RUI SHI

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Hong Kong, Hong Kong SAR

EDUCATION

- **Nanjing Univeristy (NJU)** *Sept, 2021 - June, 2025*
  Bachelor of Engineering in Artificial Intelligence, ***Outstanding Graduate*** Nanjing, China
  - **Grade:** 4.48/5.00 , Overall Ranking: Top 10%
  - **Core Courses:** Data Structures and Algorithms Analysis (94), Operating Systems (100), Distributed and Parallel Processing (96), Advanced Machine Learning (98), Deep Learning Platform and Application (93.4), Knowledge Representation and Processing (100)
- **University of Hong Kong (HKU)** *Jan, 2024 - June, 2024*
  Exchange Student in Computer Engineering, ***GPA equivalent to First Class Honours*** Hong Kong, Hong Kong S.A.R.
  - **Core Courses:** Pattern Recognition and Machine Intelligence (A+), Natural Language Processing (A-)

WORK EXPERIENCE

- **City University of Hong Kong [CityU]** *Oct, 2025 - Now*
  Full-time Research Assistant Hong Kong, Hong Kong S.A.R.
  - Self-evolving Agent with Agentic RL
- **XM Capital Management [XM]** *Oct, 2025 - Now*
  Quantitative Research Intern Shenzhen, China
  - Deep Reinforcement Learning for mining formulaic alpha
  - LLm-based Agent trading system
- **Kuaishou Technology [Kuaishou]** *Apr, 2025 - Sep, 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.

RESEACH INTERESTS

- Self-evolving Agents, Agentic RL, Reinforcement Learning with Verifiable Rewards (RLVR)
- Diffusion LLMs, Neuro-Symbolic Learning and Reasoning

RESEARCH EXPERIENCE

Shanghai AI Lab & LAMDA Group, NJU *Shanghai, China*

- **Hierarchy RL enhanced Diffusion LLM for Safe Structured Decision**
  Research Intern | Supervisor: Prof. Jie Fu, Prof. Cunjing Ge Feb. 2025 - May. 2025
  - 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.

Clinical NLP Lab, Yale University *New Haven, United States*

- **Lite-Me-LLaMA: The Resource-Efficient Large Language Models**
  Research Intern | Supervisor: Prof. Hua Xu Jul. 2024 - Nov. 2024
  - 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 NLP Lab, Yale University *New Haven, United States*

- **Clinical Trail Matching for Patients Recruitment**

Research Intern | Supervisior: Prof. Hua Xu, Jiang Bian Jul. 2024 – Feb. 2025

◦ 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 within LangChain-OMOP framework to automate the extraction of patient eligibility criteria from clinical trial data.

◦ Deployed distributed search engine (Apache Lucene) 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.

◦ 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.

Knwoledge Representation and Reasoning Group (KRistal), NJU *Nanjing, China*

- **BondSenti: BERT-Based Bond Default Sentiment Analysis**

Team Leader | Supervisor: Prof. Yizheng Zhao, Prof. Xuebin Chen Aug, 2023 - Jun, 2024

◦ 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 & Manuscripts

C=Conference, J=Journal, S=In Submission, P=In Preparation

[J.2] 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 [Link]**. In *AMIA ANNUAL SYSPOSIUM, Vol. (2025)*.

[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. **The Development Landscape of Large Language Models for Biomedical Applications [Link]**. In *ANNUAL REVIEW OF BIOMEDICAL DATA SCIENCE*, Vol. 8 (2025).

[S.J.3] Xueqing Peng, Huan He, **Rui Shi**, Vipina K. Keloth, Lingfei Qian, Yan Hu, Jimin Huang, Qianqian Xie, Fares Alahdab, Erin Leahey, Brian Ondov, Qiaozhu Mei, Na Hong, and Hua Xu. **How Researchers Claim Novelty in Biomedical Science: A Taxonomy for Understanding Innovation [Link]**. Manuscript submitted for publication in *SCIENCE ADVANCES (2025)*.

[S.C.1] Xingguang Ji, Yahui Liu, Qi Wang, Jingyuan Zhang, **Rui Shi**, Chenxi Sun, Fuzheng Zhang, Guorui Zhou, Kun Gai. **Leanabell-Prover-V2: Verifier-integrated Reasoning for Formal Theorem Proving via Reinforcement Learning** [ArXiv]. Manuscript Perparing for *International Conference on Machine Learning (ICML), 2026.*

Honors and Awards

- Outstanding Graduate of Class 2025, Top 5% NJU, 2025
- Li and Fung scholarships, Top 5% HKU, 2024
- Gang Zheng Overseas Study Scholarship, Top 5% NJU, 2024
- Second Prize (6th place nationalwide), 19th "Citi Cup" Financial Innovation Application Competition China, 2024
- Third Prize (National Wide), China Undergraduate Mathematical Contest in Modeling China, 2023
- Excellence Award (University Level), E Fund Asset Management Cup "AI+" Innovation Challenge NJU, 2023
- Second prize (University Level), The people's scholarship in China, Top 10% NJU, 2023
- Third prize (University Level), The people's scholarship in China, Top 20% NJU, 2022

Skills

- **Programming Languages:** C, C++, Python, Java, MySQL
- **Web Technologies:** HTML5, CSS, JavaScript
- **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
- **LLM-based Agent:** LangGraph, Autogen, CAMEL, PocketFlow
- **Development Tools:** Linux, Unix, Git/Github/GitLab, LaTeX, Docker
- **Specialized Area:** Natural Language Processing, Machine Learning, Deep Reinforcement Learning