Zhonglin Liu

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Liu-Zhonglin (Joe)

Education

- **The University of Hong Kong** *Sept 2022 - Aug 2026 (Expected)*
  Bachelor of Science, major in Mathematics and Economics Hong Kong SAR, China
  - Young Scientist Scheme (YSS): An elite program offering early research training, mentorship, and international research opportunities for outstanding science students.
  - Cumulative GPA: 3.88 / 4.3

- **National University of Singapore** *Jan 2025 - May 2025*
  HKU Worldwide Undergraduate Student Exchange Programme Singapore
  - Semester GPA: 4.9 / 5.0

Research Interests

- Modelling of Complex Systems, Stochastic Models, Decision Making under Uncertainty, Applied Artificial Intelligence, Computational Biology.

Research Experience

- **Analysis, Approximation, and Control of Probabilistic Boolean Networks (Ongoing)** *2025 - Present*
  Supervisor: Prof. Ching Wai Ki (HKU)
  Systematically studied the analysis and control of PBNs for genetic systems, implementing matrix-based methods for both exact and approximate steady-state computation to ensure scalability. Formulated a finite-horizon optimal control problem with hard constraints to model realistic therapeutic interventions.

- **Information Acquisition and Design (Ongoing)** *2025 - Present*
  Supervisors: Dr. Hong Ming Tan & Prof. Jussi Keppo (NUS)
  Developed a two-period model to optimize a pharmaceutical firm's clinical trial data collection for regulatory approval. Additionally, contributed to designing an incentive mechanism for a Large Language Model (LLM) platform to acquire high-quality user information.

- **A PBN-RL-XAI Framework for Therapeutic Discovery in Melanoma** *2025*
  Independent Research
  Developed an integrated PBN-RL-XAI framework to discover therapeutic strategies for immunotherapy-resistant melanoma, identifying a novel 'hit-and-run' inhibition therapy. [🌐]

- **Inferring Progressive Disconnection in Alzheimer's Disease with PBNs** *2025*
  Supervisor: Prof. Zhang Louxin (NUS)
  Developed a novel Probabilistic Boolean Network (PBN) framework to model effective connectivity in fMRI data, identifying a progressive disconnection of DMN-to-MTL pathways in Alzheimer's disease. [🌐]

- **A Comparative Study of Algorithms for the Travelling Salesman Problem** *2024 - 2025*
  Supervisor: Prof. Zang Wenan (HKU)
  Compared classical heuristics against hybrid reinforcement learning models for the Euclidean TSP, demonstrating that an Actor-Critic agent integrated with classical methods achieves competitive performance. [GitHub]

- **Machine Learning Methods in Prediction of Online Portfolio Selection Problems** *2023 - 2024*
  Supervisor: Prof. Ching Wai Ki (HKU)
  This project investigated the integration of machine learning models, specifically LSTM and XGBoost, to predict asset prices for Online Portfolio Selection strategies. [🌐]

Publications and Manuscripts

[1] Liu, Z. (2025). **A PBN-RL-XAI Framework for Discovering a "Hit-and-Run" Therapeutic Strategy in Melanoma**. arXiv preprint arXiv:2507.10136. Under review at the IEEE International Conference on Bioinformatics and Biomedicine (BIBM).

[2] Liu, Z., & Zhang, L. (2025). **Inferring Progressive Disconnection in Alzheimer's Disease with Probabilistic Boolean Networks**. *bioRxiv*. https://doi.org/10.1101/2025.07.10.664143. Accepted for poster presentation at the Asia Pacific Bioinformatics Conference (APBC) 2025.

[3] Liu, Z., Zhao, Y., Lyu, B., & Ching, W.-K. (2025). **Integrating Machine Learning Methods for the Prediction in Online Portfolio Selection Problems**. In *Proceedings of the International Conference on Applied Research in Business, Management and Economics, Vol. 2*, pp. 17-28. Diamond Scientific Publishing. DOI: 10.33422/bmeconf.v2i1.1015.

[4] Liu, Z. (2024). **A Comparative Study of Classical and Reinforcement Learning Algorithms for the Travelling Salesman Problem**. Unpublished capstone project report.

Work/Project Experience

- **Enhancing Mathematical Understanding via Manim [🌐] [GitHub]** *2022 - Present*
  Team Leader & Main Producer Hong Kong
  - Utilized Manim to create animated educational videos illustrating mathematical concepts. In charge of managing workflows and distributing tasks.
  - Served as the main producer for videos that were broadcast across the HKU campus via U-Vision, enhancing mathematical understanding for the university community. Example of my work: Maths in a minute – 2025 - A very mathematical year.

- **Bank of China** *August 2024*
  Credit Analyst Intern China
  - Analyzed industry credit reports and prepared detailed financial summaries to support client credit evaluations.

- **Department of Mathematics, The University of Hong Kong** *Oct 2023 - Dec 2023; Feb 2024 - May 2024*
  Student Teaching Assistant Hong Kong
  - Assisted in teaching fundamental concepts of mathematics and multivariable calculus, conducting revision classes to improve student performance.
  - Developed video tutorials using Manim to visually simplify and explain complex mathematical concepts.

- **Essence Brilliant Limited** *August 2023*
  Education Content Developer Hong Kong
  - Created dynamic educational videos using Python and Manim to explain complex topics.
  - Managed team task distribution and facilitated communication between internal and external stakeholders.

Honors and Awards

- **Undergraduate Research Fellowship Programme with Research Internship Awards** *2025 - 2026*
  The University of Hong Kong [🌐]
- **Wong Yung Chow Prize in Mathematics** *2024 - 2025*
  The University of Hong Kong [🌐]
  - Awarded to the best 3rd year student in Mathematics, on the recommendation of the Head of Mathematics.
- **Hong Kong Chiu Chow Chamber of Commerce Rayson Huang Memorial Student Enrichment Award** *2024 - 2025*
  The University of Hong Kong [🌐]
- **HKU Recognition Award for Distinguished Service to the Community** *2024 - 2025*
  The University of Hong Kong [🌐]
  - Awarded for the "Enhancing Mathematical Understanding: A Students as Partners (SAP) Project in Animation and Engagement" group project, which enhanced mathematical understanding through animated videos made using Manim.
- **C.V. Starr Scholarships** *2024 - 2025*
  The University of Hong Kong [🌐]
- **Summer Research Fellowship** *2023 - 2024*
  The University of Hong Kong [🌐]
- **Dean's Honours List** *2022 - 2023, 2023 - 2024, 2024 - 2025*
  The University of Hong Kong

Extracurricular

- **Lead for Life Character Leadership Programme (Team Courage)** *2022 - 2025*
  The University of Hong Kong [🌐]
  - A multi-year programme focused on character leadership, mentorship, and service-learning. Participated in workshops on resilience and mindset, and completed a service project with the Mission for Migrant Workers.
- **Volunteer** *2023 - Present*
  Mission for Migrant Workers (MFMW) [🌐]
  - Organized and supported community events, including charity raffles and the provision of free health services for migrant workers.

Additional Information

Languages: Native Mandarin; Fluent English (TOEFL: 112/120)
Hobbies: Teaching, Photography