# Boaz Micah

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Quantum engineer with a strong background in quantum computing, algorithm design, and applied machine learning, now transitioning toward quantum hardware development. Skilled in quantum software and simulation, with a growing focus on superconducting circuits, control systems, and quantum error correction. Passionate about bridging quantum software and hardware to accelerate the development of scalable, fault-tolerant quantum computers. Brings a proven track record of delivering technical innovation in fast-paced environments and a commitment to advancing the practical realisation of quantum technologies.

## Education

**Universidad Internacional Menéndez Pelayo** Sep 2024 - Sep 2025

*Master's degree in Quantum Technologies* Madrid, Spain

- **Relevant Coursework:** Superconducting quantum circuits, Quantum technologies with photons and atoms, Implementation of quantum technologies, Quantum cryptography and communication, Machine learning and quantum computers, Advanced Quantum Theory, Quantum Information Theory, Fundamentals of quantum technologies.

**University of Edinburgh** Sep 2018 - May 2023

*Master of Science in Physics* Edinburgh, United Kingdom

- **Relevant Coursework:** Quantum Physics, Quantum Computing, Quantum Mechanics, Data Acquisition and Handling, Condensed Matter Physics, Statistical mechanics, Particle Physics, Nuclei Physics, Data Analysis and Machine Learning, Statistics and Fourier Analysis, Modelling and Visualisation in Physics.

## Work Experience

**Quantum Software Engineer** Oct 2023 – Present

*Multiverse Computing* San Sebastian, Spain

- Designed and implemented a quantum machine learning library tailored for anomaly detection, featuring quantum kernels, quantum autoencoders, and quantum clustering algorithms; successfully deployed in multiple anomaly detection use cases within the company.
- Implemented new methods in the library to evaluate whether a dataset has the potential to demonstrate quantum advantage using the geometric difference and model complexity of the classical and quantum models.
- Currently researching the application of tensor network methods for anomaly detection.
- Developed a novel QUBO formulation for DNA sequence assembly. Implemented the solution on D-Wave quantum annealers, achieving the largest DNA sequence assembly using a quantum algorithm. Successfully assembled the Enterobacteria phage PRD1 virus genome (15,000 nucleotides).
- Implemented a data augmentation technique using tensor networks, specifically Matrix Product States, to generate synthetic samples for an unbalanced dataset.
- Developed a quantum optimisation model using D-Wave's hybrid constrained quadratic model (CQM) sampler to optimise emergency vehicle forward deployment for North Wales Police, reducing run times from half a day to 10 seconds.
- Developed a machine-learning-driven alloy design framework combining nested cross-validation for model selection (XGBoost regressors) with quantile-based uncertainty estimation; integrated these

predictors into a genetic algorithm that optimises alloy compositions by maximising the probability of achieving target mechanical properties. Additionally, I incorporated SHAP analysis to obtain the interpretability of the models. The alloys were validated experimentally.

- Developed a time-series machine learning model to predict the outbreak and spread of diseases like influenza or COVID-19 to better allocate healthcare resources and implement preventive measures.
- Designed and implemented an airline hub-selection model using D-Wave's quantum annealers to determine optimal hub airports by minimising operational costs and matching passenger demand.
- Developed a deterministic, multi-stage heuristic for vehicle routing with time windows, introducing a progressive constraint relaxation strategy that rapidly constructs feasible routes, ensures predictable performance, and outperforms traditional metaheuristics in reliability and speed. The algorithm is well-suited for logistics, supply chain, and real-time dispatch applications.
- Ran large-scale quantum circuit simulations on HPC clusters and AWS EC2 instances, achieving simulations of up to 30 qubits.
- Applied best software engineering practices by using Git for version control, implementing a CI/CD pipeline, containerizing workflows with Docker, and ensuring clean, consistent code formatting
- Management of clients and technical collaboration.
- Work with multiple teams in a highly dynamic environment.

**Machine Learning Engineer Intern** May 2022 - Oct 2022

*Institute of Condensed Matter Physics (University of Edinburgh)* Edinburgh

- Trained feed-forward and recurrent neural network models using TensorFlow and scikit-learn to classify different DNA knots.
- Generated millions of uncorrelated knot conformations using molecular dynamics simulations in Python.
- The models can classify the five simplest knot types with a testing accuracy greater than 89.1%.
- The performance of the models is invariant with rotated and translated DNA knots.

## Research Work

**The structural properties of the two-dimensional magnetic material vanadium tri-iodide**

*Master's Thesis (University of Edinburgh)* Supervisor: Dr.Christopher Stock

- Investigated the temperature dependence of the crystal structure of vanadium tri-iodide using an X-ray diffractometer and refinement techniques.
- Prepared powder sample of the compound using the chemical vapor transport method and analysed the diffraction patterns using the JANA2020 software, Python and Matlab.
- Observed a structural phase transition in the 2D material around 80 K, in agreement with the literature.
- This project successfully determined the crystal structure of the 2D magnet at all temperatures.
- Gained valuable experience working independently and as part of a collaborative research team.
- The project report can be found here.

### Symmetry-optimised classical simulation of quantum circuits using sum-over-Clifford methods

*Master's Thesis* Supervisor: Dr.Juani Bermejo Vega

- Used the Sum-Over-Clifford gates technique to decompose universal quantum circuits into a sum of gates from the Clifford group. The implementation was written in C.
- Leveraged High Performance Computing (HPC) to solve the convex optimisation problem required for determining optimal quantum circuit decompositions.
- Used symmetry to decompose up to six-qubit non-Clifford gates.
- Benchmark multiple linear programming software.
- The decompositions obtained in this project can be integrated into other quantum circuit simulations, reducing the overall memory usage.

### The dependence of the diffusion coefficient of isolated DNA molecules with different topologies

*Undergraduate Project* Supervisor: Dr.Davide Michieletto

- Prepared fluorescently labelled DNA and recorded the movement of DNA molecules using a confocal microscope.
- Used Python to track the movement of the recorded DNA molecules and ImageJ to measure their area and roundness.
- Investigated the effect of topology on the movement of DNA molecules.
- The results from the project confirmed that circular DNA molecules move faster than linear DNA molecules.

### Simulator for Grover's search algorithm

- Built a simulator of a circuit-model quantum computer that implements Grover's search algorithm from scratch using Python.
- The simulator performs a search by amplifying the amplitude of the desired basis state.
- The simulator can handle up to 12 qubits without a significant time delay in running the search.
- The source of the project can be found here.

## Certification

### Qiskit Global Summer School 2024: Quantum Excellence

- **Skills:** Qiskit, Quantum Algorithms, Python, Quantum Chemistry, Quantum Computing.

## Skills

**Languages:** Python, C++, Qiskit library, PennyLane, D-Wave Ocean, Matlab, C, JavaScript.
**Technologies:** Docker, TensorFlow, PyTorch, AWS, Git.
**Concepts:** Quantum Algorithms, Quantum cryptography, Quantum error corrections, Tensor Networks, Data Structures and Algorithms, Machine Learning, Neural Networks.