RUNZE YU

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EDUCATION

Harvard University Cambridge, MA
Ph.D. in Mathematics *Advisor*: Professor Peter Kronheimer September 2023 - May 2028 (expected)
Research Focus: Low-dimensional topology, geometric analysis, and PDE

University of California, Los Angeles (UCLA) Los Angeles, CA
B.S. in Mathematics, Minor in Linguistics *GPA*: 4.0/4.0, *Summa Cum Laude* September 2019 - June 2023
Courses: Differential Geometry, Graduate Algebra and Analysis Series, Numerical Analysis, Machine Learning, C++ I and II, Computer Organizations, Computational Linguistics I and II

HONORS AND PUBLICATIONS

- **Runze Yu**. "Linearity of Generalized Cactus Groups." In: *Journal of Algebra* 635 (Dec. 2023).
- UCLA Department of Mathematics Daus Prize (top 3 undergraduates) June 2023
- Putnam Competition: 3-time Honorable Mentions; UCLA Putnam Team member. Dec 2022

PROJECTS

Current Research: Family Seiberg-Witten Theory Sept 2023 - Present
- Investigated examples of exotic diffeomorphisms via Seiberg-Witten theory, applying advanced tools from differential geometry, algebraic topology, and PDE.
- Prepared seminar talks on family Seiberg-Witten theory, communicating complex proofs to diverse audiences.

Fine-Tuning Diffusion Models by Reinforcement Learning Sept 2025 - Dec 2025
Class project for MIT 6.7920 Reinforcement Learning
- Improved and implemented GRPO algorithm to fine-tune masked diffusion models using downstream user preferences and custom reward signals.
- Benchmarked reinforcement learning algorithms (GRPO, PPO, TRPO) with respect to stability and performance.
- Presented technical results and methodological comparisons to course instructors and peers.

Weighted Context-Free Grammars Sept 2022 - Dec 2022
Supervisor: Professor Tim Hunter, UCLA Department of Linguistics
- Modeled WCFG using probabilistic tools including Galton-Watson processes and generating functions.
- Implemented matrix-based expectation-maximization algorithms in Haskell and Python for parameter estimation.

Generalized Cactus Groups Jan 2021 - Sept 2021
Supervisor: Professor Raphael Rouquier, UCLA Department of Mathematics
- Defined generalized cactus groups and proved their linearity, resulting in paper "Linearity of Generalized Cactus Groups" in *Journal of Algebra*.

EXPERIENCE

Teaching Fellow: Math 21a Multi-variable Calculus, Math 21b Linear Algebra Sept 2024 - May 2026
Department of Mathematics, Harvard University
- Delivered thrice-weekly lectures, held office hours, and designed and graded examinations.

Organizer: Trivial Notions Seminar Sept 2024 - June 2025
Department of Mathematics, Harvard University
- Organized a graduate seminar series, coordinating speakers, scheduling, and departmental logistics.

Direct Reading Program Mentor Sept 2023 - June 2025
Department of Mathematics, Harvard University
- Designed and supervised self-directed learning sequences with undergraduate students. Supported students to draft, revise, and present final capstone-style papers or talks.

High School and Olympiad Math Instructor Sept 2021 - June 2023
UCLA Olga Radko Endowed Math Circle *Supervisor*: Professor Oleg Gleizer, UCLA
- Led weekly classes and developed original worksheets and problem sets to reinforce core concepts.
- Organized end-of-term inter-class competitions, including format design, scheduling, and results reporting.

SKILLS

Programming	Python (`NumPy, Pandas, sklearn, PyTorch`), MATLAB, LaTeX, Git, Haskell
Technical	Machine learning (includes deep learning), reinforcement learning, stochastic processes, optimization
Language	Mandarin Chinese (native), English (bilingual), Japanese (professional working)