

## ARTIFICIAL INTELLIGENCE AND RADIO NETWORKS

First, I would like to use this opportunity to introduce and welcome the new Associate Editor-in-Chief, Professor Nirwan Ansari, from the New Jersey Institute of Technology. With his extensive experience as an editor for many journals and magazines over the years, and a world renowned scholar in wireless communications and networks, we will work as a great team to continue to lead *IEEE Wireless Communications* to new levels.

I am very happy to announce that *IEEE Wireless Communications* received very impressive bibliometrics in the 2018 edition of the Journal Citation Reports. The new impact factor is 11.000, the eigenfactor is 0.01785, and the article influence score is 2.846. I would like to take this opportunity to thank all the people who have made significant contributions to this magazine, including all the readers for their great support, all the authors for having chosen *IEEE Wireless Communications* to publish their high quality works, all reviewers for their expertise and time, all members of the editorial board and IEEE ComSoc officers and staff for their extraordinary efforts and dedication.

In the February 2020 issue of *IEEE Wireless Communications*, we proudly present a Special Issue on Intelligent Radio: When Artificial Intelligence Meets Radio Network, with a collection of 16 articles compiled by the guest editors, Tao Chen, Hsiao-Hwa Chen, Zheng Chang, and Shiwen Mao, who have done an excellent job in editing this issue for our readers.

Cognitive radio is an emerging smart wireless communications technology being nurtured for more than two decades. It will be able to solve the radio spectrum under-utilization problem by allowing secondary users to opportunistically access the licensed channels without causing interference to the communications of the primary users. Cognitive radio empowers spectrum sensing, which refers to the ability of the radio technology to sense information from its radio environment. Through this capability, the spectrum resources that are not used by primary users can be detected. Consequently, the best spectrum allocation schemes and transmission parameters can be selected. Through the radio reconfigurability, a user will be able to change the transmitting channel quickly and adaptively according to the radio environment. The development of the fifth generation (5G) communication system extends radio services to various vertical industries, thus incurring more complexity and presenting greater challenges to wireless communications. Recent advancement of artificial intelligence (AI), including machine learning, data mining, and big data analytics, is projecting a significant promise for addressing many complex problems in wireless networks. Cognitive radio is evolving into intelligent radio, by extending the intelligence from spectrum access, to network management and service orchestration. This special issue focuses on the key challenges and recent advances that are related to artificial intelligence and radio networks, including wireless system design and optimization of AI for channel measurement, modelling and estimation, AI for network management, network applications and services, and network automation. Please stay tuned for new developments in this research area of intelligent radio, and read the editorial by the guest editors, and the papers in this special issue.

In addition to the 16 articles in the special issue, we have also included twelve accepted open call articles in this issue.



Yi Qian

The first article, "A Prototype of Co-Frequency Co-Time Full Duplex Networking" by M. Ma *et al.*, introduces the development of a prototype system for full duplex base stations that use antenna arrays to deal with the interference of the base stations, and enable full duplex communication over the uplink channel, where the theoretical focus is placed on how to use the antenna array to nullify the multiple interference and receive the signals of the desired mobile stations simultaneously. The authors also present experimental results showing the capabilities of full duplex interference nullification, and the video-performance is shown for the bi-direction communications over uplink and downlink channels in the co-frequency co-time

full duplex networking scenario with very good quality.

The second article, "Mobile Edge Computing in Unmanned Aerial Vehicle Networks" by F. Zhou *et al.*, studies three unmanned aerial vehicle-enabled mobile edge computing architectures. The authors also present a comprehensive survey for the state-of-the-art research in this area. They provide important implementation issues and discuss future research directions, key challenges and open issues.

In the third article, "VLC-CDMA Systems Based on Optical Complementary Codes", Y. Qiu *et al.*, propose a visible light communication code division multiple access (VLC-CDMA) system using optical complementary codes (OCCs), which are unipolar codes with a multiple sub-codes structure. CDMA helps to realize simultaneous transmission of signals for different users, and different users can be distinguished effectively by OCCs with their ideal auto-correlation and low cross-correlation functions. The authors illustrate the ways to construct OCCs with various lengths and different numbers of subcodes according to the system requirements. They further show the simulations to verify the effectiveness of the proposed VLC-CDMA system.

S. Yang *et al.*, in the fourth article, "Development of an Underground Through-Soil Wireless Acoustic Communication System", demonstrate how soil can be used as a communication medium for wireless acoustic digital communication over distances up to 50 m at 20 bps data rates. The authors propose a small thumper-source showing a superior energy efficiency, compactness, and suitability for target frequency ranges. The practical development of wireless underground sensor networks would benefit numerous applications, including online infrastructure monitoring, earthquake warning systems, and agricultural automation.

In the fifth article, "Cooperative Computing Anytime, Anywhere: Ubiquitous Fog Services", X. Lyu *et al.* present their recent research results of ubiquitous fog computing, where computing and storage resources are unified based on stochastic optimization designs across wired and wireless networks. They study enabling techniques to address practical challenges, including spatiotemporally coupled decisions, outdated incentives for cooperation, massive access requests in limited wireless bandwidth, and computing acceleration.

In the sixth article, "Cloud based mmWave WLANs: Architectural Paradigms, Proposals and Perspectives", K. Cheng *et al.*, investigate some cutting-edge technologies for future wireless local area networks. Considering both the rapid growth in data traffic and the advantages of centralized control in cloud

radio access network (C-RAN), the authors propose a new architecture named W-CRAN, along with a dual-band protocol stack, to achieve orchestrated coordination and improved network throughput.

N. Cheng *et al.* in the seventh article, “A Comprehensive Simulation Platform for Space-Air-Ground Integrated Network”, present the developed space-air-ground integrated network (SAGIN) simulation platform which supports various mobility traces and protocols of space, aerial, and terrestrial networks. Centralized and decentralized controllers are implemented to optimize the network functions such as access control and resource orchestration.

Vehicle-to-vehicle (V2V) networks are motivated primarily by improving transportation safety, efficiency and convenience. Safety applications require low latency, high reliability communication, with trust between members of the network. In the eighth article, “Safety Assessment of Radio Frequency and Visible Light Communication for Vehicular Networks”, C. J. Rapson *et al.*, give a comprehensive review of the characteristics required in order to fulfil this promise for implementations of V2V networks using DSRC, LTE, 5G, and Visible Light Communication, and consider possible enhancements to address the identified weaknesses.

In the ninth article, “Secure Transmission via Beamforming Optimization for NOMA Networks”, Y. Cao *et al.* present their secure transmission schemes based on beamforming optimization designed to combat both internal and external eavesdropping for downlink multi-input single-output NOMA networks.

In the tenth article, “Spectral Efficiency Enhancement in Satellite Mobile Communications: A Game-Theoretical Approach”, F. Li *et al.* propose a game-theoretical approach to maximize satellite spectrum utilization. They investigate the feasibility to introduce dynamic satellite spectrum pricing or auction to maximize spectrum utilization efficiency. They also discuss several issues for the challenges and future works in satellite mobile communications.

C. Gomez *et al.*, in the eleventh article, “IPv6 over LPWANs: connecting Low Power Wide Area Networks to the Internet of Things”, present an ultralightweight IPv6 adaptation layer designed for Low Power Wide Area Networks (LPWANs), Static Context Header Compression and Fragmentation (SCHC), which is being standardized by the IETF.

Finally, in the twelfth and last article, “Deep Learning for Physical-Layer 5G Wireless Techniques: Opportunities, Challenges and Solutions”, H. Huang *et al.* review the development of deep learning solutions for 5G communication, and then propose several efficient schemes for deep learning-based 5G scenarios. The authors present the key ideas for several important deep learning-based communication methods along with the research opportunities and challenges.

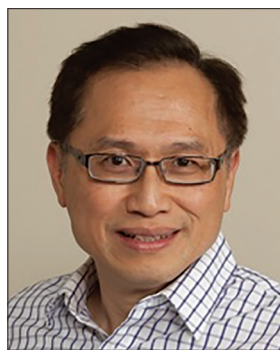
I hope you will enjoy reading these articles in the February issue. Happy New Year 2020!

### BIOGRAPHY

YI QIAN [M'95, SM'07, F'19] (yi.qian@unl.edu) received a Ph.D. degree in electrical engineering from Clemson University, 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 the University of Puerto Rico at Mayaguez, and a senior researcher at the National Institute of Standards and Technology. His research interests include wireless communications and networks, and information and communication network security. More specifically, 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. He is currently a Distinguished Lecturer for IEEE Communications Society.

## FROM THE NEW ASSOCIATE EDITOR-IN-CHIEF

The first Universal Mobile Telecommunications System (UMTS) wideband code division multiple access (W-CDMA) was launched in 2001. Envisioning the rapid growth of wireless technologies and systems, it was around this time that the COMSOC leadership decided to change the name of the magazine from IEEE Personal Communications, which was originally spun off from IEEE Communications Magazine, to *IEEE Wireless Communications*. The leadership of the magazine continues to enhance its quality; *IEEE Wireless Communications*, with an impact factor of 11, is a premier venue for engineers and researchers to quickly grasp cutting edge technologies on wireless communications. I have served in a number of editorial boards, including as a Senior Technical Editor of IEEE Communications Magazine, and have participated in the growth of *IEEE Wireless Communications* as an author as well as a guest-editor. It is indeed my privilege to be called upon to serve our community in a greater role as the Associate Editor-in-Chief of this fine magazine. I look forward to working with the authors, referees, editors, and the COMSOC support staff, and the Editor-in-Chief, Dr. Yi Qian, to uphold the magazine's quality and readership.



Nirwan Ansari

### BIOGRAPHY

NIRWAN ANSARI [S'78, M'83, SM'94, F'09], Distinguished Professor of Electrical and Computer Engineering at the New Jersey Institute of Technology (NJIT), received a Ph.D. from Purdue University, an MSEE from the University of Michigan, and a BSEE (summa cum laude with a perfect GPA) from the New Jersey Institute of Technology (NJIT). He is a Fellow of National Academy of Inventors. He authored *Green Mobile Networks: A Networking Perspective* (Wiley-IEEE, 2017) with T. Han, and co-authored two other books. He has also (co-)authored more than 600 technical publications. He has guest-edited a number of special issues covering various emerging topics in communications and networking. He has served on the editorial/advisory board of over ten journals including the new role as Associate Editor-in-Chief of *IEEE Wireless Communications*. His current research focuses on green communications and networking, cloud computing, drone-assisted networking, and various aspects of broadband networks. He was elected to serve in the IEEE Communications Society (ComSoc) Board of Governors as a member-at-large, has chaired some ComSoc technical and steering committees, is current Director of ComSoc Educational Services Board, has been serving in many committees such as the IEEE Fellow Committee, and has been actively organizing numerous IEEE International Conferences/Symposia/Workshops. He is frequently invited to deliver keynote addresses, distinguished lectures, tutorials, and invited talks. Some of his recognitions include several excellence in teaching awards, a few best paper awards, the NCE Excellence in Research Award, several ComSoc TC technical recognition awards, the NJ Inventors Hall of Fame Inventor of the Year Award, the Thomas Alva Edison Patent Award, Purdue University Outstanding Electrical and Computer Engineering Award, the NCE 100 Medal, and designation as a COMSOC Distinguished Lecturer. He has also been granted more than 40 U.S. patents.