RUI SHI

+86-152-1072-3175 | jerrysiri.shi@mail.utoronto.ca

happy-boy-jerry | JerrySiRi | jerrysiri.github.io

Toronto, Ontario, Canada

Education

- **University of Toronto** *Sept, 2025 - June, 2027*

  Master of Science in Applied Science (Computer Science) Toronto, Canada

- **Nanjing Univeristy** *Sept, 2021 - June, 2025*

  Bachelor of Engineering in Artificial Intelligence, Outstanding Graduate Nanjing, China

  - **Grade:** 4.48/5.00%, Overall Ranking: Top 10%
  - **Scholarship:** Gang Zheng Overseas Study Scholarship (2023, Top 5%), The people's scholarship in China, the second prize (2023, Top 10%)
  - **Honors:** 19th "Citi Cup" Financial Innovation Application Competition, second prize, 6th place nationwide (2024); China Undergraduate Mathematical Contest in Modeling, Third Prize (2023); E Fund Asset Management Cup "AI+" Innovation Skills Challenge, Excellence Award (2023)

- **The University of Hong Kong** *Jan, 2024 - June, 2024*

  Exchange Student in Computer Engineering, GPA equivalent to First Class Honours Hong Kong, Hong Kong S.A.R.

  - **Scholarship:** Li and Fung scholarships (2024, Top 5%)

Professional Experience

- **Kuaishou Technology [ ]** *Apr, 2025 - Aug, 2025*

  Large Language Model Algorithm Research Intern Beijing, China

  Leanabell-Prover-V2: Verifier-integrated Reasoning for Formal Theorem Proving

  - Established iterative RL training framwork for Kimina-Prover and DeepSeek-Prover via VeRL, SandFusion and verifier-integrated DAPO & GRPO, designed feedback masking and reward mechanisms (e.g. Abstract Structure Tree, tactic count, etc.) to achieve rising validation performance, improved verifier usage and zero entropy collapse.
  - Implemented vLLM-based evaluation pipeline with Lean proof assistant feedback, outperformed SOTA 7B Provers by 2%-5.3%, boosted MiniF2F by 3.2% (Kimina) and 2.0% (DeepSeek) and solved an additional challenging problem on Proverbench.
  - Explored curriculum-based decomposed subgoal methods for complex formal statements, using Claude-3.7-Sonnet to generate challenging cold-start data despite limited success; investigated Partial Rollout strategies with shared reasoning trajectories for formal proofs to address inefficiencies in generating RL rollout data.

Research Experience

- **Hierarchy RL enhanced Diffusion LLM for Safe Structured Decision** *Feb, 2025 - May, 2025*

  Supervisor: Prof. Jie Fu, Prof. Cunjing Ge Shanghai AI Lab & Nanjing University, China

  - Designed a novel hierarchical generative framework by integrating block-level Masked Diffusion Models with RLVR; modeled state transitions via diffusion timesteps using a Dirac-based multi-step MDP formulation, enabling controllable and structured reasoning generation.
  - Modified the GRPO algorithm to estimate approximate log-probabilities from a single diffusion trajectory, followed by multi-round refinement updates, which significantly improved computational efficiency and reduced KL divergence instability during training.
  - Conducted large-scale distributed LoRA training with Accelerate and DeepSpeed on 7B models (Dream, Qwen) across tasks like medical chain-of-thought and Python code completion; benchmarked generation quality and speed across diffusion steps, showing that MDMs outperform autoregressive models on planning-intensive tasks such as math and programming.

- **Lite-Me-LLaMA: The Resource-Efficient Large Language Models** *Jul, 2024 - Nov, 2024*

  Supervisor: Prof. Hua Xu Yale University, US

  - Led the construction of a public dataset with 602k sample for medical question answering, ensuring well-balanced and impurity-free data across multiple medical categories to optimize the model's performance in diverse scenarios.
  - Developed a continual pre-training pipeline for the LLaMA3-8B model on a 72.47-billion-token biomedical corpus, leveraging DeepSpeed 5 for efficient training. Implemented fine-tuning scripts using the auto-train framework.
  - Developed an vLLM-based inference and multi-tasks evaluation pipeline to extract performance metrics and deliver a fine-tuned Lite-Me-LLaMA.

- **Clinical Trail Matching for Patients Recruitment** *Jul, 2024 – Feb, 2025*

  Supervisor: Prof. Hua Xu, Prof. Bian Jiang Yale University & University of Florida, US

  - Led the design and implementation of a Text-to-SQL pipeline. Defined input/output schemas with Pydantic and converted eligibility criteria into structured traits using LLaMA 3.1 70B. Generated modular PostgreSQL queries with GPT-4o and the LangChain-OMOP framework to automate the extraction of patient eligibility criteria from clinical trial data.

- Deployed an Apache Lucene distributed search engine with Elasticsearch index of OMOP "concept" tables and implemented precise Boolean, kNN, and hybrid searches. Leveraged GPT-4o to generate synonym lists and replace placeholders in SQL queries. Evaluated queries against OMOP's "condition_occurrence" table, achieving an exciting F1 score of 0.85 on annotated criteria. Collected an Uncomputable Phenotype library to flag non-executable rules.
- Created a RAG prototype to retrieve trials by NCTID and applied LLaMA 3.3 70B for splitting and multi-level summarization. Integrated LangChain-Milvus for embedding-based query matching and performed chunk filtering with re-ranking, reaching 0.82 AUC on annotated trial documents. Improved SQL runtime checks to resolve placeholder mismatches and many-to-many mapping issues.

PROJECTS

- **BondSenti: BERT-Based Bond Default Sentiment Analysis** *Aug, 2023 - Jun, 2024*

  Supervisor: Prof. Yizheng Zhao, Prof. Xuebin Chen Nanjing & Sichuan University, China
  - Architected and deployed a real-time decision-support web application using Flask, Vue.js, Redis, and Logstash; integrated frontend and backend pipelines to visualize and stream complex financial data for executive dashboards.
  - Designed an enhanced character-level embedding scheme and implemented a multi-encoder BERT–BiLSTM–CNN–CRF model in PyTorch for named entity recognition; incorporated semantic matching for entity disambiguation, boosting extraction F1 by 20%.
  - Extended the BERT base with GPT-4 knowledge distillation and fine-tuned on a proprietary financial corpus to classify bond-default sentiment into pessimistic, neutral, and optimistic categories; coupled outputs with XGBoost to reduce RMSE in maturity and default predictions by 7%.

PUBLICATIONS

C=CONFERENCE, J=JOURNAL, S=IN SUBMISSION, P=IN PREPARATION

[J.1] Zhiyuan Cao, Vipina K. Keloth, Qianqian, Xie, Lingfei Qian, Yuntian Liu, Yan Wang, **Rui Shi**, Weipeng Zhou, Gui Yang, Jeffrey Zhang, Xueqing Peng, Ethan Zhen, Ruey-Ling Weng, Qingyu Chen, Hua Xu. (2025). **The Development Landscape of Large Language Models for Biomedical Applications**. In *ANNUAL REVIEW OF BIOMEDICAL DATA SCIENCE*, Vol. 8 (2025).

[C.1] Xingguang Ji, Yahui Liu, Qi Wang, Jingyuan Zhang, Yang Yue, **Rui Shi**, Chenxi Sun, Fuzheng Zhang, Guorui Zhou, Kun Gai. (2025). **Leanabell-Prover-V2: Verifier-integrated Reasoning for Formal Theorem Proving via Reinforcement Learning**. In *ArXiv*.

[S.1] Weipeng Zhou, **Rui Shi**, Gui Yang, Anran Li, Hua Xu, Timothy A. Miller. "Impact of Context on Large Language Models for Clinical Named Entity Recognition. (2025). **Impact of Context on Large Language Models for Clinical Named Entity Recognition**. Manuscript submitted for publication in *AMIA Annual Symposium*.

[S.1] Qianqian Xie, Aokun Chen, Cheng Peng, Lingfei Qian, Yan Wang, Xuguang Ai, Jimin Huang, **Rui Shi**, Gui Yang, Dennis Shung, Qingyu Chen, Yonghui Wu, Jiang Bian, and Hua Xu. (2025). **Lite-Me-LLaMA: Resource-Efficient Large Language Models for Medical Applications**. Manuscript submitted for publication in *Journal of the American Medical Informatics Association*.

SKILLS

- **Programming Languages:** C, C++, Python, Java
- **Web Technologies:** HTML5, CSS, JavaScript
- **Database Systems:** MySQL
- **Formal Verification Languages:** Lean 4, Dafny
- **Data Science & Machine Learning:** Scikit-Learn, Numpy, Pandas, Scipy, Matplotlib
- **Deep Learning & Reinforcement Learning:** PyTorch, LangChain, vLLM, DeepSpeed, VeRL, OpenRLHF
- **Development Tools:** Linux, Unix, Git/Github/GitLab, LaTeX, Docker
- **Specialized Area:** Natural Language Processing, Machine Learning, Deep Reinforcement Learning, Neuro-Symbolic Reasoning