

Editorial

Guest Editorial: Foreword of the Special Issue on Real-World Applications of Machine Learning

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Machine learning is an ever-growing field, and many real-time applications are utilized in daily life [1–4]. There are already various successful machine learning applications, and these applications are continuously increasing due to the development of new algorithms and methods. From the real-time forecasting of events to visual analysis tasks, the performance of state-of-the-art algorithms is unmatched [5–7].

This Special Issue entitled “Real-World Applications of Machine Learning” comprises a compilation of research and review articles. Its primary objective is to present advancements in artificial intelligence methodologies and frameworks, alongside their practical deployment in real-world scenarios. Each article underwent a meticulous peer-review procedure overseen by our Guest Editors. We wish to express our gratitude to all of the authors for their dedicated efforts in submitting articles of exceptional caliber. The Guest Editors would also like to express their gratitude to the anonymous reviewers who offered their invaluable assistance and support in assessing the manuscripts included in this Special Issue. Following a thorough review process, a total of 11 papers were chosen for publication.

Contribution 1 in this Special Issue is titled “The Challenges of Machine Learning: A Critical Review”, and it was authored by Enrico Barbierato and Alice Gatti. This review article discusses the diverse interpretations of learning and the emergence of machine learning (ML) within the field of artificial intelligence (AI). It underscores the challenge in ML in providing causal explanations despite its predictive capabilities, emphasizing the need to bridge this gap through advancements in reinforcement learning and imitation learning, which mirror human cognitive processes.

The next paper (Contribution 2) is titled “Sentiment Analysis in Portuguese Restaurant Reviews: Application of Transformer Models in Edge Computing”, and it was authored by Alexandre Branco, Daniel Parada, Marcos Silva, Fábio Mendonça, Sheikh Shanawaz Mostafa and Fernando Morgado-Dias. This study considers and develops sentiment analysis in Portuguese restaurant reviews using transfer learning and transformer-based pre-trained models. The deployment of models on edge devices highlights their potential for real-time solutions, underscoring the importance of machine learning advancements in practical applications.

Contribution 3 is titled “Deep Learning-Enabled Improved Direction-of-Arrival Estimation Technique”, and was authored by George Jenkinson, Muhammad Ali Babar Abbasi, Amir Masoud Molaei, Okan Yurduseven and Vincent Fusco. This article introduces a novel approach using deep learning (DL) to enhance direction-of-arrival (DOA) estimation, particularly in extreme signal-to-noise-ratio (SNR) conditions. By integrating DL techniques like multi-layer perceptron and convolutional neural networks, it surpasses traditional methods like the multiple signal classification (MUSIC) algorithm, showcasing the importance of machine learning in improving signal processing tasks, even in challenging scenarios.

Contribution 4 is titled “Simultaneous Pipe Leak Detection and Localization Using Attention-Based Deep Learning Autoencoder”, and was authored by Divas Karimanzira.



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This article presents a data-driven approach, using machine learning for leak detection in water distribution networks (WDNs). Utilizing a hybrid autoencoder neural network (AE) with spatial and temporal attention mechanisms, it achieves a high detection rate. Through simulations and a real case study, this study underscores the importance of machine learning in improving leak detection systems.

Contribution 5 is titled “Fault Diagnosis of Oil-Immersed Transformers Based on the Improved Neighborhood Rough Set and Deep Belief Network”, and was authored by Xiaoyang Miao, Hongda Quan, Xiawei Cheng, Mingming Xu, Qingjiang Huang, Cong Liang and Juntao Li. This paper emphasizes the significance of precise transformer fault diagnosis in power systems. It introduces a novel approach using non-coding ratios and an improved algorithm to streamline feature variables for constructing a Deep Belief Network (DBN) diagnostic model, highlighting machine learning’s pivotal role in enhancing fault diagnosis accuracy for reliable power system operation.

Contribution 6, titled “Training Data Augmentation with Data Distilled by Principal Component Analysis”, was written by Nikolay Metodiev Sirakov, Tahsin Shahnewaz and Arie Nakhmani. This paper proposes a novel method for data augmentation using principal component analysis (PCA), enhancing machine learning (ML) classifier statistics. By distilling vectors through PCA and augmenting the original set, it significantly improves ML classification accuracy. The experimental results confirm the effectiveness of PCA-distilled vectors in boosting classification statistics, highlighting the importance of machine learning techniques for data augmentation in training.

Contribution 7 of this Special Issue is “Efficient and Secured Mechanisms for Data Link in IoT WSNs: A Literature Review”, and it was authored by Muhammad Zulkifl Hasan and Zurina Mohd Hanapi. This review article focuses on the rapid development of IoT and WSNs, emphasizing the crucial role of machine learning in addressing data link layer issues like flow control, QoS, and security. By optimizing WSN-IoT architectures, it aims to enhance network performance and industrial productivity, highlighting the importance of machine learning in practical solutions for future advancements.

The Contribution 8 is titled “Efficient Secure Routing Mechanisms for the Low-Powered IoT Network: A Literature Review”, authored by Muhammad Zunnurain Hussain and Zurina Mohd Hanapi. This paper emphasizes the rapid development of Wireless Sensor Networks in the Internet of Things (WSN-IoT) and the crucial role of machine learning in addressing security threats. It underscores the need for enhanced network management and security measures within WSN-IoT to ensure system resilience and mitigate risks, highlighting avenues for future research in optimizing WSN-IoT frameworks.

Contribution 9 is titled “Research on Non-Intrusive Load Recognition Method Based on Improved Equilibrium Optimizer and SVM Model”, authored by Jingqin Wang, Bingpeng Zhang and Liang Shu. This article focuses on load identification for green energy consumption, highlighting the role of machine learning in this field. It introduces an improved equilibrium optimizer (IEO) to enhance support vector machine (SVM) parameters, resulting in improved recognition accuracy. The findings underscore the importance of machine learning in optimizing load recognition tasks for energy-saving initiatives.

The penultimate paper (Contribution 10) in this Special Issue was authored by Pruk Sasithong, Amir Parnianifard, Nitinun Sinpan, Suvit Poomrittigul, Muhammad Saadi and Lunchakorn Wuttisittikulij, and is titled “Simulation-Based Headway Optimization for the Bangkok Airport Railway System under Uncertainty”. This article highlights the importance of machine learning, specifically particle swarm optimization (PSO), in optimizing urban rail transit systems such as the one used in Bangkok’s. By considering real-world constraints and objectives, this study demonstrates the efficacy of PSO-based simulation models in achieving efficient train scheduling.

The last paper (Contribution 11) in this Special Issue was authored by Syed M. Ali, Yanling Guo, Syed Tahir Hussain Rizvi, Roohul Amin and Awais Yasin, and is titled “Interval Type 2 Fuzzy Adaptive Motion Drive Algorithm Design”. This paper presents an intelligent interval type 2 fuzzy adaptive motion drive algorithm for off-road uphill vehicle

simulators, improving realism and driver training effectiveness. By conducting test drives, it demonstrates a superior performance in simulating terrain changes and ensuring driver safety compared to conventional methods.

Finally, our we would like to express our gratitude to the Editor-in-Chief and all of the editorial staff of the *Electronics* journal for supporting the publication of this Special Issue.

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