

Yunhai Hu

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EDUCATION

New York University

M.S. in Computer Science Courant, GPA:3.9

Sep. 2024 - May 2026

Manhattan, NY

Shandong University

B.S. in Applied Mathematics, GPA:4.0

Sep. 2017 - Jun. 2022

Shangdong, CN

TECHNICAL SKILLS

Languages: Python, Java, C++, Rust **Frameworks:** Transformers, Verl, DeepSpeed, vLLM, Flink, Spark, Kubernetes
AI Expertise: LLM & VLM; Agent & Multi-Agent; RAG & Reasoning; PEFT & RL; Speculative Decoding

PROFESSIONAL EXPERIENCE

Machine Learning Engineer Internship @ Thin Red Line AI

RL-Trained LLM Agent with Hybrid DSL for On-Device Email Retrieval 🧠

July 2025 – Present

- Designed an **edge-side email retrieval agent** with a DSL unifying **SQL queries** and **semantic search**, leveraging structured email storage and semantic optimization, while meeting on-device latency constraints.
- Constructed **RL-oriented training data** by sampling email rows and combining structured fields with semantic facts to generate grounded queries, addressing the lack of reliable ground truth and DSL supervision that **limits SFT**.
- Developed a **composite reward strategy** (format, executability, correctness, length) and integrated advanced RL methods (**GRPO**, **DAPO**, **GSPO**) to enhance reasoning while mitigating reward hacking.
- Improved accuracy from **12% to 83%**, and compressed CoT sequences by **87%**, enabling **on-device feasibility**.

Research Intern @ Cerebras System

DREAM: Entropy-Adaptive Cross-Attention for Multimodal Speculative Decoding 🧠

Feb. 2025 – May 2025

- Achieved **2–4× faster inference** on Pixtral with tree-based speculative decoding and cross-attention draft models, showing robustness across ScienceQA, MMT-Bench, and related benchmarks while **preserving output quality**.
- Optimized draft training on **LLaVA-Mix-665K** instructions using layer-wise distillation with **dynamic mid-layer selection**, where both **final logits** and **intermediate features** from the target model provide supervisory signals.

Full-time Software Engineer @ Bilibili Technology Co., Ltd.

May 2022 - Sep. 2024

AI-driven real-time data platform and stream-batch unification

- Built **stream-batch unified SQL pipelines** for Ads/AI models, handling **click-show joins and algorithm execution**, supporting both real-time serving and offline re-computation for training-serving consistency
- Developed a **cloud-native Flink+K8S platform**, improving scalability and reliability of algorithm data services
- Optimized **Flink RocksDB state backend**, cutting peak-time resource load by **15%** and boosting system stability

RESEARCH PROJECTS

MAICRL: Multi-Agent In-Context RL for Clinical Diagnosis

Collaborative Research, MIT Media Lab

May. 2025 – Present

- Developed a **multi-agent** diagnostic workflow (initial diagnosis, specialist **multi-turn** refinement, final decision) and applied **In-Context Reinforcement Learning** to help agents adapt strategies using contextual examples with rewards.
- Designed a two-level **reward mechanism** using Hit@3 with turn-level and decayed global scoring, and built RareBench rollout memory with positive/negative exemplars to enhance in-context adaptation.
- Used **ICRL** to address key challenges in multi-agent diagnosis, aligning diagnostic styles across models, enriching diagnostic outcomes through specialist collaboration, and enhancing multi-turn communication quality.

Enhance Retrieval-Augmented Generation with Monte Carlo Tree Search

Collaborative Research, YaleNLP 🧠

Dec. 2024 – Mar. 2025

- Developed **MCTS-RAG**, combining Monte Carlo Tree Search with retrieval-augmented generation, yielding **23% accuracy gain** on GPQA over leading baselines by enhancing search efficiency and factual grounding.
- Designed **concurrent expansion** (parallel rollouts) and **dynamic pruning** (cutting branches by low value estimates), preventing wasted search and reducing hallucinations, leading to **3.2× speedup and 45% fewer tokens**.
- Introduced **hallucination control** by pruning low-consistency nodes and enforcing grounding via retrieval verification
- Outperformed SOTA baselines (Search-o1, RAG-Star, DeepRAG) by **8%**, matching GPT-4o with a 7B model.

PipeSpec: Breaking Stage Dependencies in Hierarchical LLM Decoding

SAILAB Research, NYU

Oct. 2024 – Dec. 2024

- Proposed a **hierarchical** pipeline-based speculative decoding framework enabling asynchronous parallel execution.
- Designed a prediction verification mechanism to break serial dependencies while **ensuring prediction correctness**.
- Achieved up to **2.54× speedup** on various tasks, offering a scalable acceleration strategy for multi-device deployments.

PUBLICATIONS

- Hu, Y., et al.** DREAM: Drafting with Refined Target Features and Entropy-Adaptive Cross-Attention Fusion for Multimodal Speculative Decoding. NeurIPS, 2025.
- Hu, Y., Zhao, Y., et al.** MCTS-RAG: Enhancing RAG with Monte Carlo Tree Search. EMNLP Findings, 2025.
- Hu, Y., et al.** Speculative Decoding and Beyond: An In-Depth Survey of Techniques. EMNLP Findings, 2025.
- McDanel, B., Zhang, S. Q., **Hu, Y., et al.** PipeSpec: Break Stage Dependencies in LLM Decode. ACL Findings, 2025.