

Alexander Koziell-Pipe

QUANTUM COMPUTING · ARTIFICIAL INTELLIGENCE · CATEGORY THEORY

Quantum Group, Dept. of Computer Science, University of Oxford, UK

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Education

Wolfson College, University of Oxford

Oxford, UK

DPHIL COMPUTER SCIENCE - SUPERVISORS: PROF. ALEKS KISSINGER, PROF. BOB COECKE

Oct. 2021 - present

- Category-Theoretic Semantics for Hybrid Quantum Classical Machine Learning
- Quantum Circuit Optimization with Reinforcement Learning and Graph Neural Networks.
- Wolfson Harrison UK Research Council Quantum Foundation Scholar (Full Tuition Fees & Stipend).
- Member of the Oxford Quantum Group.

Lincoln College, University of Oxford

Oxford, UK

MPhys MASTER OF PHYSICS - 1ST CLASS HONOURS

Oct. 2015 - Jun. 2019

- Thesis Title: Interaction of Chiral Magnetic Skyrmions
- Lord Crewe Scholar (£700).

St Paul's School

London, UK

A LEVELS & GCSE

Sept. 2009 - Jun. 2014

- (A2 Level) Mathematics: A*, Physics: A*, Further Mathematics: A*, Chemistry: A*
- (AS Level) all of the above: As, Biology: A (A highest awarded grade at AS Level)
- (GCSE) 9 A*s and 3 As including A*s Maths, Physics, Chemistry, Biology, Electronics

Preprints

- | | | |
|------|--|---------------------------------------|
| 2024 | Hybrid Quantum-Classical Machine Learning with String Diagrams , to appear
Presented at PLDI Workshop on Quantum Software 2024, Copenhagen, Denmark | Alex Koziell-Pipe,
Aleks Kissinger |
| 2021 | Functorial Language Models (Extended Abstract) , arXiv:2103.14411
Presented at Semspace (Workshop on Semantic Spaces at the Intersection of NLP, Physics, and Cognitive Science) and ACT (Applied Category Theory Conference), 2021. Implemented in JAX. | Alexis Toumi, Alex
Koziell-Pipe |

Experience

Hitachi Vantara LLC

London, UK

SE LUMADA FELLOW

Sep. 2020 - Dec. 2020

- Developing advanced analytics for energy plant anomalies.
- Chosen out of a pool of more than 500 applicants; selected for academic excellence, intellectual curiosity, and communication skills.
- Pandas, Seaborn, Scikit-learn, Tensorflow, SQL, Time Series, SVMs, Random Forests, RNNs, LSTMs.

Helix RE Inc.

London, UK

COMPUTER VISION ENGINEER

Jul. 2019 - Oct. 2019

- Computer Vision Engineering as part of a mission to create 'digital twins' of buildings.
- Contributed production-level code used in the company's main data processing pipeline.
- Python, Unit Testing, Matplotlib, Computational Geometry.

Online Education Partnership Ltd.

Remote/Worldwide

MATHEMATICS AND SCIENCE TUTOR

Jun. 2016 - Sept. 2020

- Teaching Maths and Science to students around the world (Hong Kong, US, Dubai) via an online interface.
- Commended for ability to effectively communicate difficult scientific concepts to students.
- Subjects: Mathematics, Further Mathematics Physics, Chemistry and Biology, up to and including A Level. University-level Linear Algebra.

National Tsing Hua University

Hsinchu, Taiwan

CONDENSED MATTER PHYSICS INTERN

Mar. 2015 - Apr. 2015

- Introduction to research on Weyl Semimetals: solid state crystals in a topologically non-trivial phase of matter.

University of Texas at Dallas

Dallas, Texas, USA

ATMOSPHERIC PHYSICS INTERN

Feb. 2015 - Mar. 2015

- Running computer simulations in FORTRAN to study the effect of airborne particles on cloud formation.

Teaching

Oxford Study Abroad Programme

Oxford, UK

TUTOR

Oct. 2022 - March. 2024

- Machine Learning with a computer vision focus. PyTorch implementation of arxiv:1512.04150.
- Quantum Computation
- Special Relativity

Extracurricular Activity

ZX Calculus Seminar

Worldwide

CO-ORGANIZER

Sep. 2023 - present

- The ZX Seminar is a virtual venue for researchers to share their work related to the ZX calculus - a formal graphical language for Quantum Computing.
- Responsibilities include inviting speakers, scheduling seminars, and co-chairing events.

Wolfson Quantum Foundations Research Cluster

Wolfson College, Oxford

RESEARCH CLUSTER REPRESENTATIVE

Oct. 2021 - present

- Responsibilities include inviting speakers, organizing and chairing talks and discussions.
- Previous topics include 'The Connection between Quantum Mechanics and Contemporary Music' and 'Supersymmetry as an Evolutionary Adaptation'.

Oxford University Gymnastics

Oxford University Sport

MEN'S CAPTAIN

Oct. 2021 - Mar. 2022

Mar. 2018 - Mar. 2019

- Contributed, as part of a committee, to managing Oxford University Gymnastics Club.
- Attended meetings, organized and led a team, and supported and taught other club members.
- Elected by teammates and members of the gymnastics club.

Oxford University Gymnastics

Oxford University Sport

IT OFFICER

Mar. 2017 - Mar. 2018

- Maintained a website, produced video content, managed publicity and multiple social media accounts.
- HTML, CSS, Image and Video Editing (GIMP, DaVinci Resolve), Social Media Management.

Halley Science Society

St Paul's School

CLUB PRESIDENT

Sep. 2013 - Jun. 2014

- Invited speakers and hosted lectures for the St Paul's School Science Society.
- Notable speakers include Professor John Ellis, who talked about the Higgs Boson shortly after its experimental confirmation.

Grants, Awards & Achievements

ACADEMIC

- | | | |
|---------|--|----------------------|
| 2018-19 | Lord Crewe Scholarship (£700) , awarded to 11 out of 304 students to mark outstanding work. | University of Oxford |
| 2017 | Sidgwick Exhibition 2017-18 (£150) , awarded for exceptional academic achievement and promise. | University of Oxford |
| 2014 | Senior Mathematics Prize , chosen for outstanding work out of approximately 20 students. | St Paul's School |
| 2013-14 | Senior Academic Scholarship (£50) , for top results in AS-level and excellent work throughout the year. | St Paul's School |

SPORTING

- | | | |
|----------------|---|----------------------|
| 2023,
19,18 | Full Blue (Gymnastics) x3 , Oxford University's highest sporting achievement. | University of Oxford |
| 2022
17,16 | Half Blue (Gymnastics) x3 , Oxford University's second highest sporting achievement. | University of Oxford |

GRANTS

2023	Wolfson College High Profile Sports Grant (£200) , Awarded to support individual graduate students who are striving towards the peak of sporting success.	Wolfson College, University of Oxford
2018	Club Development Grant (£1000) , won in open competition to support further development of Oxford University Gymnastics Club.	Oxford University Sport
2016, 17,19	Lincoln College Blues Fund (£150, £270, £125) , to support achievement in gymnastics.	Lincoln College, University of Oxford

Open Source Contributions

2023	Ivy - The Unified AI Framework , Function implementation and tests using the hypothesis framework.
2023	Chyp - An interactive theorem prover for string diagrams , Contributions to hypergraph backend, parser, and drawing code.

Skills

Research	Mathematics (Category Theory), Quantum Computing, Machine Learning
Programming Languages	Up to date: Python, Haskell. Previously learned: Rust, C++, HTML, CSS, javascript, Swift
Natural Languages	Fluent English, Français Niveau Intermédiaire, 初級日本語

Extra Information

Technical Interests Algorithms, Programming Languages, Web Development, IOS App Development, Deep Learning, Pytorch, Tensorflow, Data Science, Blockchain Technology, Cryptocurrency, Cryptoeconomics, Game Development, Command Line, Linux, Version Control, Git, Github Pro Account, Neuroscience

Sport Artistic Gymnastics, Skiing, Snowboarding, Tennis, Windsurfing, Horsemanship, Martial Arts

Music Trumpet Grade 4, Piano Grade 2

Self Teaching and Online Courses

(An accumulation of self-motivated self-teaching out of curiosity, fascination and a passion for learning. Please note that I may need a refresher on some of the skills in these courses.)

Andrej Karpathy	Neural Networks: Zero to Hero (https://karpathy.ai/zero-to-hero.html) , Reverse-mode automatic differentiation from scratch. PyTorch. Self attention and Transformers. GPTs.	Andrej Karpathy
Coursera	Machine Learning , Linear and Polynomial Regression, PCA, SVMs, Neural Networks, MATLAB and Octave.	Stanford University, Andrew Ng
Coursera	TensorFlow in Practice Specialization , Dense Neural Networks, CNNs, RNNs, LSTMs and Time Series Analysis with TensorFlow.	deeplearning.ai
Coursera	Algorithms Part I , Algorithmic design and analysis, A* Search, k-d Trees, Java.	Princeton University
Udemy	Complete Web Development Bootcamp , HTML, CSS, javascript, Nodejs, React, Databases (SQL, mongoDB), Authentication and Security.	LondonAppBrewery
Udemy	iOS 12 & Swift - The Complete iOS App Development Bootcamp , Swift, Databases (Core Data, Realm), CoreML, ARKit, SwiftUI.	LondonAppBrewery
Udemy	Deep Learning A-Z , Theory behind different deep learning models, Tensorflow, Keras and Pandas.	SuperDataScience
Udemy	Blockchain A-Z , Theory behind blockchain technology, coding a simple cryptocurrency in Python, the Solidity programming language.	SuperDataScience
Udemy	How to Program Games: Tile Classics in JS for HTML5 Canvas , Creating browser-based games from scratch using javascript and HTML.	ChrisDeLeon
Kaggle	Kaggle Courses , Basics of the Seaborn plotting library, Pandas, and Machine Learning.	Various
fast.ai	fast.ai Course , PyTorch, Computer Vision, NLP, implementing academic papers, data mining.	Jeremy Howard