Editorial

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Research Award for Innovative Technology for Pocket SCORM. He also advanced information systems to strengthen operational efficiency and organizational development.

1 Introduction

Artificial intelligence (AI) and data-driven technologies are advancing quickly, but their environmental impact and long-term sustainability have become urgent issues. Sustainable development requires that innovation moves forward while protecting natural resources and ecosystem services. Big data provides crucial insights into environmental, social, and economic systems. AI offers analytical and predictive tools, and green learning ensures these technologies are used in energy-efficient and responsible ways. This special issue was created to collect research that develops effective and sustainable AI-powered solutions for future web services and digital ecosystems.

Finally, the accepted articles in this issue can be grouped into three areas. The first focuses on environmental sustainability, including studies on detecting high-emission vehicles and applying VR to marine ecology education. The second highlights resource-efficient infrastructures, with contributions on customer churn prediction, adaptive ECG filtering for wearable healthcare, and modelling of dynamic social networks. The third highlights service optimisation, such as swarm-based recommendation systems and continuous-time reinforcement learning for robotic control. Together, these works show how emerging technologies in big data, AI, and green learning can help support sustainable development in future web services.

This special issue highlights how AI, big data, and green learning can be combined to develop solutions that are both effective and sustainable. The accepted papers not only improve methodologies but also showcase practical applications in various fields. We thank the Editor-in-Chief of *IJWGS* and the editorial team for their support, and we appreciate the efforts of all authors and reviewers who made this issue possible. Section 2 offers an overview of each accepted article.

2 AI-driven technology towards sustainable web service development

The first article, 'Real-time system for detecting high-emission diesel vehicles using deep learning', describes a system that applies YOLOv4 to identify diesel vehicles with high emissions in Taiwan. The model is trained with image augmentation and optimisation techniques, achieving an accuracy of over 91%. This approach offers a helpful reference for environmental monitoring and protecting public health.

The second article, 'Predicting e-commerce customer churn using a PCA-AdaBoost combined model', proposes a hybrid method for forecasting customer churn on e-commerce platforms. The model combines principal component analysis with AdaBoost to include behavioural indicators and clustering refinements. The experiments show an accuracy of over 98%, demonstrating that the approach is effective for customer relationship management and long-term platform sustainability.

The third article, 'Bi-phase LSTM: a LSTM-based autoencoder architecture for dynamic social network prediction', introduces a dual LSTM structure that combines an

autoencoder and a predictor to model changing social networks. Tests on three datasets demonstrate that the method offers stable and precise predictions of future network configurations.

The fourth article, 'Adaptive proportional-derivative adjuster for notch filtering in wearable ECG monitoring', introduces an adaptive filter that adjusts parameters in real time to suppress noise in ECG signals. The method is optimised for low-power microcontrollers, reducing resource use while maintaining signal clarity. Tests with a smart clothing prototype confirm its suitability for continuous and energy-efficient monitoring in wearable healthcare.

The fifth article, 'Improved simplified swarm optimisation for bipartite graph convolutional network', combines swarm optimisation with graph convolutional networks to improve recommendation accuracy. By integrating node features and eye-tracking data, the method enhances prediction of user preferences while keeping computational costs low.

The sixth article, 'Enhancing environmental education through virtual reality: a case study in primary marine ecology learning', develops VR-based learning materials to support marine ecology education for primary school students. The study designs four interactive games using the ADDIE model and evaluates them through expert feedback and classroom application. The results suggest that VR can increase students' interest and awareness in environmental issues, providing a practical tool for ecology education.

The seventh article, 'Implementation matters of continuous-time deep reinforcement learning and its application in robotic arms' an area that has received less attention compared to its discrete counterpart. The study focuses on hyperparameter settings using the Hamilton-Jacobi DQN algorithm and reports how these choices affect reproducibility and computational efficiency. The experiments on Mujoco and PandaGym tasks show that careful parameter selection improves both learning stability and robotic arm control performance.

Taken together, these articles show how data-driven methods and AI techniques can be applied across different domains, from environmental protection and healthcare to education and digital services. The special issue highlights approach that improves accuracy and efficiency while considering sustainability and practical use. We are grateful to the authors for their contributions and to the reviewers and editorial team for their support in completing this issue.

3 Conclusions

In conclusion, this special issue demonstrates how big data, artificial intelligence, and green learning can be integrated to promote sustainable web service development. The accepted papers contribute new methods and practical applications while also addressing environmental and social considerations. We anticipate that the findings presented here will inspire further research and collaboration across various fields. Looking ahead, the challenge is to create intelligent systems that not only boost efficiency but also reduce environmental impact and promote long-term social benefits.