SEBASTIAN ORBELL

Researcher / Developer / Engineer

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Qualifications

DPhil sponsored by Graphcore | Machine learning and Bayesian methods for the optimisation and control of quantum computing systems.

University of Oxford

2019-2023 | Trinity College, Oxford

Thesis in progress under the supervision of Prof. Andrew Briggs and Dr. Natalia Ares.
The general aim of my research is to probe and advance the efficacy of semiconductor qubits for large scale universal quantum computing. This is with a specific focus upon developing algorithms which introduce novel machine learning and Bayesian techniques in the domain of optimal automatic control in semiconductor quantum computing experiments. I conduct qubit experiments at ultra low temperatures using dilution refrigerators and build autonomous systems to optimise qubit properties.

Integrated Masters degree in Chemistry | First Class

University of Oxford

2015-2019 | St John's College, Oxford

Thesis entitled "Spin Dynamics of Radical Pairs" completed under the supervision of Prof. Manolopoulos, rewarded **First Class**.
Computational and theoretical research on quantum theory and spin dynamics.
Developing object-orientated quantum and semi-classical algorithms in Python, Fortran 90, and Julia. Using numerical optimisation and inference methods to elucidate physical principles from theory and experimental data.

Rewarded **First Class** in Oxford University Chemistry 3rd, 2nd, and 1st year exams.
Supplementary subject in Quantum Chemistry = 89%.

Career

Quantum engineer - internship

IQM - Callibration and benchmarking team

August 2022 - February 2023 | Helsinki, Finland

I contributed to the development of an automated calibration and optimisation procedure for superconducting qubit devices. This principally involved designing and implementing Bayesian data analysis and decision making tools. In addition, I assisted in the lab with device installations and cool-downs. I then built a fully differentiable device simulator and used this tool to design optimal quantum control schemes for robust single qubit gates.

Machine Learning Research scientist - internship

Graphcore - Research team

June - September 2021 | Bristol

I was investigating the potential of the IPU for accelerating novel generative methods, in particular denoising diffusion probabilistic models which are most notable for their use in the DALI-2 text to image generator. I successfully demonstrated that we could leverage their specialist computing hardware, the IPU, to gain an advantage over competitive hardware in this domain. I also wrote a blog-post about this work for Graphcore's medium page.

Machine Learning Engineer - internship

EcoSync

March 2021 Oxford

Data processing and programming an attention network, using Pytorch, for time series analysis.

Machine Learning Research

Oxford Artificial Intelligence Society

2021 University of Oxford

Exploring methods for classifying and generating measurements of elementary particles using machine learning.

Non Stipendiary Lectureship in Chemistry

St John's College

2021 University of Oxford

2019-2021 – Tutorials at St John's college Oxford. First, Second, and third years undergraduate physical chemistry tutorials including Quantum Mechanics, Photo physics, NMR and Atomic and molecular spectroscopy.

DNA synthesis - Summer internship

ATDBio

June 2017 Research laboratory, Oxford Science Park

Lead research on chemical and biochemical techniques including DNA synthesis, enzymatic reactions and purification using HPLC and analysis with the UPLC and Mass Spec machines.

Publications and awards

Publications - Journal

- Orbell et al., Deep Reinforcement Learning for Efficient Measurement of Quantum Devices, Nature physics journals Quantum Information, (2021). https://www.nature.com/articles/s41534-021-00434-x

Publications - Other

- Medium - https://sebastian-orbell.medium.com/

Conferences

- Machine Learning for Quantum 2021 video poster. "Bayesian methods for the efficient measurement of Rabi oscillations".
- APS March Meeting 2021 talk. "Deep Reinforcement Learning for Efficient Measurement of Quantum Devices".

Awards

- 2020 Trinity college Graduate academic prize.
- 2017 Christopher Coley Prize for academic excellence (St John's College).
- Oxford University supplementary subject in Quantum Chemistry = 89%
- Casberd Scholar 2016-2019 St John's College, University of Oxford.

Technical skills and experience

- IBMQ hackathon 2020. Project leader for Byskit – a framework for compiling Bayesian Networks into quantum circuits using IBM's Qiskit.
- G-Research Oxford vs Cambridge Hackathon 2020 – developed a continuous blackjack bot.
- Autonomous Intelligent Machines Systems (AIMS) lecture course.
- Introduction to Quantum information – Artur Ekert.
- Rust based state-vector and density matrix simulator $https://crates.io/crates/bra\_ket/0.1.3$