ICEEECS2025

2nd International Conference on Advances in Electrical-Electronics Engineering and Computer Science

October 24-25, 2025
Skopje - North Macedonia

Abstract Book

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Generative AI for Synthetic Sensor Data Generation in Embedded Systems

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Presentation/Paper Type: Abstract

Abstract **–** In embedded systems, the availability of diverse and high-quality sensor data is a critical prerequisite for the development, testing, and deployment of intelligent algorithms. However, acquiring such data can be expensive, timeconsuming, or even impractical in scenarios involving harsh environments, rare events, or early-stage prototyping. Generative Artificial Intelligence (Generative AI) offers a promising solution by synthesizing realistic sensor data that mimics the statistical and temporal characteristics of real-world measurements. This paper explores the application of state-of-the-art generative models—including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Diffusion Models—for the creation of synthetic sensor datasets in embedded contexts. We evaluate the quality of generated data using both perceptual similarity and downstream task performance, such as classification accuracy and anomaly detection. Furthermore, the paper proposes a lightweight architecture for real-time integration of generative models in resource-constrained environments, demonstrating its applicability in edge-based embedded systems. Our findings show that Generative AI not only augments training datasets but also enhances the robustness and adaptability of AI-driven embedded applications.

Keywords – Generative Artificial Intelligence, Synthetic Sensor Data, Embedded Systems, Generative Adversarial Networks (GANs), Edge Computing

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Assessment of Pregnancy Outcomes in Gynecological Cancer Patients Undergoing Fertility-Sparing Surgery with Machine Learning Techniques

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Presentation/Paper Type: Oral / Abstract

Abstract – Gynecological cancers are a significant global health concern, and their treatment often involves the surgical removal of the uterus and ovaries. However, this approach can lead to the loss of fertility, particularly in women diagnosed at a young age. Considering the global rise in infertility and the desire of cancer patients of reproductive age to preserve their ability to have children, exploring fertility-preserving options in the treatment of young women with gynecological cancer has become a clinically important consideration. In this context, fertility-preserving surgery (FSS), which involves partial rather than total removal of the uterus, has emerged as a promising alternative treatment. This study utilizes machine learning approaches based on artificial intelligence (AI) to forecast pregnancy outcomes using records of patients who gynecological cancers underwent FSS. Data from 160 patients treated in two private hospitals in Turkey between 2010 and 2022 were used with institutional ethics permission. Before model training, processes of feature engineering were carried out, which included feature selection, handling missing values, outlier analysis, handling imbalanced data, encoding categorical variables, and feature scaling. To improve model performance, hyperparameter optimization was performed. The experimental results displayed that Extreme Gradient Boosting had the highest training accuracy (89%), while Random Forest and Decision Tree models showed good generalization abilities, with test accuracy of 75% and 78%, respectively. In conclusion, these results indicate that the developed model can accurately predict pregnancy outcomes across multiple classifiers after FSS. Such AI-driven tools have the potential to improve treatment plans for young patients with gynecological cancer and support individualized fertility counselling when integrated into clinical workflows.

Keywords – Machine learning, feature engineering, pregnancy prediction, gynecological cancer, fertility-sparing surgery

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A Literature Review on Digital Restoration: Preservation of Historic Buildings with HBIM, Artificial Intelligence and Virtual Reality

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Presentation/Paper Type: Oral / Abstract

Abstract – This study presents a comprehensive literature review on the digital preservation of historic buildings by focusing on the integration of Historic Building Information Modeling (HBIM), artificial intelligence (AI), and virtual reality (VR). Historic structures are under continuous threat from natural disasters, human negligence, wars, and environmental decay. Traditional preservation approaches, though valuable, often fall short in terms of time efficiency, cost-effectiveness, and accessibility. The integration of digital tools—particularly HBIM—offers a multidimensional solution, enabling accurate documentation, simulation of environmental impact, and data-driven decision-making. Through qualitative content analysis of scholarly articles and case studies, the research identifies current practices, benefits, and limitations of digital preservation methods. Findings suggest that the convergence of HBIM, AI, and VR enhances the sustainability and accessibility of cultural heritage conservation projects.

Keywords – HBIM; Artificial Intelligence; Virtual Reality; Digital Preservation; 3D Model.

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Carbon Sequestration and Oxygen Production with Microalgae: Digital Bioreactor Design and Experimental Results

Mehmet Emin Korkusuz[1], Nihal Arı Korkusuz[2], Dilara Gündüz[1], Ayşe Sena Türeyen[1]
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Presentation/Paper Type: Oral / Abstract

Abstract **–** Terraforming is a critical process that has come to the forefront of space research in terms of the sustainability of extraterrestrial life. This study aims to develop a new bioreactor equipped with a digital observation system to evaluate the performance of Chlorella, Scenedesmus, and Spirulina microalgae under different environmental parameters (CO_2, O_2, pH, TDS, turbidity), inspired by experiments conducted on the International Space Station as part of the Axiom Space-3 mission. The system enables real-time visualization and analysis of data obtained from sensors integrated with the Arduino IDE through a Python-based interface. Experimental findings showed that Spirulina species had the highest oxygen production capacity under full spectrum light and that the oxygen level in the bioreactor environment increased significantly as the CO_2 concentration increased. A Python-based interface was developed and tabulated to visualize and interpret the data from the Arduino IDE-monitored system more quickly. High-efficiency carbon sequestration and biomass production were targeted through the developed bioreactors. By simultaneously examining the responses of microalgae to CO_2 feeding and light conditions, it was determined that the Spirulina species is the most efficient species among the three species in oxygen production under full-spectrum light. Furthermore, according to experimental findings, the Spirulina species exhibited the highest oxygen production under full-spectrum light, and increasing the CO_2 concentration to the 7000-10000 ppm range raised the oxygen level in the bioreactor environment from 20.5% to 22.1%. The growth rate and biomass increase observed in all microalgae species were reliably tracked and recorded using a digital system. Based on the data obtained, the potential of microalgae for carbon absorption, oxygen production, and biomass production was confirmed, and it was demonstrated that these microorganisms form an important foundation for sustainable energy production and terraforming studies.

Keywords – Terraforming, microalgae, digital observation system, space biotechnology

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Who Completes, Who Gets a Certificate? Digital Traces and Learning Outcomes in MOOCs

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Presentation/Paper Type: Oral / Abstract

Abstract – This study aims to investigate the factors affecting course completion and certification among participants in the context of Massive Open Online Courses (MOOCs). Logistic regression analyses were conducted based on participants' demographic characteristics and learning interactions in the online course "Elements of Structures" offered by the Massachusetts Institute of Technology (MIT). The analyses revealed that variables such as graduate education level, age groups (especially ages 45 and above), number of days of interaction, number of video plays, number of chapters completed, and writing activity had significant effects on the likelihood of both course completion and certification. The contribution of written interaction and content completion to success was found to be particularly significant. Model performance was evaluated using ROC curves and AUC (Area Under the Curve). The AUC values of 0.80 and 0.92, respectively, demonstrated high classification accuracy. The findings reveal that logistic regression analysis is an effective tool in developing predictive models for predicting user success on MOOC platforms and offer strategic recommendations for personalized, interaction-oriented design of learning environments.

Keywords – Massive Open Online Courses (MOOCs), Educational Data Mining, Logistic Regression, Course Completion, Certification, Student Engagement

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Recognition of Mushroom Species Using Few-Shot Learning Method with a Siamese Network

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Presentation/Paper Type: Oral / Abstract

Abstract – Mushrooms, as nutritionally and medicinally valuable macrofungi, require accurate recognition due to the presence of toxic species causing severe health risks. Traditional methods based on morphology are time-consuming and prone to human error, which makes automated solutions essential. In this study, a siamese neural network with a ResNet18 backbone was applied to mushroom species recognition under a 7-way 3-shot learning setting. The dataset, derived from Kaggle, was pre-processed with background removal, resizing, normalization, and augmentation to ensure reliable feature extraction. The model was trained with cosine embedding loss and evaluated using accuracy, precision, recall, F1-score, and confusion matrix analysis. Results demonstrated a classification accuracy of 90.48%, with species recognized almost perfectly. These findings confirm the effectiveness of siamese networks for mushroom classification and suggest future improvements.

Keywords – few-shot learning, siamese network, mushroom recognition, image classification, deep learning