

Rui Zhao

Computer Science · Artificial Intelligence

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Personal Statement

I am a passionate and self-driven Computer Science undergraduate student specializing in AI. With research experience and learning ability far beyond my peers, I have a strong foundation in mathematics, artificial neural networks, reinforcement learning, large models and agent. While devoting myself to research, I also actively participate in projects and competitions in our school, which have honed my practical skills of coding and tool-using as well as cooperation abilities. I am interested in history, philosophy, literature and music so that I can think about the problems in the world from multiple perspectives and get inspiration from them.

In a word, I am eager to learn and explore the unknown, and I am looking forward to utilizing multi-modal perception to enhance AI's understanding of the world.

Currently, I am working under the guidance of Prof. Alex Lamb, exploring world models and dynamics understanding. I also have experience working with Postdoc Songjie Niu on knowledge graph construction and with Prof. Hongning Wang on AI teaching assistant and reinforcement learning for cognitive reasoning.

Research Interests

Reinforcement Learning, World Model and VLA, Computer Vision, Generative Models.

Education

2023 – **B.Eng. Department of Computer Science and Technology, Tsinghua University, Beijing, China**

Academic Performance

GPA: 3.9/4.0, **Rank:** 9/172

Research Projects

Action-space Model-based Reinforcement Learning for VLA

- Used a bidirectional per-token encoder to replace exploration through the denoising process by traditional gaussian action disturbance, ensuring fine-grained control over the action space
- 2026 – now ○ Designed a new algorithm for likelihood-based reinforcement learning to remove the bias introduced by the disturbance
- Implemented isolated post-training on pi0-like VLA and applied foundation world model to improve the efficiency

Compressing Generative World Models via Reinforcement Learning

- Tried to remove the noises and reserve task-relevant or reward-relevant information in world model by making the output more compressed
- Designed a composite reward signal including jpeg compressibility, action prediction consistency (via a custom resnet inverse action model), and value preservation to guide a diffusion world model finetuning process
- Focused on efficient and stable RL post-training on world model to improve long-horizon accuracy and downstream policy performance

RL for Reasoning

- Used the concepts in human cognitive psychology to design the reased process
- Constrcuted the cognitive graph / tree to represent the reasoning process and finding the better trajectory
- 2025 ○ Used groups of samples with relative scores generated by DeepSeek R1 to train a smaller reward model
- Finetuned Qwen by RL to enhance general cognitive reasoning ability, not only on special tasks or datasets, and achieving better performance

Automated Construction of Knowledge Graph in Knowledge-intensive Domain

- Proposed an expandable framework of KG construction Tree-KG, including initial construction and iterative expansion
- 2024 – 2025 ○ Achieved sota performance compared with existing methods such as GraphRAG, especially when using textbooks
- Paper accepted at ACL 2025 main conference, Patent pending

Industrial Experience

2024 – 2025 **AI Teaching Assistant (Developer of AI Cosmos)**, *Tsinghua University*, Beijing, China

Developed the core Meta Agent for the university's AI education system

- **Meta Agent Architecture:** Based on **OpenManus**, designed a high-level agent capable of formulating reusable, generalizable workflows for diverse teaching tasks (e.g., grading, course design) from single instructions
- **Automated Tool & Workflow Construction:** Implemented a "Tool Maker" to synthesize Python scripts as new tools, and a "Workflow Maker" to organize operations into executable graphs, enabling the system to self-expand its capabilities

Also worked on knowledge extraction: Extracting knowledge from textbooks and other materials to build a knowledge graph for the course

Now AI Cosmos has been used in the university's daily academical activities, including course learning and research assistance.

Honors and Scholarships

Program	Tsinghua University Undergraduate Academic Research Promotion Program Level A, 2025
Scholarship	ShuPing Scholarship, 91-92, 93-94, 95-96
Scholarship	Academic Excellence Scholarship, 2024
Scholarship	Comprehensive Performance Scholarship, 2025
Competition	3rd Place, Red Mountain Open-Source Large Model Innovation Competition, 2024
Competition	Second Prize, The 43th Tsinghua University "Challenge Cup" (Information Technology Track), 2025
Competition	10th Place, "Rollman" - The 29th Intelligent Agent Competition (Ghost Track), 2025
Honor	Best Popularity Award, Student Innovation and Research Annual Conference, 2024

Skills

Languages Python, C, C++, Rust, Typescript, Javascript, SystemVerilog
Frameworks PyTorch, HuggingFace, Weight & Biases, OpenCV
Tools Git, Docker, Linux, LaTeX, VSCode

Publications

- [1] Songjie, N., et al. *Tree-KG: An Expandable KG Construction Framework for Knowledge-intensive Domains*. ACL 2025 main conference.

Languages

Chinese Native
English Fluent (CET-6: 611; TOEFL: 112, Reading 30, Listening 30, Speaking 24, Writing 28)