Open Canvas

project : Advancing and promoting QC using Alliance DRI to current and future quantum scientists

Problem

Presently, quantum processors are noisy and small and cannot currently facilitate the implementation of fully-scaled quantum circuits for solving practical scientific problems. Quantum simulators, i.e. classical computers, can mimic quantum evolution processes that occur in real quantum systems, but only up to a limit. In quantum algorithms research, simulation is often the first route in before executing a circuit on real quantum hardware. Conventional computers may be used for quantum simulation, but supercomputers provide much greater computational power. Large memory and processing power is an essential for quantum computation. Some quantum simulation methods are approximate and others are exact, but both are still limited in terms of dimensionality of the problem and/or circuit depth they can accurately captur. Since there are limits to the performance and accuracies of different quantum simulation methods, it is important to evaluate and compare them.

Solution

I propose to access and use the available digital research infrastructure (DRI) for high-performance computing in exploring quantum algorithms. I shall evaluate various simulation methods and real quantum computing for performance and scalability using these facilities. With the success of this study, I then hope to promote the use of DRA infrastructure for quantum computing through seminars and science outreach activities and tutorial website.

Unique Value Proposition

This project intends to engage the quantum computing research community as well as potential future scientists on utilizing HPC for quantum computing using the Digital Research Infrastructure. This will be achieved through high school science outreach events and research seminars. There will be a concerted effort made in reaching members of minority groups.

Key Metrics

*Ease-of-access and ease-of-use of DRA's HPC tools/ services.
*Job wait and processing times.
*Accuracy and scaling performance of simulation methods or quantum computer for a given quantum circuit.
*Feedback from seminars and outreach events.

User Profiles

Target audience and early adopters

Quantum computing researchers, future quantum scientists, high school students who may be interested in STEM-oriented careers, science enthusiasts, equity-seeking members within the above groups

User Channels

Through the quantum computing tutorial website, social media promotion, Let's talk science (LTS) learning platform. In-person high school visits and high school symposium to be held at UVic in February 2025.

Resources Required

*Access to Digital Research Alliance's HPC services/tools within BC and Canada.
*DRA training relating to running jobs.
*Volunteers/contributors for content creation and assistance in science outreach activities.
*Website/content/seminar hosting and any printed materials for activities

Contributor Profiles

Contribution types and ideal contributors

Contributions include training for use of DRI and assistance in organizing outreach events. These would be facilitated by Digital Research Alliance support personnel, undergrad and grad students for science outreach content, Let's talk science (LTS) facilitator, participating high schools registered through LTS platform, participating research organizations for hosting seminars.

Contributor Channels

Let's Talk Science organization, Quantum BC, Black in Quantum group, Universities in BC

Project Execution

Product

Community