

Richie Yeung

richie.yeung@cs.ox.ac.uk | github.com/y-richie-y

EDUCATION

University of Oxford, Wolfson College

Oxford, United Kingdom

Doctor of Philosophy, Department of Computer Science

2022 – Present

- Supervised by Professor Bob Coecke and Professor Aleks Kissinger
- Research focus on combining Machine Learning with ZX calculus to tackle problems in Quantum Computing
- Proved optimal compilation of parametrised quantum circuits using ZX Calculus
- Developed fast Rust implementation of AlphaZero MCTS for Constrained Clifford Tableau Synthesis
- Developed Rust-based GraySynth algorithm for synthesising Trotterised Hamiltonians
- Use distance-preserving rewrites and path covers to synthesise logical states of CSS codes

University of Oxford, St. Cross College

Oxford, United Kingdom

Master of Science, Department of Computer Science, Distinction

2019 – 2020

- Dissertation: Diagrammatic Design and Study of Ansätze for Quantum Machine Learning (88%)
- Achieved 100% on Quantum Computing Exam

University of Cambridge, Trinity College

Cambridge, United Kingdom

Bachelor of Arts, Department of Computer Science and Technology, First Class

2016 – 2019

- Dissertation: Hard Examples for the Graph Isomorphism Problem (73%)
- Achieved 90% in final year exams

WORK EXPERIENCE

Researcher and Software Developer

2020 – Present

Quantinuum

Oxford, United Kingdom

- Developed `discopy`, software library for computing with monoidal categories
- Developed `lambeq`, software library for quantum natural language processing (QNLP)
- Developed `cryptomite`, software library for randomness extraction
- Developed `optyx`, software library for compiling and simulating linear optical circuits
- Created and proved completeness of ZXW calculus
- Used RL and GNNs to find good stabiliser decompositions for simulating quantum circuits

Software Engineering Intern

Summer 2019

GSA Capital

London, United Kingdom

- Developed an automated hedging system
- Designed randomised algorithms to solve NP-Hard optimisation problems
- Performed backtest simulation for new hedging strategy to estimate its effect on P&L

Software Engineering Intern

Summer 2018

Bloomberg LP

London, United Kingdom

- Developed a backend for HashiCorp Vault, a secret management system, using Golang
- Developed a plugin system for the Vault storage backend over RPC
- Developed `comdb2` plugin, supporting leadership elections for high availability

TECHNICAL SKILLS

Languages: Python, Rust, Java, C, Go

Developer Tools: git, bash

Libraries: PyTorch, JAX, Quimb, Cotengra, Stim

PUBLICATIONS

My research interest lies in the intersection of quantum computing, machine learning and category theory. I am currently working on improving the simulation and optimisation of quantum circuits by combining reinforcement learning with the ZX calculus, a diagrammatic calculus for quantum computing.

Please refer to my [Google Scholar](#) for a full list of publications.

REFERENCES

- [Mir+22] Eduardo Reck Miranda, Richie Yeung, Anna Pearson, Konstantinos Meichanetzidis, and Bob Coecke. “A Quantum Natural Language Processing Approach to Musical Intelligence”. In: *Quantum Computer Music: Foundations, Methods and Advanced Concepts* (Jan. 2022), pp. 313–356. DOI: 10.1007/978-3-031-13909-3_13/FIGURES/35. URL: https://link.springer.com/chapter/10.1007/978-3-031-13909-3_13.
- [SWY22] Razin A. Shaikh, Quanlong Wang, and Richie Yeung. “How to Sum and Exponentiate Hamiltonians in ZXW Calculus”. In: *Electronic Proceedings in Theoretical Computer Science, EPTCS* 394 (Dec. 2022), pp. 236–261. DOI: 10.4204/EPTCS.394.14. URL: <http://arxiv.org/abs/2212.04462><http://dx.doi.org/10.4204/EPTCS.394.14>.
- [Cha+23] Francois Charton, Alexandre Krajenbrink, Konstantinos Meichanetzidis, and Richie Yeung. “Teaching small transformers to rewrite ZX diagrams”. In: *The 3rd Workshop on Mathematical Reasoning and AI at NeurIPS’23*. 2023.
- [Poo+23] Boldizar Poor, Quanlong Wang, Razin A. Shaikh, Lia Yeh, Richie Yeung, and Bob Coecke. “Completeness for arbitrary finite dimensions of ZXW-calculus, a unifying calculus”. In: *Proceedings - Symposium on Logic in Computer Science 2023-June (2023)*. ISSN: 10436871. DOI: 10.1109/LICS56636.2023.10175672.
- [FYC24] Cameron Foreman, Richie Yeung, and Florian J Curchod. “Statistical testing of random number generators and their improvement using randomness extraction”. In: *Entropy* 26.12 (2024), p. 1053.
- [Hua+24] Qunsheng Huang, David Winderl, Arianne Meijer-van de Griend, and Richie Yeung. “Redefining Lexicographical Ordering: Optimizing Pauli String Decompositions for Quantum Compiling”. In: *2024 IEEE International Conference on Quantum Computing and Engineering (QCE)* (Sept. 2024), pp. 885–896. DOI: 10.1109/QCE60285.2024.00108. URL: <https://ieeexplore.ieee.org/document/10821336/>.
- [KYW24] Mark Koch, Richie Yeung, and Quanlong Wang. “Contraction of ZX diagrams with triangles via stabiliser decompositions”. In: *Physica Scripta* 99 (10 Sept. 2024), p. 105122. ISSN: 1402-4896. DOI: 10.1088/1402-4896/AD6FD8. URL: <https://iopscience.iop.org/article/10.1088/1402-4896/ad6fd8><https://iopscience.iop.org/article/10.1088/1402-4896/ad6fd8/meta>.
- [KYS24] Alexander Koziell-Pipe, Richie Yeung, and Matthew Sutcliffe. “Towards Faster Quantum Circuit Simulation Using Graph Decompositions, GNNs and Reinforcement Learning”. In: *The 4th Workshop on Mathematical Reasoning and AI at NeurIPS’24*. 2024.
- [WYK24] Quanlong Wang, Richie Yeung, and Mark Koch. “Differentiating and Integrating ZX Diagrams with Applications to Quantum Machine Learning”. In: *Quantum* 8 (Oct. 2024), p. 1491. ISSN: 2521327X. DOI: 10.22331/q-2024-10-04-1491. URL: <https://quantum-journal.org/papers/q-2024-10-04-1491/>.
- [Wet+24] John van de Wetering, Richie Yeung, Tuomas Laakkonen, and Aleks Kissinger. “Optimal compilation of parametrised quantum circuits”. In: (Jan. 2024). URL: <https://arxiv.org/abs/2401.12877v2>.
- [For+25] Cameron Foreman, Richie Yeung, Alec Edgington, and Florian J. Curchod. “Cryptomite: A versatile and user-friendly library of randomness extractors”. In: *Quantum* 9 (Jan. 2025), p. 1584. ISSN: 2521327X. DOI: 10.22331/q-2025-01-08-1584. URL: <https://quantum-journal.org/papers/q-2025-01-08-1584/>.
- [HYM25] Carys Harvey, Richie Yeung, and Konstantinos Meichanetzidis. “Sequence processing with quantum-inspired tensor networks”. In: *Scientific Reports* 2025 15:1 15 (1 Feb. 2025), pp. 1–12. ISSN: 2045-2322. DOI: 10.1038/s41598-024-84295-2. URL: <https://www.nature.com/articles/s41598-024-84295-2>.
- [Pap+25] Axel Pappalardo, Pierre Emmanuel Emeriau, Giovanni De Felice, Brian Ventura, Hugo Jaunin, Richie Yeung, Bob Coecke, and Shane Mansfield. “Photonic parameter-shift rule: Enabling gradient computation for photonic quantum computers”. In: *Physical Review A* 111 (3 Mar. 2025), p. 032429. ISSN: 24699934. DOI: 10.1103/PHYSREVA.111.032429/FIGURES/3/MEDIUM. URL: <https://journals.aps.org/pr/abstract/10.1103/PhysRevA.111.032429>.