Jujian Zhang

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Professional Experience

Harmonic AI Palo Alto, US

Expert in formal method (AI/LLM application in mathematics) May/2025 - Present

- Natural language processing — from natural language to formal language then verification of problems of the International Olympia level difficulty
- High-quality data generation for improving abilities of AI in logic and mathematical reasoning — 100% accuracy rate in resampled validation set
- AIMO competition

Project Numina Beijing, China

Researcher - formal method (AI/LLM application in mathematics) May/2024 - Apr/2025

- Application of formal methods in combinatorics
- Specialized dataset for benchmarking AI performance at combinatorics

Education

Imperial College London

PhD, Mathematics Oct/2021 - Oct/2025

- Research focus: formal method in algebraic geometry
- Teaching activities: foundations of mathematics, mathematical analysis, linear algebra, formal method

London School of Number Theory and Geometry (LSGNT)

Study areas: advanced topics in number theory and geometry 2021 - 2022

University College London

MA with Distinction, Philosophy 2020 - 2021

- Research focus: homotopy type theory and interpretation of identity
- Study areas: logic, philosophy of mathematics, relativity etc.

Imperial College London

MSc with Distinction, Mathematics 2019 - 2020

- Research focus: transcendental number theory
- Study areas: partial differential equation, modular form, elliptic curve, algebraic geometry, homological algebra etc.

University of Bristol

BSc first class with Honours, Mathematics 2016 - 2019

- Study areas: statistics, mathematical analysis, ordinary differential equation, linear algebra, analytical number theory, commutative algebra etc.

Technical Skills

- Programming languages: Python (with machine learning modules numpy, pandas, scikit-learn); C/C++; Lean; Rust
- Database: Postgresql, SQLite
- Web: HTML/JS/CSS, Python+Flask
- Office Skills: Word/Excel/PowerPoint, LaTeX, i2
- Miscellaneous: full UK driving license

Funding and Prizes

Schrödinger-Roth Scholarship - £78,000 — Imperial College London
Fully-funded studentship for PhD study with London-weighted stipend — 2021-2025

AIM Workshop - $2500 — American Institute of Mathematics
Advancing formal method in algebraic geometry — sheaf cohomology — Jun/2024

Best Performing Student - £100 — University of Bristol
2016-2019

Publication and Conferences

Graded Rings in Lean's Dependent Type Theory
Intelligent Computer Mathematics (CICM 2022) — Springer
- A general framework of working with graded objects in Lean

Formalising the Proj Construction in Lean
14th International Conference on Interactive Theorem Proving (ITP 2023) — LIPIcs
- Formally verifying the foundational Proj construction in algebraic geometry
- The world's first formally verified non-affine scheme

Formalisation of the Category of Hopf Algebras in Lean4
Mathematical Software (ICMS 2024) — Springer
- Construction of the monoidal category of Hopf algebras and its relation with the category of group schemes
- A useful object used in the celebrated Fermat last theorem

CombiBench: Benchmarking LLM Capability for Combinatorial Mathematics
arXiv:2505.03171 — Preprint
- A specialised dataset for benchmarking LLM in reasoning about combinatorics

A Formal Proof of the Irrationality of $\zeta(3)$ in Lean 4
arXiv:2503.07625 — Preprint
- Irrationality of $\zeta(3)$ and prime number theorem

Flat modules
London Learning Lean — Imperial College London
- Equivalence of different definitions of flat modules

Proj Construction
London Learning Lean — Imperial College London
- Grothendieck's Proj Construction

Formalising Brauer Group and Group Cohomology in Lean4
Formalisation of mathematics with interactive theorem provers — Cambridge University
- The correspondence between the relative Brauer Group and group cohomology for finite dimensional Galois field extensions

Formalising the Multigraded Proj Construction in Lean4
Formalisation of mathematics with interactive theorem provers — Cambridge University
- Generalisation of Grothendieck's construction of Proj scheme

Language

- Chinese - Native
- English - Professional proficiency
- French - Professional reading

Interests

- Strategic games: Go and Chess
- Physical activities: Pilates, hiking and workout
- Literature: light reading of philosophy in logic or recreational mathematics