

# YUANZHE HU

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## EDUCATION

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**University of California, San Diego (UCSD)**

*Sep. 2024 – Mar. 2026 (expected)*

MS. in Computer Science Engineering

GPA: 3.86/4.0

**Huazhong University of Science and Technology (HUST)**

*Sep. 2020 – Jun. 2024*

B.S. in Artificial Intelligence (Honored Class, Qiming School)

GPA: 3.91/4.0

## RESEARCH SUMMARY

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**Model Diagnostics and Optimization:** Designed and improved model training dynamics analysis and hyperparameter optimization by applying mathematical tools from Random Matrix Theory. These methods yield more accurate layer-wise hyperparameters for LLM pruning[1] and LLM fine-tuning[2].

**Memory & Reasoning for LLM and Agents:** Designed MemoryAgentBench[3], a comprehensive benchmark to evaluate memory agents and LLM across multiple core competencies. Contributed to the design of memory-augmented LLMs (M+)[4], Mem-alpha[5], and the SFT role on K2-Think[6].

**Research Advisors:** Yaoqing Yang, Julian McAuley, Zhiting Hu.

## PUBLICATIONS

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- [1] **Yuanzhe Hu**, K. Goel, V. Killiakov, and Y. Yang, “Eigenspectrum analysis of neural networks without aspect ratio bias,” in *ICML*, 2025.
- [2] Z. Liu\*, **Yuanzhe Hu**\*, T. Pang, Y. Zhou, P. Ren, and Y. Yang, “Model balancing helps low-data training and fine-tuning,” in *EMNLP (Oral Presentation)*, 2024.
- [3] **Yuanzhe Hu**\*, Y. Wang\*, and J. McAuley, “Evaluating memory in llm agents via incremental multi-turn interactions,” in *ArXiv*, 2025.
- [4] Y. Wang, D. Krotov, **Yuanzhe Hu**, Y. Gao, W. Zhou, J. McAuley, D. Gutfreund, R. Feris, and Z. He, “M+: Extending memoryllm with scalable long-term memory,” in *ICML*, 2025.
- [5] Y. Wang, R. Takanobu, Z. Liang, Y. Mao, **Yuanzhe Hu**, J. McAuley, and X. Wu, “Mem- $\alpha$ : Learning memory construction via reinforcement learning,” in *ArXiv*, 2025.
- [6] “K2-think: A parameter-efficient reasoning system,” in *ArXiv*, 2025.

\* Equal Contribution

## RESEARCH AND INDUSTRIAL EXPERIENCE

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**Large-Scale Reasoning LLM Training and Causal Analysis [6]**

Jun 2025 - Sep 2025

*Intern, Supervisor: Prof. Zhiting Hu*

Institute of Foundation Models – MBZUAI / LLM 360

- My role in this project includes data pre-processing, model training, and technical report writing.
- Engineered and built the large-scale supervised fine-tuning (SFT) pipeline for models up to 70B parameters (e.g., LLaMA-3.1-70B, Qwen2.5-32B) on multiple GPU cluster.
- Achieved good results on challenging reasoning benchmarks by leveraging this pipeline, scoring 57.3 on LiveCodeBench (code generation) and 72.1 on AIME 2025 (math reasoning).
- Investigated key issues in SFT, including training loss behavior, data selection and mixing strategies, and the relationship between training dynamics and model performance; documented insights and best practices for future reference.

**Memory LLM and Agents Benchmarking and Construction [3], [4]** Oct 2024 - Jun 2025  
*CSE Research Course, Supervisors: Yu Wang and Prof. Julian McAuley* UC San Diego

- Led the development of **MemoryAgentBench**, a comprehensive benchmark framework to systematically evaluate memory in LLM agents by simulating incremental, multi-turn interactions.
- Designed and implemented the evaluation framework for M+, and conducted systematic benchmarking against baseline methods including LLaMA-3.1-8B with BM25 retrieval.
- Contributed to training Memory Alpha in long dialogue history settings, achieving 52% test accuracy on LME(S\*) using only one-third of the full context window.
- Co-authored three research papers: MemoryAgentBench (under review, 2k Monthly Downloads on Hugging Face), RL Memory Agents and the M+ (accepted to ICML 2025).

**De-biased Model Diagnosis Based on Eigspectrum and MP-Law [1]** Nov 2024 - Apr 2025  
*Supervisors: Prof. Yaoqing Yang* Dartmouth College

- Theorized and empirically validated that existing eigspectrum analysis is biased by weight matrix **aspect ratios**, a phenomenon explained by the **Marchenko-Pastur (MP) law**, leading to inaccurate layer diagnostics.
- Developed **FARMS**, a novel subsampling method grounded in **Random Matrix Theory (RMT)**, to normalize weight matrices to a fixed aspect ratio, enabling an unbiased, size-invariant evaluation of layer training quality.
- Validated the method's effectiveness across diverse domains (**LLM Pruning, CV, SciML**), consistently **outperforming state-of-the-art** layer-wise optimization methods.
- First-authored a research paper accepted to the **ICML 2025**.

**Layer-wise Optimization on Low-data SFT and Training [2]** Jun 2023 - Jun 2024  
*Supervisors: Dr. Pu Ren and Prof. Yaoqing Yang* Dartmouth College

- Utilized the **spectral analysis of model weights**, based on Heavy-Tailed Self-Regularization (HT-SR) theory, to establish a quantitative link between data scarcity and imbalanced layer-wise training, providing a theoretical foundation for designing superior model diagnosis metrics and optimization methods.
- Developed a dynamic **layer-wise learning rate** scheduling algorithm to rebalance training quality across layers, overcoming limitations of prior optimizers in NLP training scenarios.
- Validated the method's effectiveness through extensive experiments on diverse models and benchmarks, improving LLM test accuracy by **2-10%** in low-data SFT and leading to a **co-first** authored publication at EMNLP 2024 (**Oral Presentation**).
- Investigated the framework's generalizability by extending the layer-wise method to tune **other hyperparameters** (e.g., weight decay, dropout), and validated its effectiveness on image classification with ResNet/ViT models on the CIFAR-100 dataset.
- Involved in the rebuttal process and supplementing experimental data for the paper accepted by NeurIPS 2023.

## COMPETITION AWARDS / SERVICE

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Second Prize at 17th National College Students Intelligent Car Race (Top-7% among 2771 teams), awarded by Chinese Automation Association, Summer 2022, Project Leader.  
Reviewer for ICLR 2026, ARR 2025 (July / Oct.), and Workshops.  
Volunteer for ICML 2025

## TECHNICAL SKILLS

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<b>Programming Languages</b>	Python, C/C++, SQL, Bash, Matlab
<b>Machine Learning Tools</b>	PyTorch, Hugging Face Transformers, LLaMA Factory, Verl