Ruike Zhu

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EDUCATION

Computer Science (Ph.D.) GPA: 3.94 University of Illinois at Urbana–Champaign *Aug. 2022 – Dec. 2027*
Computer Science (M.S.) GPA: 4.0 University of Illinois at Urbana–Champaign *Aug. 2021 – May 2022*
Computer Engineering (B.S.) GPA: 3.7 UIUC & Zhejiang University *Aug. 2017 – May 2021*
Research Focus: Diffusion, Flow Matching Models, LLM, NLP

WORK EXPERIENCE

Machine Learning Research Intern, GeHealthcare *May. 2025 – Aug. 2025*

- Developed a **model-agnostic framework** to predict patient mortality using temporal EHR sequences and historical ICD codes in a highly imbalanced dataset.
- Designed an AI-driven agent to optimize a Retrieval-Augmented Generation (RAG) pipeline with **dynamically retrieving similar patient case** besides knowledge retrieval.
- Applied reinforcement learning to refine query generation, creating a custom reward score based on prediction accuracy.
- Achieved a **34% improvement** in AUROC compared to baseline models, demonstrating the effectiveness of adaptive knowledge retrieval in clinical prediction tasks.

Research Assistant, University of Illinois at Urbana-Champaign *Aug. 2023 – Now*

- Designed a **two-stage text-to-image generation pipeline** that achieves **accelerated inference** while preserving semantic alignment and visual fidelity.
- Using a few-step flow-matching student for fast coarse synthesis, followed by a new text-conditioned flow refinement model to recover detail and fidelity, balancing speed and quality.
- Shortened inference from dozens of diffusion steps to **1–4 coarse steps plus a few refinement steps**, preserving semantic alignment and visual quality as measured by standard T2I metrics.

SKILLS

Programming: **Python**, SQL, MATLAB
Packages: **Pytorch**, **TensorFlow**, NumPy, Scikit-learn, Pandas
Specialties: **Diffusion, Flow Matching Models**, LLM, Natural Language Processing, Machine Learning

SELECTED PROJECTS

Exploring Virtual Logic Depth for Scaling Laws || MIT,UIUC *Feb. 2025 - May. 2025*

- Systematically study the parameter-reuse scaling on **LLM reasoning and knowledge capacity** under controlled protocols.
- Explored multiple reuse patterns and identified a cycle-repetition scheme that substantially improves reasoning, validated on **both synthetic and real-world benchmarks.**
- Achieved a **52% accuracy boost** on reasoning tasks and over 100% improvement on the AIME benchmark, demonstrating a new paradigm for scaling reasoning capabilities in LLMs.

Multi-Stage Probabilistic Generative Super Resolution || UIUC *May. 2024 - Jan. 2025*

- Propose a **novel three-stage pre-training and fine-tuning paradigm** that enables the model to effectively learn medical image features under **few-shot conditions.**
- Utilizing **ControlNet**, the MSP-SR framework successfully achieves knowledge transfer from natural image domains to the medical domain.
- Under the same few-shot setting, MSP–SR surpasses prior SOTA on various medical dataset, especially with **32.2% PSNR improvement** and 46.0% lower LPIPS on OASIS dataset.

SELECTED PUBLICATIONS

- **Zhu, R.**, Weston, M. C., Banerjee, A. MSP-SR: Multi-Stage Probabilistic Generative Super Resolution with Scarce High-Resolution Data. *UAI 2025.*
- **Zhu, R.**, Beyond Parameters: Exploring Virtual Logic Depth for Scaling Laws, *submitted to ICLR 2026*
- Zeng, Z., **Zhu, R.**, Xia, Y., Zeng, H., Tong, H. Generative Graph Dictionary Learning. *ICML 2023*
- **Zhu, R.***, Qi, Z.*, Fu, Z.*, Chai, W.*, Kindratenko, V. Weakly Supervised Two-Stage Training Scheme for Deep Video Fight Detection Model. *ICTAI 2022 (pp. 677-685). IEEE.*