Introduction to the JOCN Special Issue on Intelligent Networks at the Edge

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This Special Issue on Intelligent Networks at the Edge contains a collection of invitation-only extensions based on papers presented at the Future Optical Networks and Communications (FONC) Symposium in the IEEE Future Network World Forum (FNWF), 13–15 November 2023, Baltimore, Maryland, USA. We present a brief introduction followed by an overview of the topics covered in the papers.

New and emerging network services require ultra-high data rates and quality-of-service (QoS) performance. In order to meet the capacity demand, space-division-multiplexing-based elastic optical networks (SDM-EONs) and fine-grained optical transport networks (OTNs) are proposed, and novel resource management mechanisms have attracted a lot of interest. Meanwhile, considering the critical role of optical networks in society, physical-layer security is gaining interest. Moreover, high-speed optical communications are finding applications in passive optical networks (PONs), in-building networks, and satellite communications. These trends, together with new technological advances on network control and management, will shape the future of optical networks and communications.

In this Special Issue (SI), we include five papers, which were extended from the conference papers presented at the Future Optical Networks and Communications (FONC) Symposium in the IEEE Future Network World Forum (FNWF) 2023.

In "Cluster-based unsupervised method for eavesdropping detection and localization in WDM systems," H. Song *et al.* present a clustering-based method and an eavesdropping diagnosis framework tailored for wavelength-division multiplexing (WDM) systems. The framework is designed to handle diverse eavesdropping scenarios, including dynamic detection, classification, and localization of eavesdropping events.

In "Flexible-queue-management-based bandwidth allocation in higher-speed PONs," J. Li *et al.* propose a flexible-queue-management-based dynamic bandwidth allocation (DBA) mechanism to enable direct allocation of bandwidth to queues under their QoS requirements. The proposed mechanism enables a DBA engine to get the arrival time and QoS requirements of data frames in queues as well as the queue status in ITU-T 50G PONs.

In "Machine-learning-based impairment-aware dynamic RMSCA in multi-core elastic optical networks," J. L. Ravipudi

and M. Brandt-Pearce show how to tackle the routing, modulation, spectrum, and core assignment (RMSCA) of SDM-EONs that comprise multi-core links by leveraging a network-state-dependent route and core selection method based on a deep neural network classifier.

In "CLARA+: dual machine learning optimized resource assignment for translucent SDM-EONs," S. Petale and S. Subramaniam propose a dual-optimized RMSCA algorithm, namely, the Capacity Loss Aware Resource Assignment Algorithm (CLARA+), to optimize capacity utilization of SDM-EONs to improve resource availability and performance.

In "Multi-layer resource scheduling architecture and algorithm for a service-oriented optical network based on a fine grain OTN," Y. Zhao *et al.* design a service-oriented multi-layer resource scheduling architecture and algorithm based on the introduction of OTN fine-grained technology. The proposed service awareness scheme can enable OTNs to better match service requirements.

We, as the guest editors, hope that our readers will find these articles inspiring and informative. Meanwhile, we would like to appreciate all the authors for submitting their papers to the SI, the reviewers for their high-quality and timely reviews, and the staff and Editor-in-Chief of the *Journal of Optical Communications and Networking* (JOCN) for their kind help and support.

Guest Editors:
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