Editorial Introduction to JSTQE Special Issue on Machine Learning in Photonic Communication and Measurement Systems

Zibar, Darko; Turitsyn, Sergei; Jalali, Bahram; Kojima, Keisuke; Furdek, Marija

Published in:
IEEE Journal of Selected Topics in Quantum Electronics

Link to article, DOI:
10.1109/JSTQE.2022.3191912

Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights. 

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Editorial

Introduction to JSTQE Special Issue on Machine Learning in Photonic Communication and Measurement Systems

From being a niche field within computer science, the field of machine learning has gone mainstream within the last couple of years. The reason is that researchers around the world that work within photonics systems and components design have realized that machine learning brings a new set of highly-effective tools that can be used to: 1) design novel components and systems 2) optimize transmission systems and 3) obtain more accurate measurements.

Indeed, using machine learning to design the next generation of components and systems as well as measurement systems is an emerging line of research in the photonics community. The hope is that the machine learning will enable a new generation of transformative photonic components and systems that can outperform current solutions in terms of: performance, measurement accuracy, flexibility, reconfigurability and power consumption. The strength of machine learning is to find effective solutions for problems for which we do not have analytical solutions and which are hard, as well as time consuming, to solve using numerical procedures.

The purpose of this special issue of JSTQE is to highlight the recent progress, challenges and trends in utilizing machine learning techniques for developing next-generation of photonic communication and measurements systems. The papers published in this issue cover a broad range of topics summarized in the following sections:

- **Optical components**: contributions include how to use neural networks to optimize optical fibre designs, beam profiles, optical couplers, bandpass filters and metasurfaces.
- **Optical communication systems**: contributions describe how to use machine learning techniques such as deep neural networks and auto-encoders to combat impairments in multi-channel optical communication systems and perform optical performance monitoring.
- **Classical and quantum measurement systems**: contributions include how to use deep diffractive neural networks and deep neural networks for microscopy and optical beam shaping, respectively.
- **Optical networks**: contributions describe various machine learning techniques to perform network management, wavelength assignment and routing.

The issue is completed with 8 invited papers and 15 contributed papers, authored by well-regarded research groups from all over the world.

We hope you will find this JSTQE Special Issue on Machine Learning in Photonic Communication and Measurement Systems to be an interesting and useful reference that will impact, stimulate and promote further research in applying machine learning techniques to advance photonic communication and measurement systems.

**Acknowledgment**

This issue was made possible by dedicated efforts of a number of people. We would like to thank the authors of all papers in this issues, as well as all reviewers around the world who provided high-quality reviewers of the manuscript. Finally, we would like to thank the IEEE publications staff for their general support for preparing this issue.

Digital Object Identifier 10.1109/JSTQE.2022.3191912