Happy New Year 2022!

Yi Qian

In 2021, *IEEE Wireless Communications* has made tremendous achievements again thanks to the great contributions of readers, authors, reviewers, editors, and the publications staff. In 2021, we published nine special issues and feature topics, with special topics on full duplex communications, edge intelligence, e-health applications, IoT applications, aerial computing, AI-assisted wireless communications, and intelligent surfaces for 5G and beyond. We received 302 submissions and published 71 high-quality articles in those nine special issues and feature topics. In addition, we received 274 open call submissions in 2021 and published 72 excellent articles in the six issues in 2021. Moreover, we also published special column articles in Scanning the Literature, Book Reviews, Industry Perspectives, and Spectrum Policy and Regulatory Issues in each of the six issues in 2021, thanks to the contributions of the column editors. I am very happy to announce that *IEEE Wireless Communications* received better bibliometrics in the 2020 edition of the Journal Citation Reports. The new impact factor is 11.979, the eigenfactor is 0.01575, and the article influence score is 2.829. I would like to take this opportunity to thank all the people again who have made significant contributions to this magazine! In the new year 2022, *IEEE Wireless Communications* will continue to meet the new challenges and serve our community in developing next generation wireless technologies.

In this issue of *IEEE Wireless Communications*, we are pleased to present two feature topics to bring together researchers, industry practitioners, and individuals working on the related areas to address some of these technical challenges for intelligent surfaces for wireless communications, and sustainable energy infrastructures via AI-assisted wireless communications. The feature topic on "Intelligent Surfaces for 5G and Beyond" includes a collection of 8 articles, by guest editors C. Yuen, C. Huang, I. F. Akyildiz, M. Di Renzo, and M. Debbah; the other feature topic on "Empowering Sustainable Energy Infrastructures via AI-Assisted Wireless Communications" includes a collection of 12 articles, by guest editors M. Aloqaily, S. Kanhere, Y. Xiao, I. Al Ridhawi, and W. Guibene. Thanks to the two guest editor teams who did an excellent job in editing these two feature topics for our readers. Please stay tuned for new developments in the research area of intelligent surfaces for wireless communications, and sustainable energy infrastructures via AI-assisted wireless communications and read the editorials and the articles in the feature topics.

In this issue, we are also very glad to present 7 articles accepted from open call.

The first article, "Deep Learning based Channel Extrapolation for Large-Scale Antenna Systems: Opportunities, Challenges and Solutions" by S. Zhang *et al.*, presents the channel extrapolation concept and analyzes three major challenges, i.e., the acquisition of the original subspace information, the selection of the original subspace and the mapping scheme from the original subspace to the targeted one. The authors divide the channel extrapolation into three typical types: antenna extrapolation, frequency extrapolation and terminal extrapolation. For antenna extrapolation, they find that the ordinary differential equation (ODE)-based neural network (NN) outperforms the traditional NN model. For frequency extrapolation, when the gap between different frequency bands is large, it needs a small number of pilots to refine the extrapolation. For terminal extrapolation, due to subspaces with large difference, it is difficult to achieve a good performance only though NNs. The utilization of sensory data and transfer learning can improve the extrapolation performance. Finally, they discuss several potential research directions on channel extrapolation.

The second article, "Scalable Mobile Edge Computing: A Two-tier Multi-site Multi-server Architecture with Autoscaling and Offloading" by Y.-D. Lin *et al.*, proposes a 2-tier multi-site multi-server architecture and integrates Latency Satisfaction Aware Autoscaling (LSAA) and Dynamic Weight Offloading (DWO) to address the two problems above. Offloading is a short-term solution to hotspot traffic, while autoscaling is a long-term solution to traffic fluctuation. A 2-tier MEC testbed was implemented in the framework of OpenNESS with 3GPP integration, with experimental comparisons of 1-tier vs. 2-tier, uniform vs. hotspot, transient vs. persistent hotspot traffic, with or without offloading and autoscaling. Under heavy hotspot traffic, 2-tier MEC satisfies 86 percent, 73 percent, and 21 percent traffic with both offloading and autoscaling, offloading only, and without offloading and autoscaling, respectively, while 1-tier MEC only satisfies 32 percent, 32 percent, and 21 percent traffic.

In the third article, "Deep Learning for Wireless Networking: The Next Frontier," Y. Cheng *et al.* provide a survey of the recent efforts in leveraging deep learning (DL) for wireless network optimization, probing insightfully where and how the supremacy of DL based approaches comes versus the conventional modeling-based approaches. The authors also discuss the challenges of applying the state of the art from the machine learning community to general wireless network optimization problems and point out several promising research directions. In addition, to demonstrate the potential of DL techniques, they present a case study in which DL based approaches are used to mitigate the computation complexity in the canonical yet challenging wireless network flow optimization problem.

In the fourth article, "Reconfigurable Intelligent Surfaces: Potentials, Applications, and Challenges for 6G Wireless Networks," S. Basharat *et al.* provide a tutorial overview of reconfigurable intelligent surfaces (RISs) for 6G wireless networks. The authors present a comprehensive discussion on performance gains that can be achieved by integrating RISs with emerging communication technologies. They address the practical implementation of RIS-assisted networks and expose the crucial challenges, including the RIS reconfiguration, deployment and size optimization, and channel estimation. They further explore the integration of RIS and non-orthogonal multiple access under imperfect channel state information. The numerical results illustrate the importance of better channel estimation in RIS-assisted networks and indicate the various factors that impact the size of RIS. They finally present future research directions for realizing RIS-assisted networks in 6G communication.

In the fifth article, "Federated Learning for Industrial Internet of Things in Future Industries," D. C. Nguyen *et al.* provide a detailed overview and discussions of the emerging applications

of federated learning (FL) in key Industrial Internet of Things (IIoT) services and applications. A case study is also provided to demonstrate the feasibility of FL in IIoT. Finally, the authors highlight a list of interesting open research topics that need to be addressed for the full realization of FL-IIoT in industries.

In the sixth article, "Deep Reinforcement Learning for Handover-Aware MPTCP Congestion Control in Space-Ground Integrated Network of Railways," J. Xu and B. Ai present the space-ground integrated network (SGIN) oriented high-speed railway (HSR) (SGINHSR) with multipath transmission control protocol (MPTCP). Leveraging cross-layer information such as reference signal received power, the authors design a new cross-layer aided MPTCP congestion control (CC) mechanism targeted at SGIN-HSR based on deep reinforcement learning, which is referred to as HSR-CC, to alleviate performance degradation problems induced by handover. The experimental results show that HSRCC significantly enhances the goodput and outperforms state-of-the-art MPTCP CC algorithms in SGIN-HSR environment where handover frequently occurs.

In the seventh and the last article, "A Unified Cognitive Learning Framework for Adapting to Dynamic Environment and Tasks," Q. Wu *et al.* propose a unified cognitive learning (CL) framework for the dynamic wireless environment and tasks. The mathematical framework for the proposed CL is established. Using the public and authoritative dataset, the authors demonstrate that the proposed CL framework has three advantages, namely, the capability of adapting to the dynamic environment and tasks, the self-learning capability, and the capability of "good money driving out bad money" by taking modulation recognition as an example. The proposed CL framework can enrich the current learning frameworks and widen the applications.

I hope you enjoy reading these articles in this issue of *IEEE Wireless Communications*.

Biography

Yi Qian [M'95, SM'07, F'19] received a Ph.D. degree in electrical engineering from Clemson University, in Clemson, South Carolina. He is currently a professor in the Department of Electrical and Computer Engineering, University of Nebraska-Lincoln (UNL). Prior to joining UNL, he worked in the telecommunications industry, academia, and government. Some of his previous professional positions include serving as a senior member of scientific staff and a technical advisor at Nortel Networks, a senior systems engineer and a technical advisor at several startup companies, an assistant professor at University of Puerto Rico at Mayaguez, and a senior researcher at National Institute of Standards and Technology. His research interests include wireless communications and networks, and information and communication network security. He has research and industry experience in wireless communications and networks, wireless sensor networks, vehicular communication networks, information and communication network security, smart grid communications, broadband satellite communications, optical communications, high-speed communications and networks, and Internet of Things. He was previously Chair of the IEEE Technical Committee for Communications and Information Security. He was the Technical Program Chair for IEEE International Conference on Communications 2018. He serves on the Editorial Boards of several international journals and magazines, including as the Editor-in-Chief for *IEEE Wireless Communications*. He was a Distinguished Lecturer for IEEE Vehicular Technology Society and a Distinguished Lecturer for IEEE Communications Society. He received the Henry Y. Kleinkauf Family Distinguished New Faculty Teaching Award in 2011, the Holling Family Distinguished Teaching Award in 2012, the Holling Family Distinguished Teaching/Advising/Mentoring Award in 2018, and the Holling Family Distinguished Teaching Award for Innovative Use of Instructional Technology in 2018, all from University of Nebraska-Lincoln. He is the principal author of the textbook, "Security in Wireless Communication Networks," published by IEEE Press/Wiley in 2021.