From the Editor's Desk

AI-Empowered Next Generation Consumer Internet of Things

Norbert Herencsar
Brno University of Technology

I WELCOME THE readers to the second issue of the year 2023, the March/April issue of the *IEEE Consumer Electronics Magazine* (*MCE*).

As the Internet of Things (IoT) industry grows, so do the opportunities to utilize services and encounter different threats. The IoT is characterized by AI-empowered sensing (AIeS) embedded into nodes/devices of the IoT ecosystem. AIeS facilitates IoT services to gather data for intelligent assessments. Moreover, the quality of the collected data is central to correct control and optimal evaluation. More recently, the dramatic improvements in sensing technologies have made possible many previously unimaginable applications and services; however yet have introduced tremendous challenges in terms of security, trust, and services. Analytically, the escalation of the AIeS has been essential for overcoming these notable challenges. AIeS are stereotypically considered by intelligent data collection from the sensors deployed at nodes/devices and the capability to propose novel services via the Internet. AIeS performs distributed signal processing in the lower layer of the sensing system hierarchy. To ensure the quick-witted automation required in the next-generation IoT, AIeS must be secured and reliable. From the user side, these AIeS offer the promise of utilizing previously stranded asset data from low-cost, connected sensors directly monitoring or close by to equipment and machines in the field. The emergence of AI has increased the impact in terms of sensing for IoT-based better services and business models. However, some open issues, such as data trustworthiness and quality, security, privacy, and reliability, need to be addressed when integrating AI.

This issue of *MCE* is to provide practitioners and researchers interested in security and services with the state-of-the-art intelligent sensing available for next-generation IoT. Additionally, this issue solicits discussions of best practices of AI's latest innovations and services in the domain of secured sensing for future IoT. Therefore, it is my pleasure to introduce a collection of high-quality articles dedicated to AI-empowered IoTs in this issue.

SPECIAL SECTION: SECURITY, TRUST AND SERVICES FOR AI-EMPOWERED SENSING IN THE NEXT GENERATION IOT

Gradient-Constraint Super-Resolution Reconstruction Method Serving for Infrared Target Detection: This article proposes a multi-frame image super-resolution algorithm based on edge gradient regularization to solve this problem. In order to improve the resolution of the infrared image while simultaneously improving the visual saliency of a weak

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infrared target, an edge-preserving regularization term is designed and introduced into the solving process of the Bayesian problem. The experimental results demonstrate that the proposed method can generate high-resolution images with good performance in terms of edge preservation and detail enhancement.

Secure-Enhanced Federated Learning for AI-Empowered Electric Vehicle Energy Prediction: This article considers both the effectiveness of energy management and the potential risks of federated learning (FL) for electric vehicle infrastructures (EVIs). Authors propose a lightweight authentication FL-based energy demand prediction for EVIs with a premium-penalty mechanism. Security analysis and performance evaluation prove that the proposed framework can generate an accurate electricity demand prediction framework to defend against multiple FL attacks for EVIs.

Complexity Analysis of Internet of Things RFID in the Management of Fast-Fashion Apparel Enterprises: This article applies radio frequency identification (RFID) technology to the entire fast-fashion apparel business management process. In terms of experimental methods, this study uses qualitative and quantitative methods, questionnaire surveys, and comparative analysis and introduces the relevant theories of the clothing industry. In the experimental design, the three aspects of operating cost, implementation cost, and profitability in enterprise management are designed. The authors provided a reference for fast-fashion brands to implement RFID technology.

Art Installation Design and Algorithm Research Oriented to Heterogeneous Computing Architecture and Particle Swarm Algorithm: This article aims to study the design and algorithm of art installations for heterogeneous computing architecture and particle swarm algorithms. The experimental results show that by fully using the GPU hardware storage structure to improve memory access speed and reduce cache failure, the combination of particle swarm algorithm and heterogeneous computing system enables the calculation of the carrier components to obtain three times the acceleration effect.

Digital Art Design System Based on Big Data Technology and Interactive Virtual Technology: This article designs a digital art design system based on Big Data technology and interactive virtual technology. The authors analyzed several aspects of time-consuming, comparison of the accuracy of different methods, the relationship between speedup and data volume, average CPU utilization, gesture recognition, and recognition of various functions. The system designed in this article has a good recognition effect in terms of interaction. It has significance for the realization of virtualization, informatization, and digital transformation of artistic design.

Opportunities and Challenges of Compensation and Governance of Network Neural Ecological Environment Damage in the Era of Artificial Intelligence: In this article, based on the artificial intelligence era background, the use of the neural network algorithm to collect and deal with the ecological environment in the network environment damage and compensation for the relevant data, and the use of the habitat equivalent analysis method to analyze the collected experimental data, from the ecological environment of water resources, land resources, biological resources, and damage to the ecological environment in atmospheric resources were analyzed. The authors showed that the settlement rate of compensation for ecological and environmental damage is 41.96%.

A Secure Multilayer Architecture for Software-Defined Space Information Networks: Due to the unique characteristics of software-defined networking (SDN) and space information networks (SINs), a hybrid version of them, e.g., software-defined space information networks (SDSINs), can handle many complicated tasks. This article proposes a secure multi-layer SDN architecture that separates the paradigm into terrestrial, aerial, and ground domains and facilitates security solutions. The authors explored the specifics of the architecture's development and implementation. In addition, the descriptive results demonstrate that the proposed architecture will significantly improve the multi-layer efficiency gains of configuration upgrading and decision-making.

Intelligent Sports Prediction Analysis System Based on Edge Computing of Particle Swarm Optimization Algorithm: This article combines the predictive performance of the edge computing of the particle swarm optimization algorithm in artificial intelligence and the traditional sports event predictive analysis method to design an intelligent sports predictive analysis system. Experiments show that the prediction accuracy of the intelligent

sports prediction analysis system for sports events is higher than that of traditional sports events prediction methods, which can reach about 89.6%, and it can better cater to the interests of readers who are concerned about sports events.

Blockchain-Based Medical Certificate Generation and Verification for IoT-Based Healthcare Systems: Blockchain technology with IoT can significantly affect the healthcare industry by improving efficiency, security, and transparency and can provide more business opportunities. Therefore, a privacy-preserving technique has been proposed in this article for IoT-based healthcare systems using blockchain technology. The proposed architecture provides an interface between the users and healthcare centers to generate and maintain health documents. Results and discussion show that the proposed scheme is more efficient than the existing schemes.

An Improved Algorithm and Implementation of Data Mining for Intelligent Manufacturing Association Rules Based on Pattern Recognition: This article optimizes and analyzes intelligent manufacturing based on pattern recognition and uses improved association rule data mining algorithms to improve it from many aspects. The research content of the article is based on a multi-faceted analysis. The association rules in the improved algorithm of data mining are used as a technical means to promote the acquisition and analysis of experimental data. Research has constructed a pattern recognition system, a data mining system, and the most basic workshop production model in the manufacturing process.

Evaluation of the Service Capability of Maritime Logistics Enterprises Based on the Big Data of the Internet of Things Supply Chain System: This article aims to study maritime logistics enterprises' service capabilities based on IoT Big Data's supply chain system. Based on the evaluation of logistics service capabilities and related research on maritime logistics, this paper establishes a shipping enterprise logistics service ability evaluation index system and a logistics service ability evaluation hierarchical analysis model. The results show that the logistics capability evaluation method is more targeted for evaluating maritime logistics services, with an evaluation accuracy of 97%.

IoT-Driven Artificial Intelligence Technique for Fertilizer Recommendation Model: This article proposes an architectural model with four layers that aid in deploying a smart farming system with limited energy consumption, including sensor, network, service, and application. Focusing on the application layer, the authors implement a deep learning approach to build a fertilizer recommendation system that matches the expert's opinion. Finally, the whole system outcomes are presented as a single mobile application for farmers' ease of use.

Intelligent Dynamic Test System for Vehicle Engine Based on 5G Internet of Things: This article investigates smart car engine systems in the 5G IoT era. The authors focused on the PUMAOPEN test system of AVL and the system under test, the state management of the test process, and the intelligent transformation of key components. The results show that studies and analyses of the dynamic working conditions of intelligent vehicles on the IoT compare the dynamic working conditions with the steady working conditions from qualitative to quantitative.

This Special Section on Security, Trust and Services for AI-Empowered Sensing in the Next Generation IoT presents the selected set of articles to cover the scope. I would like to thank the Guest Editors, Professors Deepak Jain, Dhruva Ghai, and Saraju P. Mohanty, for their effort and hard work for this strong special section which will be interesting reading for the readers of *MCE* as well as the researchers around the globe.

LOOKING FORWARD

I hope that the current issue dedicated to AI-Empowered Next Generation Consumer Internet of Things becomes a good read for a broader set of the Consumer Technology community to advance their knowledge. *MCE* will continue the trend of covering more themes for enthusiastic and dedicated readers in future issues on the current and emerging topics with the active support from the editorial board members, reviewers, and authors worldwide.

Norbert Herencsar is currently an Associate Professor with the Department of Telecommunications, Brno University of Technology, Brno, Czech Republic. He is the Editor-in-Chief of the *IEEE Consumer Electronics Magazine*. He received the Ph.D. degree in teleinformatics from the Brno University of Technology, Czech Republic, in 2010. He is a senior member of the IEEE. Contact him at herencsn@ieee.org.