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Research Focus

- **Reasoning & Planning:** MCTS-LLM, PRM-RL, working memory
- **Multimodality:** vision, audio (speech/music), and language
- **Post-Training:** instruction tuning, DPO, reinforcement learning
- **Mechanistic interpretability:** Memory for long-context modelling

Education

Dartmouth College Hanover, NH, USA

Ph.D. in Computer Science Aug. 2023 – Apr. 2026 (expected)

Advisor: [Professor Soroush Vosoughi](#)

Brandeis University

Waltham, MA, USA

M.S. in Computer Science

Sep. 2021 – Jun. 2023

GSAS Research Fellowship Recipient

Northeastern University

China

B.S. in Computer Science

Sep. 2017 – Jun. 2021

Outstanding Honor Thesis Award

Experience

Honda Research Institute USA

San Jose, CA, USA

Research Intern

Jun. 2024 – Sep. 2024

Project: Multimodal LLM Post-Training (8B - 70B) and Synthetic Data Generation

Developed a **global-local multi-agent planning system** for understanding human behaviors in **multimodal environments**, achieving **4.6%** improvement over state-of-the-art solutions. Implemented post-trained small agents to facilitate inference-time alignment and scaling to 405B parameters. Research paper under review at ICML 2025.

Host: [Dr. Shao-Yuan Lo](#)

Under Review

Overcoming Multi-step Complexity in Theory-of-Mind Reasoning: A Scalable Bayesian Planner

[Preprint](#) | [Code](#) | *A global-local structure that uses Bayesian inverse planning for global planning, then allows LLMs to fully focus on local reasoning.*

Chunhui Zhang, Zhongyu Ouyang, Sean Dae Houlihan, Kwonjoon Lee, Nakul Agarwal, Soroush Vosoughi, Shao-Yuan Lo

Superficial Self-Improved Reasoners Benefit from Model Merging

[Preprint](#)

Xiangchi Yuan, **Chunhui Zhang**, Zheyuan Liu, Dachuan Shi, Soroush Vosoughi, Wenke Lee

Growing Through Experience: Scaling Episodic Grounding in Language Models

[Preprint](#) | [Code](#) | *Post-trained agentic LLMs (DPO on 3B, 8B, and 70B models) on MCTS-sampled data from physical simulators to enhance planning capabilities.*

Chunhui Zhang, Elsie Wang, Zhongyu Ouyang, Xiangchi Yuan, Soroush Vosoughi

Knowing More, Acting Better: Hierarchical Representation for Embodied Decision-Making

[Preprint](#) | *Post-trained Multimodal LLMs as embodied agents in physical indoor environments.*

Chunhui Zhang, Zhongyu Ouyang, Zheyuan Liu, Soroush Vosoughi

Publications

Pretrained Image-Text Models are Secretly Video Captioners

[Preprint](#) | [Code](#)

*Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2025) Main Conference (**Oral Presentation**).*

*An RL (reinforcement learning) post-training recipe that trains a **Top-2** multimodal LLM captioner on PaperswithCode Leaderboard, outperforming industry MLLM captioners.*

Chunhui Zhang*, Yiren Jian*, Zhongyu Ouyang, Soroush Vosoughi

Temporal Working Memory: Query-Guided Segment Refinement for Enhanced Multimodal Understanding

[Preprint](#) | [Code](#)

Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2025) Findings.

Extending my previous papers from NAACL 2025 and EMNLP 2025, this research utilizes working memory to enable multimodal LLMs to handle long multimodal contexts.

{Xingjian Diao*, **Chunhui Zhang***}, Weiyl Wu, Zhongyu Ouyang, Pei-jun Qing, Ming Cheng, Soroush Vosoughi, Jiang Gui

Is It Navajo? Accurate Language Detection in Endangered Athabaskan Languages

[Preprint](#) | [Code](#)

*Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL 2025) Main Conference (**Oral Presentation**).*

Ivory Yang, Weicheng Ma, **Chunhui Zhang**, Soroush Vosoughi

Working Memory Identifies Reasoning Limits in Language Models

Chunhui Zhang, Yiren Jian, Zhongyu Ouyang, Soroush Vosoughi

The Conference on Empirical Methods in Natural Language Processing (EMNLP 2024).

Learning Musical Representations for Music Performance Question Answering

Xingjian Diao, **Chunhui Zhang**, Tingxuan Wu, Ming Cheng, Zhongyu Ouyang, Weiyl Wu, Soroush Vosoughi, Jiang Gui

Findings of the Association for Computational Linguistics: Empirical Methods in Natural Language Processing (Findings of EMNLP), 2024.

Expedited Training of Visual Conditioned Language Generation via Redundancy Reduction

Yiren Jian, Tingkai Liu, Yunzhe Tao, **Chunhui Zhang**, Soroush Vosoughi, Hongxia Yang

Annual Meeting of the Association for Computational Linguistics (ACL, Oral Presentation), 2024.

Aligning Relational Learning with Lipschitz Fairness

{Yaning Jia, **Chunhui Zhang**}, Soroush Vosoughi.

International Conference on Learning Representations (ICLR), 2024.

Note: Co-first author Jia was a master student who was mentored by me. Thanks Jia.

Mitigating Emergent Robustness Degradation on Graphs while Scaling-up

{Xiangchi Yuan, **Chunhui Zhang**}, Yijun Tian, Yanfang Ye, et al.

International Conference on Learning Representations (ICLR), 2024.

Note: Co-first author Yuan was a master student who was mentored by me. Thanks Yuan.

Graph Mixed Supervised Learning via Generalized Knowledge

Xiangchi Yuan, Yijun Tian, **Chunhui Zhang**, Yanfang Ye, Nitesh V Chawla, et al.

ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD), 2024.

GCVR: Reconstruction from Cross-View Enable Sufficient and Robust Graph Contrastive Learning

Qianlong Wen, Zhongyu Ouyang, **Chunhui Zhang**, Yiyue Qian, Chuxu Zhang, Yanfang Ye

The Conference on Uncertainty in Artificial Intelligence (UAI), 2024.

Symbolic Prompt Tuning Completes the App Promotion Graph

Zhongyu Ouyang, **Chunhui Zhang**, Shifu Hou, Shang Ma, Chaoran Chen, Toby Li, Xusheng Xiao, et al.

European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD), 2024

How to Improve Representation Alignment and Uniformity in Graph-based Collaborative Filtering?

Zhongyu Ouyang, **Chunhui Zhang**, Shifu Hou, Chuxu Zhang, Yanfang Ye

International AAAI Conference on Web and Social Media (ICWSM), 2024.

Breaking the Trilemma of Privacy, Utility, and Efficiency via Controllable Machine Unlearning

{Zheyuan Liu, Guangyao Dou}, Yijun Tian, **Chunhui Zhang**, Eli Chien, Ziwei Zhu

ACM International World Wide Web Conference (WWW/TheWebConf), 2024.

When Sparsity Meets Contrastive Models: Less Data Can Bring Better Class-Balanced Representations

Chunhui Zhang, Chao Huang, Yijun Tian, Qianlong Wen, et al.

International Conference on Machine Learning (ICML), 2023. AAAI-DCAA 2023 Best Paper Runner-up Award

Chasing All-Round Graph Representation Robustness: Model, Training, and Optimization

Chunhui Zhang, Yijun Tian, Mingxuan Ju, Zheyuan Liu, et al.
International Conference on Learning Representations (ICLR), 2023.

Mind the Gap: Mitigating the Distribution Gap in Graph Few-shot Learning

Chunhui Zhang, Hongfu Liu, Jundong Li, Yanfang Ye, et al.
Transactions on Machine Learning Research (TMLR), 2023.

Fair Graph Representation Learning via Diverse Mixture-of-Experts

{Zheyuan Liu, **Chunhui Zhang**}, Yijun Tian, Erchi Zhang, et al.
ACM International World Wide Web Conference (WWW/TheWebConf), 2023.

Note: Co-first author Liu (in alphabetical order) was an undergraduate who was mentored by me. Thanks Liu.

Boosting Graph Neural Networks via Adaptive Knowledge Distillation

Zhichun Guo, **Chunhui Zhang**, Yujie Fan, Yijun Tian, et al.
AAAI Conference on Artificial Intelligence (AAAI), 2023.

Heterogeneous Graph Masked Autoencoders

Yijun Tian, Kaiwen Dong, **Chunhui Zhang**, et al.
AAAI Conference on Artificial Intelligence (AAAI), 2023.

Heterogeneous Temporal Graph Neural Network Explainer

Jiazheng Li, **Chunhui Zhang**, Chuxu Zhang.
ACM International Conference on Information and Knowledge Management (CIKM), 2023.

Label-invariant Augmentation for Semi-Supervised Graph Classification

Han Yue, **Chunhui Zhang**, Chuxu Zhang, and Hongfu Liu.
Conference on Neural Information Processing Systems (NeurIPS), 2022.

Co-Modality Imbalanced Graph Contrastive Learning

Yiyue Qian, **Chunhui Zhang**, Yiming Zhang, Qianlong Wen, Yanfang Ye, et al.
Conference on Neural Information Processing Systems (NeurIPS), 2022.

Look Twice as Much as You Say: Scene Graph Contrastive Learning for Self-Supervised Image Caption Generation

Chunhui Zhang, Chao Huang, Youhuan Li, Xiangliang Zhang, Yanfang Ye, et al.

ACM International Conference on Information and Knowledge Management (CIKM), 2022.

GraphBERT: Bridging Graph and Text for Malicious Behavior Detection on Social Media

Jiele Wu, **Chunhui Zhang**, Zheyuan Liu, Erchi Zhang, Steven Wilson, et al.

IEEE International Conference on Data Mining (ICDM), 2022.

Towards Tailored Models on Private AIoT Devices: Federated Direct Neural Architecture Search

Chunhui Zhang, Xiaoming Yuan, Qianyun Zhang, Guangxu Zhu, Lei Cheng, and Ning Zhang.

IEEE Internet of Things Journal (IEEE-IoTJ), Feb. 2022.

Honors and scholarships

ACL Oral Presentation Award	2024
Graduate School of Arts and Sciences Fellowship	2021 – 2023
GSAS Ph.D. Student Conference Award	2023
Travel and Research Grant	2022
CIKM Travel Grant Award	2022
AAAI-DCAA Best Paper Runner-up Award	2023

Teaching experience

Teaching Assistant, Computer Science, Brandeis Fall 2021 & Spring 2023

CS 133A: Graph Mining

Graphs are capable of modeling complex social, technological, and biological systems. This course covers the core concepts, models, and algorithms of graph mining.

Teaching Assistant, Computer Science, Brandeis Spring & Fall 2022

CS 165B: Deep Learning

This course covers the core methods and algorithms of deep learning techniques.

Service and outreach

Program Committee/Conference Reviewer

NeurIPS 2023, NeurIPS Datasets and Benchmarks track 2023, AAAI 2023, Learning on Graphs 2023, NeurIPS 2022, CIKM 2022, ICDM 2022, IEEE HPCC 2020

Journal Reviewer

IEEE Transactions on Knowledge and Data Engineering, IEEE Transactions on Network Science and Engineering, ACM Transactions on Intelligent Systems and Technology, Neurocomputing, Big Data