Quantum information and Artificial Neural Networks-based Signal Processing using Integrated Photonics

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ABSTRACT

Integrated photonics is contributing to new emerging technologies for advanced signal processing, based on machine learning and quantum information science. In this work, we utilize compact, reconfigurable, on-chip devices to develop photonic artificial neural networks and quantum signal processors for telecommunication applications. Our work demonstrates the recovery and reconstruction of high-speed telecommunication signals with ultralow latency, as well as enhances the speed and security of quantum communication. Characterized by their highly efficient and intelligent processing, parallelization, and reduced power consumption, these technologies are set to pave the way for the next generation of telecom networks.

Keywords: Integrated photonics, machine learning, artificial neural networks, entangled photon states, quantum key distribution

BIOGRAPHY

Roberto Morandotti received his M.Sc. degree in physics from the University of Genova, Genova, Italy, in 1993, and his Ph.D. degree from the University of Glasgow, Glasgow, U.K., in 1999. Since 2003, he is with INRS-EMT, Varennes, Canada.

His current research interests include integrated and quantum optics, as well as Terahertz science and applications.

Roberto Morandotti is a Fellow of the Royal Society of Canada, of the AAAS, of the IEEE, of the APS, of the Optica, of the SPIE, and an NSERC E.W.R Steacie Memorial Fellow 2011, a recipient of the NSERC Synergy 2019 and Brockhouse Awards 2020, as well as of the QC Prix Marie-Victorin 2022 and the ACFAS Prix Urgel-Archambault 2023. He served as a Chair and Technical Committee Member for several Optica, IEEE, and SPIE sponsored meetings, and was recognized as an exceptional Mentor by the Canadian Association for Graduate Students in 2018.