RUIWEN ZHOU

zhouruiwen@u.nus.edu ◇ https://skyriver-2000.github.io

EDUCATION

Ph.D. student in Computer Science, National University of Singapore — Aug 2025 – Present

M.Eng. in Computer Science, Shanghai Jiao Tong University — Sep 2022 – Mar 2025

B.Eng. in Information Engineering, Shanghai Jiao Tong University — Sep 2018 – Jun 2022

RESEARCH INTERESTS

Core Areas: Large Language Models (LLMs), AI Agents, Reinforcement Learning (RL).

Research Focus:

- AI agents (for coding, research, etc.) and multi-agent systems.
- Reinforcement learning and retrieval augmentation for (agentic) LLMs.
- LLM reasoning within complex context and social environments.

SKILLS

- **Languages:** Python, C++, LaTeX.
- **Frameworks:** PyTorch, Transformers, vLLM, VeRL, TRL.

EXPERIENCE

Ph.D. Student, Supervised by: Prof. Min-Yen Kan & Prof. Soujanya Poria — Aug 2025 – Present
WING Lab (National University of Singapore) — *Singapore*

- **Research Focus:** LLM-based Agents, Multi-Agent Systems, RL for LLM Reasoning.
- **Project: Trust Estimation and Utilization in LLM-Based Multi-Agent Systems**
  - Investigated LLMs' sycophancy and inadequate ability to evaluate peer reliability in multi-agent systems, and formulated the learning problem of *history-aware reference* as an alternative solution, which introduces the historical interactions of peers as additional input and shifts the task from evaluating peer reasoning quality to estimating peer reliability based on interaction history.
  - Developed *Epistemic Context Learning* (ECL), a reasoning framework that conditions predictions on explicitly-built peer profiles from history, and further proposed to optimize ECL by RL using auxiliary rewards.
  - Conducted extensive experiments to show that ECL enables Qwen 3-4B to outperform a history-agnostic baseline 8x its size (Qwen 3-30B) and boosts frontier models to near-perfect (100%) performance, and did additional analysis that provides insights on how historical trust is learned and utilized.
  - **Under Review at ICML 2026.**
- **Project: Measuring and Mitigating Rapport Bias in Multi-Agent Interactions**
  - Investigated the vulnerability of LLMs to social rapport bias and peer pressure, which often compromises factual accuracy in group settings.
  - Contributed to construction of KAIROS benchmark and evaluated GRPO with outcome rewards as a mitigation strategy, validating that RL-tuned LLMs can improve over base models in resisting social conformity.
  - **Accepted at ICLR 2026.**
- **Project: Co-Evolving of LLM-Based Collaborative Agents**
  - Developing a test-time RL framework where multiple agents are co-optimized towards better collaborative performances on coding tasks like SWE-Bench and MLE-Bench.

Visiting Student, Supervised by: Prof. William Yang Wang Jul 2024 – Dec 2024
NLP Group (UC Santa Barbara) *Santa Barbara, U.S.*

- **Research Focus:** LLM Reasoning, LLM Evaluation
- **Project: LLM Reasoning under Natural Language Rule Guidance**
  - Addressed the limitation of existing benchmarks that focus on simple first-order logic, failing to evaluate LLMs' adherence to complex, real-world constraints (e.g., tax/legal rules).
  - Led the creation of RuleArena, a benchmark requiring long-context understanding and multi-hop reasoning based on real-world applications (airlines, NBA, and tax). Developed rigorous evaluation metrics to decouple rule retrieval errors from rule reasoning errors.
  - Conducted comprehensive evaluation of mainstream LLMs (GPT-4o, Claude-3.5, etc.), revealing critical gaps in handling high-order logic constraints compared to first-order logic tasks.
  - **Published at ACL 2025 Main Conference.**
- **Project: Contamination-Free LLM Evaluation**
  - Mitigated the critical "Data Contamination" issue where static benchmarks leak into training data, rendering evaluations unreliable.
  - Co-developed a fully automated pipeline that constructs evaluation samples using dynamic, time-sensitive knowledge (from Wikidata/Wikipedia updates post-training cutoff).
  - **Published at ACL 2025 Main Conference — Selected as SAC Highlight.**

Student Researcher, Supervised by: Prof. Weinan Zhang Jan 2021 – Mar 2025
APEX Lab (Shanghai Jiao Tong University) *Shanghai, China*

- **Project: Retrieval-Augmented LLM Agents**
  - Addressed the issue of "plausible but wrong" and noisy in-context example in trajectory-level retrieval for long-horizon agentic tasks.
  - Developed TRAD, a novel agent framework combining Step-wise Thought Retrieval (using CoT as search queries and keys) and Aligned Decision (for concentrating on key trajectory segments) mechanisms.
  - Achieved SOTA performances on ALFWorld and Mind2Web. Successfully deployed in enterprise RPA scenarios at China Pacific Insurance Company (CPIC), improving task success rate from 65.0% to 92.5%.
  - **Published at SIGIR 2024.**
- **Project: Risk-Sensitive Distributional RL**
  - Identified a fundamental "biased optimization" flaw in existing Risk-Sensitive RL (RSRL) where standard Bellman operators fail to converge for general distortion risk measures.
  - Proposed Trajectory Q-Learning (TQL), a theoretically rigorous algorithm modeling history-dependent return distributions to guarantee convergence to the optimal risk-sensitive policy, the first general solution for optimizing diverse risk measures (e.g., CVaR) with provable optimality.
  - **Work done during internship at MSRA — Published at DAI 2025.**
- **Project: Retrieval-Augmented Graph Representation Learning**
  - Tackled the limitation of independent instance modeling in tabular data prediction tasks.
  - Co-designed a Hypergraph Neural Network utilizing retrieval-based neighborhood propagation to explicitly model high-order cross-row feature and label interactions.
  - Achieved SOTA results on CTR prediction and Top-N recommendation benchmarks.
  - **Work done during internship at AWS — Published at NeurIPS 2022.**

PUBLICATIONS

[1] **Ruiwen Zhou**, Maojia Song, Xiaobao Wu, Sitao Cheng, Xunjian Yin, Yuxi Xie, Zhuoqun Hao, Wenyue Hua, Liangming Pan, Soujanya Poria, Min-Yen Kan. Epistemic Context Learning: Building Trust the Right Way in LLM-Based Multi-Agent Systems. *arXiv preprint arXiv:2601.21742*.

[2] Shengtao Zhang, Jiaqian Wang, **Ruiwen Zhou**, Junwei Liao, Yuchen Feng, Weinan Zhang, Ying Wen, Zhiyu Li, Feiyu Xiong, Yutao Qi, Bo Tang, Muning Wen. MemRL: Self-Evolving Agents via Runtime Reinforcement Learning on Episodic Memory. *arXiv preprint arXiv:2601.03192*.

[3] Sitao Cheng, Xunjian Yin, **Ruiwen Zhou**, Yuxuan Li, Xinyi Wang, Liangming Pan, William Yang Wang, Victor Zhong. From Atomic to Composite: Reinforcement Learning Enables Generalization in Complementary Reasoning. *arXiv preprint arXiv:2512.01970*.

[4] Maojia Song, Tej D. Pala, **Ruiwen Zhou**, Weisheng Jin, Amir Zadeh, Chuan Li, Dorien Herremans, Soujanya Poria. Measuring and Mitigating Rapport Bias of LLMs under Multi-Agent Social Interactions. *ICLR 2026*.

[5] **Ruiwen Zhou**, Wenyue Hua, Liangming Pan, Sitao Cheng, Xiaobao Wu, En Yu, William Yang Wang. RuleArena: A Benchmark for Rule-Guided Reasoning with LLMs in Real-World Scenarios. *ACL 2025*.

[6] Xiaobao Wu, Liangming Pan, Yuxi Xie, **Ruiwen Zhou**, Shuai Zhao, Yubo Ma, Mingzhe Du, Rui Mao, Anh Tuan Luu, William Yang Wang. AntiLeak-Bench: Preventing Data Contamination by Automatically Constructing Benchmarks with Updated Real-World Knowledge. *ACL 2025 (Oral & SAC Highlight)*.

[7] **Ruiwen Zhou**, Yingxuan Yang, Muning Wen, Ying Wen, Wenhao Wang, Chunling Xi, Guoqiang Xu, Yong Yu, Weinan Zhang. TRAD: Enhancing LLM Agents with Step-Wise Thought Retrieval and Aligned Decision. *SIGIR 2024 (Oral)*.

[8] **Ruiwen Zhou**, Minghuan Liu, Kan Ren, Xufang Luo, Weinan Zhang, Dongsheng Li. Is Risk-Sensitive Reinforcement Learning Properly Resolved? *arXiv preprint arXiv:2307.00547*.

[9] Kounianhua Du, Weinan Zhang, **Ruiwen Zhou**, Yangkun Wang, Xilong Zhao, Jiarui Jin, Quan Gan, Zheng Zhang, David Wipf. Learning Enhanced Representations for Tabular Data via Neighborhood Propagation. *NeurIPS 2022*.

SELECTED AWARDS

- NUS Graduate Research Scholarship 2025
- Huatai Securities Fellowship 2024
- First-Class Excellence Scholarship 2022, 2024
- Zhiyuan Honors Scholarship (Top 5%) 2019, 2020, 2021
- China National Scholarship (Rank 1/144) 2020
- A-Class Excellence Scholarship (Rank 1/144) 2020