around system complexity, regulatory fragmentation, and social skepticism.

Our results highlight that AI's value in the bioeconomy depends on tailoring strategies to fit the specific strengths and gaps of national contexts. We recommend scalable policy mechanisms, cross-sector collaboration, and interdisciplinary education initiatives to create an ecosystem where AI can realize its full potential in driving circular bioeconomic transitions.

AI-Driven Personalized Nutrition in the Gulf: A Systematic Review and Conceptual Framework for Culturally Aware Digital Nutrition Interventions

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Abstract

The Gulf region faces unprecedented nutritional challenges with rising diet-related chronic diseases and unique cultural dietary patterns. This systematic review examines AI's role in enhancing nutritional health through personalized nutrition plans and dietary monitoring, addressing technological adaptability to Gulf-specific contexts. Following PRISMA guidelines, we analyzed literature from 2018-2024 using query transformation techniques. From 237 candidate papers identified through systematic screening and citation chaining, 50 highly relevant studies were selected based on Gulf relevance, peer-review status, and AI nutrition applications.

AI-driven systems utilize diverse methodologies including machine learning, deep learning, computer vision, reinforcement learning, federated learning, and natural language processing (Kassem et al., 2025; Ordovás, 2024; Rojanaphan, 2024). Applications span clinical domains (chronic disease management), individual level (personalized plans), and policy level (population strategies) (Gaikwad et al., 2024; Kahalkar & Vyas, 2024; Sudharson et al., 2024). Fifteen studies incorporated wearable technologies for real-time monitoring, while gamification enhanced user engagement (Espinosa-Salinas et al., 2024; Kelly et al., 2021; Mortazavi & Gutierrez-Osuna, 2021). However, significant cultural adaptation gaps exist, with limited Gulf-specific dietary pattern integration. Ethical concerns regarding privacy, bias, and accessibility remain inadequately addressed (Abdelmageed et al., 2024; Varshney et al., 2023; Vegesna, 2024).

This review presents a novel conceptual framework systematically categorizing AI approaches, aligning methodologies with nutrition subfields, and defining application levels. The framework integrates technological capabilities with health outcomes, addressing critical gaps in region-specific AI nutrition research.

Priority directions include developing explainable AI systems, creating culturally contextualized Gulf-adapted solutions, establishing regional food databases, integrating genomics and sensors, and developing ethical frameworks. Longitudinal validation studies are essential for sustained effectiveness in Gulf populations.

A Multi-criteria Based Assessment of Cybersecurity Due Diligence for External Dependencies

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Abstract

The value of an organization is influenced by multiple factors, including market capitalization, products and services, organizational size, and its cybersecurity posture. As cyber threats increasingly target interconnected systems, assessing external dependencies has become a critical component of cybersecurity due diligence. This thesis proposes a comprehensive framework to evaluate an organization's cybersecurity level, with a specific focus on external dependencies.
The framework integrates structured methodologies, including the Analytical Hierarchy Process (AHP) and Multi-Criteria Decision Making (MCDM), to systematically assess cybersecurity due diligence practices. It outlines the due diligence process, relevant criteria, and assessment tools used to evaluate organizations with varied structures and architectures. A cybersecurity due diligence checklist is developed to support standardized evaluations.
This research also includes a practical application of the proposed framework through a structured questionnaire and data analysis, generating insights into the effectiveness of external dependency management. The results demonstrate the framework's potential to support informed decision-making and enhance organizational resilience. The thesis concludes with a discussion on the framework's implications, limitations, and recommendations for future work.

Visualizing SHA-1: Enhancing the Educational Understanding of Cryptographic Algorithms

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Abstract

This paper presents EduSHA, a web-based interactive learning tool designed to enhance comprehension of the SHA-1 hashing algorithm, with a primary focus on advanced undergraduate computer science students studying cryptographic functions. EduSHA addresses limitations observed in conventional cryptography education, where complex algorithms are often taught through text-heavy lectures or static diagrams that fail to support deeper conceptual understanding.

EduSHA is built upon the Hypermedia Algorithm Visualization (HalVis) architecture and integrates SVG-based diagrams with step-by-step animations to demonstrate key components of SHA-1, including message padding, preprocessing, and compression. The platform incorporates interactive exercises, problem-based learning tasks, and user-driven input to create a highly engaging and accessible learning experience.

A mixed-method evaluation was conducted with advanced undergraduate students (n=small sample) to assess EduSHA's effectiveness. Quantitative results indicated that participants using EduSHA achieved higher post-test scores compared to pre-tests, suggesting improved understanding of SHA-1 concepts. However, the statistical reliability of the findings was limited by a small participant pool, uneven distribution, and varying learning environments. Qualitative feedback, on the other hand, strongly supported EduSHA's effectiveness, with students consistently reporting that the tool was educational, engaging, and highly accessible

EduSHA meets its design objectives of fostering active learning, improving accessibility, and increasing engagement in cryptographic education. While further large-scale studies are needed to strengthen the quantitative evidence, the qualitative findings suggest that EduSHA has significant potential as a supplementary laboratory resource in computer science curricula. By combining interactivity, visualization, and problem-based learning, EduSHA addresses known shortcomings in cryptographic education and provides a robust foundation for future interactive tools targeting other complex security algorithms.

Pulse of the Campus: Real-Time Health Tracking with Bangle.js 2

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Abstract

In smart campus environments, the growth of wearable Internet of Things (IoT) devices opens up new avenues for improving user experience, safety, and health. Step detection, heart rate monitoring, and motion sensor data recording are all combined in this paper's real-time health and activity monitoring system, which is based on the Bangle.js 2 smartwatch. Without the need for a native app, the system streams data straight from Bangle.js 2 to an interactive dashboard in the browser using the Web Bluetooth API, making visualization and analysis simple.

The suggested platform provides analysis on step counts, levels of physical activity, and heart rate trends while tracking both individual and group student activity throughout the Kuwait University campus. Considering Kuwait's harsh climate, motion sensors are used with the potential to monitor wellness. The integration of a gamification module, like campus-wide step competitions, encourages faculty and students to lead healthier lifestyles.

Through the integration of real-time analytics and health awareness, this system demonstrates how wearable IoT devices can be integrated into a smart campus setting. It serves as proof of concept for the addition of activity heatmaps, data-driven campus planning, and predictive health alerts. The gathered sensor data may also be integrated with machine learning models in the future to facilitate the clustering of behavioral activity patterns among various user groups and the early detection of fatigue.

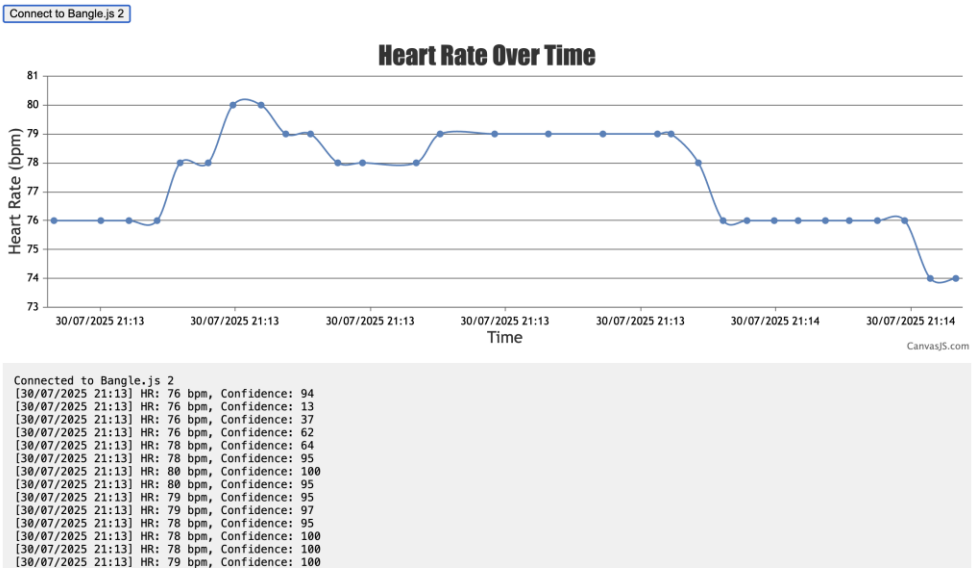

Fig. 1. Overview of the Bangle.js 2-based real-time health and activity monitoring system.

Tele-education System for Dyscalculic Student Let's Count

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Abstract

Throughout history, nations have made significant efforts to facilitate education for their people to build their societies. Tele-education learning systems appeared over the last few decades to overcome many obstacles that prevented some people from gaining access to education. Moreover, these systems provided a better educational experience by offering interactive learning environments using assistive technologies, that are useful for improving the learning performance of dyscalculic student. Dyscalculia involves several types of learning difficulties in mathematics. Dyscalculic students struggle daily in performing simple tasks that need mathematical skills. In this research we are aiming to develop a tele-education learning system for dyscalculic students. Neglecting this category of students without providing them an appropriate educational attention would have a negative impact on their future well-being. Our system will provide exercises built as games to make the learning process more attractive and effective. The system will offer the necessary resources and exercises for students at any place and at any time, making the learning process more convenient for them.

To achieve our aims, we will first investigate the latest studies and research in this area and collect the needed data about the educational process for dyscalculic students through interviews and research. Secondly, we will design the system and implement parts of the educational process. Thirdly, we will collect feedback from the intended users and make the necessary improvements.

Keywords: Online education system, Learning difficulties, Dyscalculia, Assistive technology.