QSUN Quantum Research Group of Stellenbosch University

South African Quantum Technology Initiative (SA QuTI)

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SEMINAR

Markovian Noise Modelling and Parameter Extraction Framework for Quantum Devices

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Friday, 1 March 2024 @ 14h00 SAST
Venue: Physics Seminar Room, Stellenbosch University, and online

ABSTRACT

In recent years, Noisy Intermediate Scale Quantum (NISQ) computers have been widely used as a test bed for quantum dynamics. This work provides a new hardware-agnostic framework for modelling the Markovian noise and dynamics of quantum systems in benchmark procedures used to evaluate device performance. As an accessible example, the application and performance of this framework is demonstrated on IBM Quantum computers. This framework serves to extract multiple calibration parameters simultaneously through a simplified process which is more reliable than previously studied calibration experiments and tomographic procedures. Additionally, this method allows for real-time calibration of several hardware parameters of a quantum computer within a comprehensive procedure, providing quantitative insight into the performance of each device to be accounted for in future quantum circuits. The framework proposed here has the additional benefit of highlighting the consistency among qubit pairs when extracting parameters, which leads to a less computationally expensive calibration process than evaluating the entire device at once.

BIOGRAPHY

Dean is a second-year PhD student in the Quantum Research Group of Stellenbosch University, under the supervision of Prof Francesco Petruccione. His current research focuses on the intersection of quantum computing and neuromorphic computing, to find an optimal hybridisation of these technologies.

Dean completed his BSc and BSc Honours at the University of the Witwatersrand, majoring in astronomy, astrophysics, and theoretical physics. After this he completed a NITheCS internship with Prof Petruccione and Prof Ilya Sinayskiy (University of KwaZulu-Natal) (UKZN), which was an introductory research project on quantum computing. This led to a Master's degree with the same supervisors at UKZN, which was based on an application of Open Quantum Systems techniques to model the noise of IBM quantum computers.

His research interests have since evolved to include machine learning and quantum algorithms, which are central to the idea and aims of neuromorphic quantum computing, especially for applications such as artificial intelligence and deep learning.

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