Lawrence Wu

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Education

University of Cambridge *MSc Physics* *Oct.2022–Jun.2023*

- Thesis: Combinatorial Optimisation of the Ising model with Graph Neural Networks
- Quantum Field Theory, Advanced Statistical Physics

University of Cambridge *BA(Hons) Physics, 1st class* *Oct.2019–Jun.2022*

- Scored over 90% in 2/4 final year core modules (General Relativity, Electrodynamics)
- Computing Project: Simulation of the Ising Model of Ferromagnetism
- Literature Review: Development of Quantum Computing Hardware

Relevant Modules: Statistical Physics, Advanced Quantum Mechanics, Particle Physics, Linear Algebra, PDE, Complex Analysis, Group Theory, Rep Theory, Differential Geometry

West London Free School (UK) *Sixth Form* *Oct.2017–Jun.2019*

- A-Levels (All A*s): Physics, Maths, Further Maths, Chemistry.

Taipei Municipal Jianguo High School (Taiwan) *High School* *Sept.2016–Oct.2017*

- Ranked 1st in entrance exam for the governmental Gifted Class of Mathematics and Science.

Awards

- United Steel Companies Scholarship, St John's College, University of Cambridge (2020, 2022)
- Top Gold, British Physics Olympiad (2019)

Publication

Investigation of Cosmic Preferred Directions in the Cosmic Microwave Background Using New Strategies, Lawrence Wu & Jiun-Huei Proty Wu (in preparation).

Research Experience/Projects

Combinatorial Optimisation of the Ising model using GNNs *Oct.2022–May.2023*

Supervisor: Prof. Pietro Lio, Department of Computer Science, University of Cambridge.

- Developed a Graph Neural Network(GNN) for solving Ising energy optimisation(QUBO) problems through Polarised Attention Graph Diffusion

Preferred Directions in the Cosmic Microwave Background (CMB) *Aug.2021–present*

Supervisor: Prof. Jiun-Huei Proty Wu, Department of Physics, National Taiwan University.

- Independently developed the codebase, which analyses data with over 50 million pixels each
- Applied new strategies to investigate possible preferred axes or directions in the observed full-sky CMB maps.

Efficient Wordle Solver using the Word Correlation Graph *Feb. 2022*

Independent research on Interesting Problems

- A rapid brute force solver in python based on the complete directed correlation graph between all 6000 5-letter words
- The directed graph was simplified into a simpler graph by applying a non-trivial symmetry between the edges
- Concluded the best strategy of starting with "Aloes" with an expected guess count of 3.2 guesses

Simulation of the Ising Model *Oct.2021–Apr.2022*

Undergraduate Computational Project.

- Implemented and Investigated the Ising Model using Monte-Carlo optimisation algorithms.

Simulation of the domestic and international spreading of COVID-19 *Mar.–Jun.2020*

Independent research on Models building.

- Simulated the spreading by modelling individuals as repulsive particles.
- Investigated how the spreading rate varies with the strictness of quarantining, travel restriction and social distancing
- Determined how the rate of spreading varies with the vaccination rate.

Connect Four AI *Jun.–Aug.2018*

Independent research on Machine Learning.

- A Connect4 agent based on Monte Carlo Tree Search (MCTS).

Work Experience

University Surf Society *Trip Secretary* *Jun.2022–Present*

- Planned and organised two 50-people surf trips to Morocco and the Canary Islands with budgets of over $20k

Physics Olympiad Tutor *Tutoring* *Jun.2022–Present*

- Tutoring for the preparation of IPhO, BPhO and other advanced physics competition

M2 Digital Asset Management *Summer Intern* *Jun.–Jul.2021*

Project: Research and Development of Bitcoin Pricing Models.

- Estimated the average mining cost per coin from historical mining difficulty and ASIC chip efficiency data.
- Developed codes to estimate the probability distribution of future BTC prices by using current option prices.

Programming/Computers

Python (Numpy, Pandas, PyTorch), C++, LaTeX, Linux

Hobbies

Poker, Surfing, Skateboarding, Speed Cubing, DJing(House)