Tensor network methods for quantum error correction

Record number : OPR-1045

Overview

RESEARCH DIRECTION

Stefanos Kourtis, Professeur - Department of Physics

INFORMATION

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ADMINISTRATIVE UNIT(S)

Faculté des sciences
Département d'informatique
Département de physique
Institut quantique

LEVEL(S)

1er cycle
2e cycle
3e cycle

LOCATION(S)

Département de physique et Institut quantique

Project Description

Context

Quantum computation promises advances in computing in the long run for diverse applications with significant economic and societal footprint. To unlock the full potential of quantum computation, it is necessary to counteract the inherent tendency of quantum systems to decohere and the unavoidably faulty nature of computing components through quantum error correction.

This research project aims to implement and deploy real-world quantum error correction protocols through a partnership between the research group of Prof. Stefanos Kourtis and NVIDIA, the world leader in GPU computing.
Project

The research goals of this project are to

a)   formulate a principled algorithmic approach for the discovery of hardware-specific quantum error-correcting codes capable of supporting fault-tolerant applications, and
b)   develop the algorithmic blocks necessary for high-throughput code evaluation and real-time decoding with state-of-the-art tensor network techniques.
By achieving these goals, it is expected that the team will enable demonstrations of real-time decoding on state-of-the-art GPU hardware.

Partner
NVIDIA is a world-leading manufacturer of cutting-edge GPU computing equipment. Research is to be performed in close collaboration with NVIDIA Quantum, the R&D division of NVIDIA that develops high-performance numerical libraries for the simulation of quantum systems and processes on GPUs, including CUDA Quantum and cuQuantum, as well as specialized hardware, such as the NVIDIA Grace Hopper Superchip.

Team & environment

We offer a dynamic team of 17 students, postdocs, and researchers, led by Prof. Stefanos Kourtis. The team's research activities enjoy generous financial support.

Our research team is embedded in the Faculty of Science at Université de Sherbrooke, a vibrant and diverse body of students, educators, and scientists. We are part of the dynamic research environment of the Institut quantique, a research institute comprised of more than 30 research groups from the Faculty of Science, the Faculty of Engineering, the Faculty of Humanities and the School of Management, 25 technical and professional staff members, and over 200 students and postdocs.

Application
Though there may not be available positions currently, anyone may show an interest in our team and research by writing us at quantum.ai@usherbrooke.ca.

Discipline(s) by sector

Sciences naturelles et génie

Informatique, Physique

Partner(s)

NVIDIA

The last update was on 21 May 2025. The University reserves the right to modify its projects without notice.