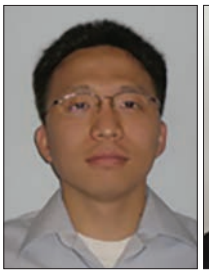
ADVANCES IN OPTICAL COMMUNICATIONS AND NETWORK TECHNOLOGIES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In 2019, optical communications and networking technologies continue to gain momentum to facilitate innovations in various networks, including not only metro and core but also access and data center networks. Moreover, we are beginning to see the applications of machine learning (ML) and artificial intelligence (AI) in these networks, aiming to make them more intelligent, adaptive, and agile. Specifically, ML and AI refer to a broad range of approaches that work with statistical data models, with which computers can solve complex optimization problems without being explicitly programmed. Considering the complexity associated with managing optical communications and networking systems and the need to make it easier, we expect to see more advances in the field of applying ML and AI for managing optical networks and systems in the coming years. In this second Optical Communications Networks Series (OCNS) issue of 2019, we have selected four contributions.

In the first contribution, "Greenfield Gradual Migration Planning toward Spectrally-Spatially Flexible Optical Networks," P. Lechowicz *et al.* introduce the unavoidable upgrade of short-term realizable elastic optical networks toward spectrally-spatially flexible optical networks that will be required to cope with the expected long-term traffic forecasts. To allow it to be gradual and cost-effective, the authors propose a stochastic iterated local search algorithm, which minimizes the required number of components to be upgraded at each migration step. An illustrative case study is also presented.

In the second contribution "Building Autonomic Elastic Optical Networks with Deep Reinforcement Learning," X. Chen *et al.* present an autonomic elastic optical networking framework by exploiting the state of the art in deep reinforcement learning. The new framework enables network agents to constantly learn and optimize service provisioning policies with experiences accumulated through dynamic network operations, while remarkably reducing the amount of human effort invested. Case studies on autonomic routing and spectrum assignment designs demonstrate the appealing prospect of the proposal.

In the third contribution, "Flexible and Scalable Optical Interconnects for Data Centers: Trends and Challenges," Y. Lu *et al.* present an overview of flexible and scalable optical interconnects for data centers by introducing the communication technologies and control methods of recent architectures. The authors also discuss the future challenges in optical transmission technologies, optical switching technologies, and control and management as well as the new opportunities to be exploited.

In the fourth contribution, "Resonant Beam Communications: Principles and Designs," M. Xiong *et al.* present the resonant beam communication technology that strikes a good balance between the signal-to-noise ratio and mobility in wireless optical communications. They show that echo effects lead to inherent interference in resonant beam communications, while frequency shifting and optical filtering help to eliminate the interference. The authors also point out that stability and duplexity of the technology should be further explored in future research.

It is our pleasure to introduce Dr. Mohamed-Slim Alouini from King Abdullah University of Science and Technology, Saudi Arabia, as a new Co-Editor of OCNS. With the addition of his service, the continuing support from our authors and reviewers, and valuable feedbacks from our readers, we are confident that OCNS will continue to be a valuable element of *IEEE Communications Magazine*.

BIOGRAPHIES

ZUQING ZHU [SM'12] (zqzhu@ieee.org) received his Ph.D. degree from the University of California, Davis, in 2007. He is currently a full professor at the University of Science and Technology of China. Prior to that, he worked in the Service Provider Technology Group of Cisco Systems, San Jose, California. His research focuses on optical networks, and he is a Senior Member of OSA, and is an Associate Editor of *IEEE Transactions on Network and Service Management* and *Optics Express*.

XIANG LIU [F'17] (xiang.liu@futurewei.com) received his Ph.D. degree in applied physics from Cornell University in 2000. He is currently the senior director of Optical Access Networks Research at Futurewei Technologies, focusing on next-generation optical access technologies. He spent the early part of his career at Bell Laboratories in New Jersey, working on high-speed optical fiber transmission technologies. He is a Fellow of the OSA and a Deputy Editor of *Optics Express*.

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