Special Session on

Recent Advances in Photonic Quantum Technologies and Quantum Optical Neural Network

in conjunction with

15th World Congress on Nature and Biologically Inspired Computing (NaBIC)

December 13-15, 2023

Website: http://www.mirlabs.org/nabic23

Hybrid Mode – Online & Offline

Onsite Venues: http://mirlabs.org/nabic23/venue2.php

Objectives and Scope

The Photonic quantum computing employs quantum mechanics to manipulate information using photons. Overcoming challenges such as reliable single photon sources, efficient photon detectors, and quantum error correction techniques, optical quantum computers have the potential to revolutionize fields like cryptography, optimization, material science, and drug discovery. Photonic quantum communication transforms information exchange by combining quantum mechanics with photonics, offering a breakthrough in secure communication immune to eavesdropping and interception. The field of photonic quantum sensing combines the principles of quantum mechanics and photonics, such as quantum entanglement, quantum interference, and quantum state squeezing, to beat current limits in sensor technology and revolutionizes the sensing and measurement capabilities. Its applications include microscopy and imaging. Quantum optical neural networks merge photonic quantum computing and neural networks. Neural networks are inspired by the human brain and excel at recognizing patterns and making decisions.

Quantum optical neural networks harness quantum principles to enhance traditional neural networks, utilizing qubits for information representation and processing, and quantum gates for operations. Quantum superposition and entanglement empower quantum neural networks to efficiently handle complex data tasks, potentially accelerating pattern recognition, data clustering, and optimization. Both photonic quantum technologies and quantum optical neural networks represent cutting-edge innovations poised to reshape information processing and artificial intelligence. As research advances, they have the potential to unlock solutions and insights previously unattainable with classical computing. This special session offers a platform for researchers, scientists, and experts to discuss advancements in photonic quantum sensing, quantum communication, quantum computing, and quantum optical neural networks. The session covers breakthroughs in Photonic Quantum Computing, Photonic Quantum Communication, and Photonic Quantum Sensing, exploring aspects like Quantum Spectral Imaging, Hyperspectral Imaging, Optical Quantum Gates, Quantum Entanglement, Cluster State Computing, Quantum Error Correction, and Quantum Algorithms. The emerging field of quantum optical neural networks is also covered, highlighting how quantum principles and neural networks are combined for novel paradigms in information processing, machine

learning, and AI., encouraging interdisciplinary discussions that bridge Photonic Quantum Technologies and Machine Learning.

Subtopics

The topics include, but are not limited to:

Photonic Quantum Computing

- Coherent state and Squeezed Coherent State and its Applications
- GKP State Generation
- Orbital Angular Momentum (OAM) Based Quantum Optical Logic Gates
- Quantum Entanglement
- Fault-Tolerant Quantum Gates
- Quantum Algorithms and Applications

Photonic Quantum Communication

- Optical Quantum Communication and Networking
- Quantum Repeaters
- GKP-based Quantum Error Correction Codes

Photonic Quantum Sensing

- Deep learning for spectral imaging and spectroscopy.
- Hyper Spectral Imaging using Machine Learning.

Quantum Optical Neural Network

- Quantum Neural Network Architectures
- Quantum Data Encoding
- Quantum Enhancements in Deep Learning
- Quantum Feature Learning
- Quantum Neural Network Training
- Noise Tolerance in Quantum Neural Networks

Paper publications

- Proceedings will be published in Lecture Notes in Networks and Systems, Springer (https://www.springer.com/series/15179)
- Indexed by SCOPUS, INSPEC, WTI Frankfurt eG, zbMATH, SCImago
- Paper maximum length is 10 pages
- Papers must be formatted according to Springer format (Latex/word) available at: https://www.springer.com/de/authors-editors/book-authors-editors/manuscript-preparation/5636#c3324

- Submission Link: https://cmt3.research.microsoft.com/NABIC2023

Important Dates

Paper submission due: **September 30, 2023**
Notification of paper acceptance: **October 31, 2023**
Registration and Final manuscript due: **November 10, 2023**
Conference Date: **December 13-15, 2023**

Special Session Chairs

- Dr. Sijo K. Joseph, GITAM University (Bengaluru Campus), India.
- Dr. Jinesh Mathew, GITAM University (Bengaluru Campus), India.
- Dr. Indu Sebastian, Newman College, Thodupuzha, Kerala, India.

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