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Graduate School of Information Sciences,
Tohoku University

Tohoku University and NTT Research Establish Joint Research Laboratory on High-Performance Photonic Quantum Computing Infrastructure

– Advancing R&D of Next-Generation Low-Power, High-Performance Computing Infrastructure Using Photonic Quantum Technology –

Highlights

- Graduate School of Information Sciences, Tohoku University (hereafter, GSIS) and NTT Research Inc. (hereafter, NTTR) will establish an international academia–industry collaboration hub focused on a new type of Coherent Ising Machine (CIM) leveraging quantum mechanical effects.
- By utilizing High-Performance Computing (HPC) technologies, the partners will build a high-performance CIM platform capable of handling tens of billions of spins with sparse connectivity, based on Tohoku University's supercomputer AOBA, and aim to provide access to researchers and engineers worldwide.
- Through this initiative, the partners will contribute to the creation of photonic quantum solutions addressing scientific and societal challenges, as well as to the development of highly skilled quantum technology professionals.

Overview

GSIS and NTTR have established a new Joint Research Laboratory on High-Performance Photonic Quantum Computing Infrastructure within the Graduate School of Information Sciences at Tohoku University.

This laboratory will promote research and development of large-scale Coherent Ising Machines with sparse connectivity by integrating high-performance computing technologies with photonic quantum technologies.

Through applications to practical combinatorial optimization problems, the initiative aims to realize next-generation low-power, high-performance computing infrastructure and to foster quantum technology professionals capable of playing active roles in the international arena.

Detailed Description

Background of the Joint Research Laboratory

Tohoku University has been designated by the Japanese government as a "Quantum Solutions Hub" and is advancing comprehensive R&D in quantum technologies, spanning device-level research, system-level integration, and socially deployable solution development.

NTT Research, Inc., established in 2019 through the reorganization of NTT Innovation Institute Inc. (NTT I3) by NTT, is a U.S.-based fundamental research organization headquartered in Sunnyvale, California. It conducts world-leading research, particularly in the field of photonic quantum technologies.

Through close collaboration between the two institutions, significant research outcomes and the cultivation of globally competitive talent are anticipated, leading to the establishment of this Joint Research Division.

Research Activities

The Joint Research Laboratory will promote R&D aimed at realizing a high-performance Coherent Ising Machine (CIM) platform capable of processing tens of billions of sparsely connected spins, leveraging HPC technologies and based on Tohoku University's supercomputer AOBA.

To create photonic quantum solutions that contribute to solving scientific and societal challenges, the platform will be used to develop quantum algorithms for practical combinatorial optimization problems, such as Constrained clustering, Scheduling, and Sparse signal recovery

In parallel, the project will explore optimal design parameters for hardware implementation of CIM systems.

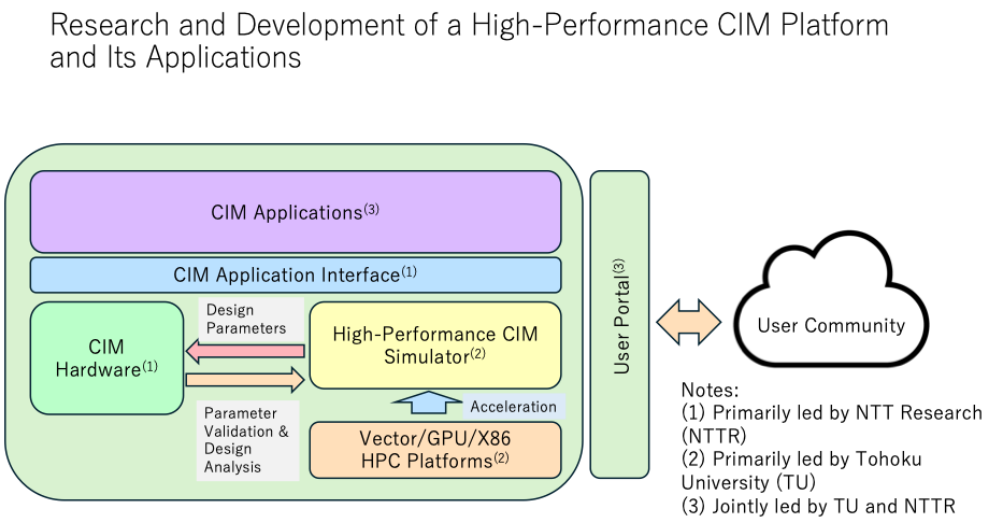
Expected Impact

This research is expected to advance the development of one of the world's largest CIM platforms and enable new quantum solutions for scientific and societal challenges that are difficult to address using conventional classical computing.

By providing this platform to the research community engaged in photonic quantum technologies and their applications, the initiative will stimulate research activities related to CIM and further accelerate innovation in this field. In particular, deriving optimal system design parameters using this platform could open the path toward practical CIM hardware systems.

Furthermore, by leveraging the international research networks of both

GSIS and NTTR, and involving young researchers and students in this initiative, the project will contribute to the development of globally competitive talent with expertise in quantum technologies and their applications.



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