EMERGING INTELLIGENT SYSTEMS AND SMART COMPUTATIONAL TECHNOLOGIES FOR FUTURE IOT


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The Internet of Things (IoT) has been widely used in different aspects of modern life and viewed as a key enabler of all types of future intelligent systems. However, as it stretches out to the terminals of diverse applications in different industries, various extreme requests are imposed on the system, e.g., extraordinary massive connections, huge bandwidth, seamless coverage, high-mobility support, ultra-reliability, and super-low latency. Correspondingly, in recent years there have been several new trends in the evolution of IoT on the basis of technical and commercial developments. For example, with the development of intelligent systems and smart computational technologies, ever-increasing research interest has been observed in applying these paradigms to smarten IoT services in multifarious ways.

To provide a comprehensive view of the research, this Feature Topic aims at gathering the results of main efforts and highlighting the major directions to help both academic and industrial communities to be aware of recent research progress in IoT related intelligent systems and computational technologies. The Call for Papers received global responses, resulting in a large number of high-quality submissions. Due to space limitation, we are able to select only nine articles that are best aligned with this Feature Topic. The nine accepted articles fulfill the goal of outlining the main research trends to shape the future work on smart IoT.

Selected as the starter of the Feature Topic, the article "Recent Progress on the Convergence of the Internet of Things and Artificial Intelligence" presents a tutorial-style overview and survey on the convergence of IoT and artificial intelligence (AI), from sensing layer, network layer to application layer. The article "Federated Machine Learning for Intelligent IoT via Reconfigurable Intelligent Surface" discusses the potential of federated machine learning in addressing critical challenges of intelligent IoT, such as exploiting the waveform property of a multi-access channel of the reconfigurable intelligent surfaces. Unmanned aerial vehicles are viewed as a promising solution for flexible IoT. The article "3D Spectrum Mapping Based on ROI-Driven UAV Deployment" develops a 3D spectrum mapping approach based on the region of interest (ROI)-driven UAV deployment and presents the framework for spectrum monitoring and management in smart IoT. The article "Deep Learning Based Multiple Beamforming for 5G UAV IoT Networks" investigates the hierarchical 5G IoT network based on UAVs, and develops a novel deep learning (DL) algorithm based on gated recurrent units and auto-encoder for trajectory prediction and pose estimation to determine the state of the UAV in advance of the next moment. The article "An Edge-Driven Security Framework for Intelligent Internet of Things" introduces the architecture of an edge-driven IoT system for intelligent IoT applications and highlights security challenges, including denial of service (DoS) attacks, software attacks, and jamming attacks. Focusing on the security and trust issues, the article "When Network Operation Meets Blockchain: An Artificial Intelligence-Driven Customization Service for Trusted Virtual Resources of IoT" employs blockchain technology to ensure the integrity of the network services and relies on AI algorithms to achieve dynamic prediction, allocation, and adjustment of network resources. Maritime networks are also envisioned as a typical scenario of future IoT. The article "AI-Empowered Maritime Internet of Things: A Parallel Network Driven Approach" designs the parallel network, regarded as a digital twin of the real network, for applying AI methods to service-oriented maritime networks with the demonstration of key utilities. The article "Cross-Domain Resource Orchestration for Edge Computing Enabled Smart Road" studies the complex interaction of cross-domain resources in the smart road and proposes a multi-agent deep reinforcement learning system to improve the quality of intelligent driving. Low-latency services are emerging as an indispensable part of IoT services. To fulfill the emerging ultra-low-latency requirement, the article "Edge Intelligence for Real-time Data Analytics in IoT-based Smart Metering System" proposes an edge intelligence-enabled smart meter system and presents both offline and online ultra-low-latency cloud-edge collaboration schemes for real-time data analytics in the systems.

This Feature Topic endeavors to provide a comprehensive overview of the development of future smart IoT, especially the emerging intelligent systems and computational technologies for it. As the research is still burgeoning, we hope this Feature Topic will not only serve as a valuable reference but also encourage more readers to contribute in this area.

Finally, we would like to express our gratitude to the authors for their generous submissions and all the reviewers for their timely and professional reviews. We also acknowledge the support from the Editor-in-Chief of *IEEE Network Magazine* and the help from the publication staff for their efforts in the publication process.

BIOGRAPHIES

XUESONG QIU [SM] was born in 1973. He received the Ph.D. degree from Beijing University of Posts and Telecommunications, Beijing, China, in 2000. He is currently a professor and the Ph.D. Supervisor with the State Key Laboratory of Networking and Switching Technology, Beijing University of Posts and Telecommunications. His research interests include network management, communication software, IoT and Blockchain. He has authored about 200 SCI/EI index papers. He presides over a series of key research projects on network management and IoT, including projects supported by the National Natural Science Foundation, the National Key Research and Development Program of China.

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