**Zhaolu Liu**

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## EDUCATION

2022-2026 **Imperial College London, London**

PhD in Mathematics, Supervised by Professor Mauricio Barahona

Thesis title: *Characterising Higher-Order Interactions: A Lattice-Theoretic Approach.*

2020-2021 **Imperial College London, London**

MRes Biomedical Research (data science stream), Achieved Distinction

2016-2020 **Imperial College London, London**

MSci Mathematics, Achieved First Class

## EXPERIENCE

2026-2028 **Chapman-Schmidt Fellow**, **Imperial College London**
Developing scalable foundation models for reconstructing the higher-order systems in neural population

2026-2027 **DAAD AInet Fellow**, **Technical University of Munich**
Investigating the higher-Order behaviours in LLM generalisation

2026-2026 **Research Associate**, **Fleming Initiative & GSK**
Multiview Molecular Representation Learning for Antimicrobial resistance drug discovery

2026-2026 **Visiting Student**, **Technical University of Munich**
Investigated the structure of LLMs trained by growing and looping frameworks using graphs and hypergraphs

2025-2026 **Student Researcher** in AI for Mathematics, **Google DeepMind**
LLM evaluations for mathematical reasoning for Gemini 3 Deep Think and ChatGPT 5.2 Pro

## AWARDS

DAAD AInet Fellowship (2026), €18300, Technical University Munich

Doris Chen PhD Merit Award for outstanding Maths PhD students (2025), £500, winner, Imperial College London

TakeAIM Competition for early-career mathematicians (2025), £500, runner-up, Smith Institute

AInet Fellowship in Explainable AI (2025), fellow, German Academic Exchange Service (DAAD) AI Network

Global Fellows Fund (2025), Imperial College London

"Smartest AI Agent", Fetch.ai Innovation Lab Hackathon (2024), £250, runner-up, London

SIAM AN24 student travel awards (2024), $800, Society for Industrial and Applied Mathematics

Cecilia Tanner Research Funding (2023), £1500, Imperial College London

## PUBLICATIONS

S Chiang, **Z Liu**, RL Peach, M Barahona (2026). *Information-Theoretic Signatures of Causality in Bayesian networks and hypergraphs.* Conference on Causal Learning and Reasoning 5 (CLeaR 2026)

**Z Liu**, RL Peach, M Barahona (2025). *Permutation-Free High-Order Interaction Tests*. Forty-Second International Conference on Machine Learning (ICML 2025).

V Coroian, **Z Liu**, A Sreevathsa, A Liardi, F Rosas, M Barahona, PAM Mediano, *Scaling Up Operational Synergy Estimators to Continuous Distributions* (Under review).

Y Xiang*, **Z Liu***, ME Garcia-Segura, D Simon, B Cao, V Wu, K Robinson, Y Wang, R Battle, RT Murray, X Altafaj, L Peruzzotti-Jametti, Z Takats (2025). *Hyperspectral Image Restoration and Super-resolution with Physics-Aware Deep Learning for Biomedical Applications*. arXiv:2503.02908.

**Z Liu**, RL Peach, M Barahona (2025). *Information-Theoretic Measures on Lattices for High-Order Interactions*. International Conference on Artificial Intelligence and Statistics 28 (AISTATS 2025).

**Z Liu**, JM Clarke, B Rohenkohl, M Barahona (2025). *Patterns of Co-Occurrent Skill in UK Job Adverts*. PLOS Complex Systems 2, e0000028.

Y Yan, MT Judge, T Athersuch, Y Xiang, **Z Liu**, B Jimenez, TMD Ebbels (2024). *Resolution Enhancement of Metabolomic J-Res NMR Spectra Using Deep Learning*. Analytical Chemistry 96, 11707

**Z Liu**, RL Peach, PAM Mediano, M Barahona (2023). *Interaction Measures, Partition Lattices and Kernel Tests for High-Order Interactions*. Advances in Neural Information Processing Systems 36 (NeurIPS 2023).

**Z Liu**, RL Peach, F Laumann, SV Mengod, M Barahona (2023). *Kernel-based Joint Independence tests for Multivariate Stationary and Nonstationary Time-Series*. Royal Society Open Science 10, 230857.

**Z Liu**, RL Peach, EL Lawrance, A Noble, MA Ungless, M Barahona (2021). *Listening to Mental Health Crisis Needs at Scale: Using Natural Language Processing to Understand and Evaluate a Mental Health Crisis Text Messaging Service*. Frontier in Digital Health 3, 779091.

## CONFERENCES

Erlangen AI Hub conference 2026, Oxford (Poster)

NetSci 2026: CausNetS: Toward a Causal Network Science satellite, Boston (Talk)

CCS 2025: Conference on Complexity Systems, Siena (Talk)

OHBM 2025: The Organization for Human Brain Mapping Annual Meeting, Brisbane (Talk)

ICSDS 2024: IMS International Conference on Statistics and Data Science, Nice (Talk)

CCS 2024: Conference on Complexity Systems, FinEcoNets satellite, Exeter (Talk)

NetSci 2024, FinEcoNets satellite, Quebec City (Talk)

AN24: 2024 SIAM Annual Meeting, Spokane (Poster)

Faculty of Natural Science Postdocs and Fellows Research Showcase 2023, Imperial, London (Talk)

ICIAM 2023: International Congress on Industrial and Applied Mathematics, Higher-order networks for complex systems minisymposium, Tokyo (Talk)

NetSci 2023, TopoNets: Between higher-order mechanisms and phenomena, Vienna (Talk)

HealTAC 2021: Heathcare Text Analytics Conference, online (Poster)

## TEACHING

Business Analytics for MBA in 2025, 2026 Imperial Business School

Network Analytics in 2022, 2023, 2024, 2025, 2026 Imperial Business School

Analysis in Business in 2023, 2024, 2025, 2026 Imperial Business School

Workforce Analytics in 2022, 2023, Imperial Business School

Methods for Data Science in 2022, department of Mathematics, Imperial College London

## SKILLS

Language: English (Fluent), Chinese (Native)

Coding: Python (Advanced), MATLAB (Advanced)