Special Issue

Al-Native Optical Networks: Machine Learning and Al for Next-Generation Automation, Resilience, and Sustainability

Message from the Guest Editor

As optical networks continue to grow in scale, complexity, and criticality, traditional reactive architectures are increasingly inadequate for delivering the resilience, agility, and sustainability required by next-generation digital infrastructure. To address these rising demands, this Special Issue seeks to inspire a paradigm shift towards Al-native optical networks.

In these next-generation systems, artificial intelligence—particularly neuromorphic and photonic AI, as well as large language models (LLMs), alongside advanced machine learning and edge intelligence—serve as foundational enablers. These technologies transform optical infrastructure from merely automated to truly proactive, empowering real-time adaptation, self-healing, zero-touch operation, and sustainable performance.

We invite submissions that advance this vision: from core technologies to holistic architectures that enable predictive maintenance, autonomous fault management, resilient and sustainable operation, and intelligent fiber sensing. Contributions addressing realworld integration, deployment challenges, human–Al collaboration, and security are especially encouraged.

Guest Editor

Dr. Khouloud Abdelli Nokia Bell Labs, 70469 Stuttgart, Germany

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Photonics
Editorial Office
MDPI, Grosspeteranlage 5
4052 Basel, Switzerland
Tel: +41 61 683 77 34
photonics@mdpi.com

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Editor-in-Chief

Prof. Dr. Nelson Tansu

School of Electrical and Electronic Engineering (EEE), The University of Adelaide, Adelaide, SA 5005, Australia

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