RUIZE RICHARD XU

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EDUCATION

The University of Chicago — Chicago, IL
Ph.D. in Computer Science; GPA 4.0/4.0; Advisor: Zhiyuan Li — Expected June 2028
Research at Toyota Technological Institute at Chicago (TTIC)
B.S. in Computer Science, Mathematics, and Economics; GPA 3.72/4.0 — June 2023
Honors: Dean's List; ACM-ICPC Mid-Central USA Gold Medal; Advanced Scholar; Jeff Metcalf Fellowship Grant

PUBLICATIONS AND MANUSCRIPTS

** Equal contribution*

Real-to-Sim-to-Real at the Last Millimeter — CoRL 2026 Late-Breaking Results
Tianchong Jiang*, **Ruize Xu***, Yicheng Li, Xiangshan Tan, Matthew Walter — Project · Paper

Teaching an Agent to Sketch One Part at a Time — ECCV 2026
Xiaodan Du*, **Ruize Xu***, David Yunis*, Yael Vinker, Greg Shakhnarovich — Project · Paper

Towards Training Transformers as a Universal Computer — Findings of EMNLP 2026
Ruize Xu, Chenxiao Yang, Yanhong Li, David McAllester — Project · Paper

Schur Nets: Exploiting Local Structure for Equivariance in Higher Order Graph Neural Networks — NeurIPS 2024
Qingqi Zhang*, **Ruize Xu***, Risi Kondor — Paper

Leanify: Verified Proof Compression and Reusable Lemma Discovery — In submission
Ruize Xu, Anxin Guo*, Yi Gu*, Tianchong Jiang*, Chenxiao Yang, Tianhao Wang, Zhiyuan Li — Project

Restart from Failure: A Drop-In Multi-Turn RL Framework for Sequential Scaling in Formal Theorem Proving — Manuscript
Ruize Xu, Shuangning Li, Tianhao Wang, Zhiyuan Li, David McAllester

RESEARCH EXPERIENCE

Real-to-Sim-to-Real Robot Learning, Robot Intelligence through Perception Lab — Jul 2026 - Present
Advisor: Matthew Walter

- Studied drawer and charger insertion with 0.7–2 mm clearances on a roughly $1,000 6-DoF arm; image-based student policies trained in Isaac Sim succeed in 12/20 drawer and 18/20 charger trials on the real robot.
- Used coding agents to write and revise scripted teachers that read simulator state; showed scripted teachers overfit the simulator less than RL teachers, and students sense contact from commanded vs. measured joint positions without force sensors.

Leanify: Mathematical Discovery through Proof Compression — Apr 2026 - Present
Advisor: Zhiyuan Li

- Developed an unsupervised approach to automated mathematical discovery with LLMs, using formal proof compression as an objective for discovering reusable abstractions.
- Abstracted over 1,000 helper lemmas used in the formal proof of Fermat's Last Theorem, reducing its proof length.

Vision-Language Model Reinforcement Learning — Oct 2025 - Present
Research collaborators: Greg Shakhnarovich, Yael Vinker

- Exploited the verification–generation gap: used LLM self-critique to bootstrap semantic part annotations for sketches through iterative proposal, critique, and refinement.
- Trained a multi-turn sketching agent with visual-feedback reinforcement learning to generate editable vector sketches one semantic part at a time.

RESEARCH EXPERIENCE (CONTINUED)

Verifiable LLM Reasoning and Lean Theorem Proving Jan 2024 - Present
Advisors: Zhiyuan Li, David McAllester

- Developed a multi-turn Lean theorem-proving environment combining chain-of-thought reasoning with formal feedback, improving on simpler proof-generation environments.
- Enabled provers to learn from failed attempts and continue on unresolved subgoals; implemented distributed execution and GRPO training in VeRL/Ray.

Transformer Code Execution and Generalization Jan 2024 - Present
Research collaborator: David McAllester

- Designed MicroPy, a computationally universal language, to study whether transformers can learn general execution rules and compose them on unseen programs.
- Trained a 59.5M-parameter transformer on randomly generated programs with PENCIL scaffolding; demonstrated generalization to human-written programs, including a SAT solver.

Higher Order Graph Neural Networks Sep 2023 - Present
Research collaborator: Risi Kondor

- Co-developed Schur Nets: designed graph representations and message-passing operations that capture local subgraph structure while respecting its symmetries.
- Constructed equivariant operations from the graph Laplacian without explicitly computing subgraph automorphism groups, improving molecular prediction on ZINC and MolHIV.

Systems and Machine Learning Group Jan 2022 - Jun 2023
Advisor: Yanjing Li

- Analyzed memory and cache bottlenecks for binary neural network inference on RISC-V with gem5 and proposed memory-optimized architectures.

INDUSTRY EXPERIENCE

Apodex, AI Research Scientist Intern Seattle, WA — Oct 2026 - Present

- Mid-training and post-training frontier LLMs for agentic coding.
- Curated Lean formal-mathematics and scientific-computing datasets to strengthen coding agents on long-horizon scientific tasks, evaluated on agentic benchmarks such as Terminal-Bench Science.

Google, Software Engineer Mountain View, CA — Jun 2024 - Sep 2024

- Built and optimized a Gmail Ads auction eligibility filter; incorporated reserve-price optimization and LLM-guided search ideas from Google DeepMind's FunSearch to improve experimental revenue by 3%.
- Designed SQL analyses and production experiments to identify auction bottlenecks and guide roll-out decisions.

Google, Software Engineer Sunnyvale, CA — Jun 2023 - Sep 2023

- Implemented a vectorized order-preserving lookup join in the F1 query kernel, reducing GoogleSQL execution cost from sort and sharding operations.
- Expanded query-kernel tests and benchmarks for join algorithms on ordered inputs.

iDeepWise, Software Engineer Beijing — May 2022 - Sep 2022

- Deployed LSTM- and BERT-based Mandarin classifiers for SMP2019 with above 90% F1 in a production pipeline.

SKILLS

Research	LLM reasoning, theorem proving, formal library compression, RLVR/GRPO, program synthesis, graph learning
Systems	Lean4, Mathlib, Lean REPL/server, VeRL, Ray, vLLM, SGLang, Docker, Slurm, Linux
ML	PyTorch, PyTorch Geometric, Deep Graph Library, Tinker, OpenAI APIs, NumPy, Pandas
Programming	Python, Lean, C++, C, Rust, Haskell, Standard ML, SQL, MATLAB, R, LaTeX
Languages	Chinese, English