Workshop II: Mathematical Aspects of Quantum Learning

## October 16 - 20, 2023

Scientific Overview

Recent results have hinted at the role quantum computing and technology may play in the future of machine learning, but much remains to be understood. For example, it has been shown that quantum computers can offer exponential improvements in learning from quantum data that comes from the physical world, and that compact quantum models can allow us to sample from probability distributions that seem inaccessible to traditional computing devices. In addition, general purpose quantum algorithms exist to dramatically speed up a number of subroutines that are pivotal in existing machine learning systems, but come with challenging caveats or have led to novel classical algorithm counterparts that challenge the advantage provided by quantum systems. However, fully grasping these results and connecting them to problems of interest today remains challenging for many reasons.

In this workshop, we hope to bring together experts from mathematics, quantum algorithms, and machine learning to better understand this intersection and reach the full potential of quantum computing and machine learning. This includes, but is not limited to, the ways in which quantum computers can accelerate existing machine learning algorithms, how we process inherently quantum data with either classical or quantum computers, and ways in which machine learning can change how we operate quantum devices. We hope to identify a number of open questions of interest in each area, and draw strong connections to the mathematical foundations of both quantum computing and machine learning.

This workshop will include a poster session; a request for posters will be sent to registered participants in advance of the workshop.

Participation

Additional information about this workshop including links to register and to apply for funding, can be found on the web page listed below. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission, and we welcome their applications.
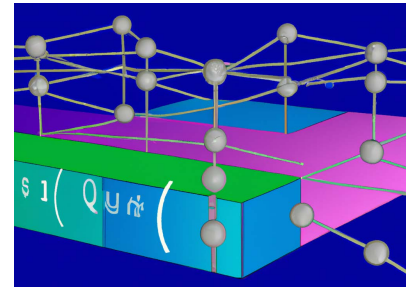
Organizers

Srinivasan Arunachalam (IBM)
Jens Eisert (FU Berlin)
Maria Kieferova (Uni. of Technology, Sydney)
Jarrod McClean (Google)
Nathan Wiebe (Uni. of Toronto)

Speakers

Amira Abbas (KwaZulu Natal)
Juan Miguel Arrazola (Xanadu)
Srinivasan Arunachalam (IBM)
Hans Briegel (Universität Innsbruck)
Matthias Caro (FU Berlin)
Juan Carrasquilla (Vector Institute)
Marco Cerezo (Los Alamos)
Patrick Coles (Los Alamos)
Vedran Dunjko (Leiden)
Jens Eisert (FU Berlin)
Vojtěch Havlíček (IBM)
Zoe Holmes (EPFL)
Hsin-Yuan (Robert) Huang (Caltech)
Maria Kieferova (Uni. of Technology, Sydney)
Nana Liu (Shanghai Uni.)
Jarrod McClean (Google)
Roger Melko (Waterloo)
Yihui Quek (Harvard)
Patrick Rebenstrost (Quantum)
Maria Schuld (Xanadu)
Ryan Sweke (IBM)
Kristan Temme (IBM)
Nathan Wiebe (Uni. of Toronto)

For more information, visit the program webpage:
www.ipam.ucla.edu/CQCWS2