

Special Issue

AI-Native Optical Networks: Machine Learning and AI 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 AI-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 real-world integration, deployment challenges, human–AI collaboration, and security are especially encouraged.

Guest Editor

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Deadline for manuscript submissions

31 August 2026



Photonics

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Impact Factor 1.9
CiteScore 3.5



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