Alexander Koziell-Pipe

linkedin.com/in/alex-koziell | github.com/alexkoziell | alex.koziellpipe.xyz

Summary

- Computer Science PhD student at the University of Oxford, conducting research at the intersection of artificial intelligence, mathematics and quantum computing. 1st Class Physics degree from the University of Oxford.
- Multiple academic awards and scholarships.
- Data science and machine learning experience in industry at both a startup and enterprise level.
- Experience with a breadth of deep learning architectures.
- Leadership and communication skills developed from multiple roles of responsibility.

Education and Honors

University of Oxford, Wolfson College *Oxford, UK*
PhD in Computer Science *Oct 2021 – Present*

- Quantum circuit simulation using reinforcement learning and graph neural networks.
- Category-theoretic semantics for hybrid quantum machine learning.
- Wolfson Harrison Quantum Foundations Scholar (Full Tuition Fees and Stipend)

University of Oxford, Lincoln College *Oxford, UK*
Master of Physics *Oct 2015 – Jun 2019*

- 1st Class Honors
- Coursework: numerical simulation design for condensed matter physics.
- Lord Crewe Scholar (£700)
- Sidgwick Exhibition Award (£150)

Skills

- **Programming Languages:** Python, JavaScript, Haskell, CSS, HTML, SQL, Solidity
- **Data Science and Machine Learning:** scikit-learn, NumPy, pandas, matplotlib, seaborn, support vector machines (SVM), decision trees, random forests, time series, OpenCV, data visualisation, EDA, ETL, WandB
- **Deep Learning:** PyTorch, TensorFlow, JAX, convolutional neural networks (CNN), recurrent neural networks (RNN), LSTM, transformers, language models, graph neural networks (GNN), reinforcement learning (RL)
- **Quantum Computing:** qiskit, qiskit machine learning, Cirq, TensorFlow Quantum
- **Other:** git, version control, Linux, Jupyter, Docker, algorithms, unit testing, SSH, asynchronous programming, React

Experience

Hitachi Vantara LLC *London, UK*
SE Lumada Data Science Fellow *Sep 2020 – Dec 2020*

- Advanced analytics for energy plant anomalies.
- Trained random forests, support vector machines and LSTMs to detect failure modes in a time series dataset.
- Our machine learning models provided a prototype early warning system for energy plant equipment failures.
- Chosen from a pool of more than 500 applicants; selected for academic excellence, intellectual curiosity, and communication skills.

HELIX RE Inc *London, UK*
Computer Vision Engineer *Jul 2019 – Oct 2019*

- Localisation task for generating digital twins of buildings.
- Implemented algorithm for determining relative positions of 360 images with overlapping visual fields.
- The algorithm facilitated automating the creation of an ‘indoor google street view’ and was used in the company’s main data processing pipeline.

Online Education Partnership Ltd *Remote/Worldwide*
Mathematics and Science Tutor *Oct 2019 – Sep 2020*

- Taught Mathematics and Science online to a global demographic (Hong Kong, US, Dubai).
- Subjects: Mathematics, Physics, Chemistry, Biology, Linear Algebra.

Publications

Hybrid Quantum-Classical Machine Learning with String Diagrams, arXiv:2407.03673 *2024*

- Presented at the PLDI Workshop on Quantum Software 2024 in Copenhagen, Denmark

Functorial Language Models, arXiv:2103.14411 *2021*

- Presented at the Applied Category Theory Conference 2021 in Cambridge, UK (Remote)

Volunteering and Leadership

Co-organizer *Remote/Worldwide*
ZX Seminar *Sep 2023 – Present*

- Invited speakers and chaired seminars on the ZX-calculus: a graphical language for quantum computing.

Research Cluster Representative *Oxford, UK*
Wolfson Quantum Foundations Research Cluster *Oct 2021 - Present*

- Invited speakers, organized and chaired events and talks.
- Topics ranged from 'The Link between Quantum Mechanics and Music' to 'Are Error Correcting Codes built into the laws of the universe?'

Men's Captain *Oxford, UK*
Oxford University Gymnastics Club *Oct 2021 – Mar 2022*

- Elected by members of the gymnastics club.
- Organized and led a team at national competitions and the annual Oxford vs Cambridge Varsity Match.

IT Officer *Oxford, UK*
Oxford University Gymnastics Club *Mar 2017 – Mar 2018*

- Maintained a WordPress site, produced video content and managed multiple social media accounts to improve the gymnastics club's online presence.

Club President *London, UK*
Halley Science Society (St Paul's School) *Sep 2013 – Jun 2014*

- Invited speakers, organized and chaired events and lectures for the school science society.
- Notable speakers included Professor John Ellis, who gave a lecture on the Higgs boson shortly after its discovery.

Grants, Awards and Achievements

Academic

- Wolfson Harrison Quantum Foundations Scholarship – University of Oxford (Full tuition fees and stipend)
- Lord Crewe Scholar – University of Oxford (£700)
- Sidgwick Exhibition Award – University of Oxford (£150)
- Senior Mathematics Prize – St Paul's School
- Senior Academic Scholarship – St Paul's School (£50)

Sporting Awards

- 4x Full Blue, Oxford University's highest sporting achievement, in Gymnastics.
- High Profile Sports Grant – Wolfson College, University of Oxford (£200)
- Blues Funding – Lincoln College, Oxford (£150, £270, £125)

Grants

- Club Development Grant. Won in open competition on behalf of Oxford University Gymnastics Club – Oxford University Sport (£1000)

Teaching

Oxford Study Abroad Programme *Oxford, UK*

- Special Relativity, Quantum Computation, Machine Learning. PyTorch implementation of arxiv:1512.04150.

Open Source Contributions

Ivy – The Unified AI Framework

- Tested TensorFlow, JAX and PyTorch backends with the hypothesis testing framework.

Chyp – An Interactive Theorem Prover for String Diagrams

- Implemented a hypergraph data structure, parser and convex optimization visualization code.