QSUN Quantum Research Group of Stellenbosch University

SA QuTI South African Quantum Technology Initiative

NITheCS National Institute for Theoretical and Computational Sciences

Stellenbosch University iYunivesithi Universiteit

SEMINAR

Should we use parameterized quantum circuits for machine learning?

Dr Ryan Sweke (AIMS South Africa & Stellenbosch University)

Friday, 24 January 2025 @ 14h00-15h00 SAST

Venues: Online and Physics Seminar Room, Stellenbosch University

ABSTRACT

Recent years have seen an incredible interest in the use of parameterized quantum circuits (PQCs) for machine learning tasks. As of yet however, it remains unclear to what extent one can use PQC based algorithms to obtain a meaningful advantage over state-of-the-art classical methods. In this talk I will discuss evidence for and against the use of some specific PQC based algorithms. Specifically, I will first show that the output distributions of local quantum circuits are hard to learn on average, and discuss the implications this has for quantum circuit born machines. Next, I will shift the focus to supervised learning, and discuss the extent to which a widely-used class of PQC based algorithms can be dequantized via classical kernel regression with random Fourier features. Finally, I will ask whether it is possible to delegate quantum machine learning tasks to untrusted classical servers – something that will indeed be crucial in the future world where most quantum computations are out-sourced to external service providers.

BIOGRAPHY

Ryan Sweke is the Alexander von Humboldt German Research Chair of Mathematics and its Applications at AIMS, as well as a senior lecturer at Stellenbosch University. He leads the Quantum at AIMS group, whose research is focused on a wide variety of topics under the broad umbrella of quantum computing and quantum information.

Ryan completed his PhD at the University of KwaZulu-Natal in 2017, with a focus on quantum algorithms for the simulation of open quantum systems. After this he spent almost five years (2018-2022) as a post-doctoral researcher at the Freie Universität Berlin, first as an Alexander von Humboldt postdoctoral fellow (2018-2019) and then as a senior postdoc of the PlanQK project, the flagship quantum machine learning initiative of the German government.

After his time in Berlin, Ryan spent just over two years as a research scientist at IBM Quantum, in San Jose, California (2022-2024) before joining AIMS as the German Research Chair in January 2025.

REGISTER: https://bit.ly/4g4LzEQ