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Editorial

THEMATIC ISSUE: APPLIED ARTIFICIAL INTELLIGENCE

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In the past, artificial intelligence was merely a part of a fantastical future; now, in just a few years, it is shaping the direction of software development, industry, cybersecurity, energy systems, manufacturing, and many other fields. Real-world application environments are becoming increasingly complex, so AI and its applications are expected to deliver accurate predictions, reliable performance, and rapid adaptation.

This thematic issue of the “International Journal of Artificial Intelligence” brings together research that reflects this broader direction in scientific inquiry, where theoretical advances are closely linked to practice and real-world applications.

The articles included in this issue cover a wide range of topics, yet they are united by a common theme. Each article explores how artificial intelligence can improve the functioning of complex systems that must respond to uncertainty and process large volumes of data. This issue features papers on deep learning in cybersecurity, adaptive data transmission optimization, power system control, industrial automation, distributed software monitoring, and much more.

Several articles examine cybersecurity from different perspectives. One study explores how modern deep learning architectures – specifically, convolutional neural networks, recurrent neural networks, transformers, autoencoders, and generative adversarial networks –can improve the performance of real-time antivirus systems. Another article focuses on anomaly detection in telecommunications networks and demonstrates the effectiveness of autoencoder-based approaches for detecting previously unseen attacks while reducing the number of false positives. These studies show that intelligent security systems are becoming more adaptive.

Another group of articles is devoted to the optimization of software systems and distributed computing environments. One of the papers proposes an adaptive architecture that uses machine learning to select data serialization formats based on current network conditions, thereby improving data transmission efficiency across various communication technologies. A related study examines strategies for optimizing machine learning in distributed intelligent systems and demonstrates that coordinated improvements to data structures, computational processes, and inter-node communication yield greater benefits than isolated optimization methods. This issue also features research on monitoring applications built on microservice architectures, where mathematical modeling and machine learning are combined to improve anomaly detection, resource management, and operational reliability.

Artificial intelligence is transforming both industrial systems and energy infrastructure. One article presents an intelligent control system for electric drives used in heavy metalworking equipment, where adaptive control based on neural networks improves accuracy while reducing energy consumption. Another study examines automated frequency control in power systems that combine nuclear generation with a high share of renewable energy sources, and demonstrates how AI-based forecasting and adaptive control can improve system stability. Complementing these studies, research on hybrid transformer neural networks shows how accurate short-term forecasting of wind and solar generation can contribute to more stable and efficient operation of microgrids.

Digital transformation in manufacturing is represented through a study devoted to architectural models of digital twins. The proposed framework illustrates how operational and management data can be integrated into a unified digital environment, creating opportunities for better forecasting, lower operating costs, and improved production efficiency. The practical orientation of this work reflects an important trend visible throughout the issue: artificial intelligence is increasingly becoming part of complete engineering ecosystems rather than remaining an isolated analytical tool.

Computer vision also occupies an important place in this collection. The paper on real-time facial emotion recognition introduces an efficient architecture designed for intelligent educational systems, balancing recognition accuracy with modest computational requirements. Its results illustrate how advances in deep learning continue to expand the range of AI applications while remaining suitable for deployment in environments with limited hardware resources.

The topics covered in this thematic issue are diverse, and this is part of its value. Machine learning models are no longer developed solely for predictive performance. They are designed to interact with infrastructure, software, communication networks, and human users. Adaptability, explainability, and reliability are repeatedly cited as key characteristics of modern intelligent systems. The articles collected here demonstrate that progress is often achieved by combining established engineering principles with the latest developments in artificial intelligence, rather than by replacing one with the other.

As Guest Editor, I hope this thematic issue will be useful to researchers, engineers, and practitioners working in different areas of artificial intelligence. The papers offer practical solutions, experimental evidence, and ideas that may inspire future research across several disciplines. Their diversity reflects the continuing expansion of AI into domains where robust and carefully designed intelligent systems are becoming an essential part of scientific and technological development.

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Elshan Rahimov
Guest Editor