

Zirui (Ray) Liu

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RESEARCH INTEREST

- **Machine Learning Algorithm & System:** Large Language Models (LLMs) efficiency & scalability;
- **Applications:** Large-scale scientific and social computing problems.

EDUCATION

- **Rice University** Houston, TX
Ph.D. Candidate in Computer Science, Advised by Dr. Xia (Ben) Hu Aug. 2021 – May. 2024 (Expected)
- **Texas A&M University (Transfer Out)** College Station, TX
Ph.D. Student in Computer Science, Advised by Dr. Xia (Ben) Hu Aug. 2019 – Aug. 2021
- **Harbin Institute of Technology** Harbin, China
Electrical Engineering, Master of Engineering Sep. 2016 – Jun. 2018
- **Harbin Institute of Technology** Harbin, China
Electrical Engineering, Bachelor of Science Sep. 2012 – Jul. 2016

RESEARCH & INDUSTRY EXPERIENCES

- **Research Intern at LinkedIn** Sunnyvale, CA
Advertisement AI team, advised by Mr. Aman Gupta. May. 2023 – Aug. 2023
 - Improving the inference efficiency of language models via dynamic sparsity.
- **Research Intern at Meta** Sunnyvale, CA
Capacity Engineering and Analysis team. May. 2022 – Aug. 2022
 - Incorporating semi-supervised learning for improving advertisement models.
- **Research Intern at Samsung Research America** Remote
Advertisement AI team, advised by Dr. Li Li and Dr. Rui Chen. May. 2021 – Aug. 2021
 - Incorporating the graph structure into the App embeddings for improving the click-through-rate.
- **Research Intern at 4Paradigm** Beijing, China
Advised by Mr. Xiawei Guo. Mar. 2019 – Aug. 2019
 - Developed the automated machine learning system for tabular data.

PUBLICATION

1. **Zirui Liu**, Zhaozhuo Xu, Beidi Chen, Yuxin Tang, Jue Wang, Kaixiong Zhou, Xia Hu, Anshumali Shrivastava “*Compress, Then Prompt: Improving Accuracy-Efficiency Trade-off of LLM Inference with Transferable Prompt*”, ArXiv Preprint & Under review, [PDF](#)
2. **Zirui Liu**, Guanchu Wang, Shaochen Zhong, Zhaozhuo Xu, Daochen Zha, Ruixiang Tang, Zhimeng Jiang, Kaixiong Zhou, Vipin Chaudhary, Shuai Xu, and Xia Hu “*Winner-Take-All Column Row Sampling for Memory Efficient Adaptation of Language Model*”, The 37th Conference on Neural Information Processing Systems (**NeurIPS**), 2023, [PDF](#)

3. **Zirui Liu**, Zhimeng Jiang, Shaochen Zhong, Kaixiong Zhou, Li Li, Rui Chen, Soo-Hyun Choi and Xia Hu. “*Editable Graph Neural Network for Node Classifications*”, The 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining on Mining and Learning with Graphs Workshop (**KDD MLG Workshop**), 2023. [PDF](#)
4. **Zirui Liu**, Kaixiong Zhou, Zhimeng Jiang, Li Li, Rui Chen, Soo-Hyun Choi, and Xia Hu. “*DSpar: Embarrassingly Simple Strategy for Efficient GNN training and inference via Degree-based Sparsification*”, Transactions on Machine Learning Research (**TMLR**), 2023. [PDF](#)
5. **Zirui Liu**, Shengyuan Chen, Kaixiong Zhou, Daochen Zha, Xiao Huang, and Xia Hu. “*RSC: Accelerating Graph Neural Networks Training via Randomized Sparse Computations*”, The 40th International Conference on Machine Learning (**ICML**), 2023. [PDF](#)
6. **Zirui Liu**, Qingquan Song, Li Li, Soo-Hyun Choi, Rui Chen, and Xia Hu. “*PME: Pruning-based Multi-size Embedding for Recommender Systems*”, (**Frontier in Big Data**), 2023. [PDF](#)
7. Ruixiang Tang, Jiayi Yuan, Yiming Li, **Zirui Liu**, Rui Chen, and Xia Hu “*Setting the Trap: Capturing and Defeating Backdoor Threats in PLMs through Honeypots*”, The 37th Conference on Neural Information Processing Systems (**NeurIPS**), 2023.
8. Shaochen Zhong, Zaichuan You, Jiamu Zhang, Sebastian Zhao, Zachary LeClaire, **Zirui Liu**, Vipin Chaudhary, Shuai Xu, and Xia Hu “*One Less Reason for Filter Pruning: Gaining Free Adversarial Robustness with Structured Grouped Kernel Pruning*”, The 37th Conference on Neural Information Processing Systems (**NeurIPS**), 2023.
9. Xiaotian Han, Zhimeng Jiang, Hongye Jin, **Zirui Liu**, Na Zou, Qifan Wang, Xia Hu. “*Retiring ΔDP : New Distribution-Level Metrics for Demographic Parity*”, Transactions on Machine Learning Research (**TMLR**), 2023. [PDF](#)
10. Guanchu Wang, **Zirui Liu**, Zhimeng Jiang, Ninghao Liu, Na Zou, and Xia Hu. “*DIVISION: Memory Efficient Training via Dual Activation Precision*”, The 40th International Conference on Machine Learning (**ICML**), 2023. [PDF](#)
11. Daochen Zha, Louis Feng, Liang Luo, Bhargav Bhushanam, **Zirui Liu**, Yusuo Hu, Jade Nie, Yuzhen Huang, Yuandong Tian, Arun Kejariwal, and Xia Hu. “*Pre-train and Search: Efficient Embedding Table Sharding with Pre-trained Neural Cost Models*”, The 6th Conference on Machine Learning and Systems (**MLSys**), 2023. [PDF](#)
12. **Zirui Liu**, Kaixiong Zhou, Fan Yang, Li Li, Rui Chen, and Xia Hu. “*EXACT: Scalable Graph Neural Networks Training via Extreme Activation Compression*”, The 10th International Conference on Learning Representations (**ICLR**), 2022. [PDF](#)
13. Daochen Zha, Louis Feng, Qiaoyu Tan, **Zirui Liu**, Kwei-Herng Lai, Bhargav Bhushanam, Yuandong Tian, Arun Kejariwal, and Xia Hu. “*DreamShard: Generalizable Embedding Table Placement for Recommender Systems*”, The 36th Conference on Neural Information Processing Systems (**NeurIPS**), 2022. [PDF](#)
14. Kaixiong Zhou, **Zirui Liu**, Keyu Duan, and Xia Hu. “*Graph Neural Networks: AutoML*”, in **Graph Neural Networks: Foundations, Frontiers, and Applications**, 2022.
15. Keyu Duan, **Zirui Liu**, Wenqing Zheng, Peihao Wang, Kaixiong Zhou, Tianlong Chen, Zhangyang Wang and Xia Hu. “*A Comprehensive Study on Large-Scale Graph Training: Benchmarking and Rethinking*”, The 36th Conference on Neural Information Processing Systems (**NeurIPS**), 2022. [PDF](#)
16. Kaixiong Zhou, **Zirui Liu**, Rui Chen, Li Li, Soo-Hyun Choi, and Xia Hu. “*Table2Graph: Transforming Tabular Data to Unified Weighted Graph*”, The 31st International Joint Conference on Artificial Intelligence (**IJCAI**), 2022. [PDF](#)

17. Zhimeng Jiang, Kaixiong Zhou, **Zirui Liu**, Li Li, Rui Chen, Soo-Hyun Choi, and Xia Hu. “*An Information Fusion Approach to Learning with Instance-Dependent Label Noise*”, The 10th International Conference on Learning Representations (**ICLR**), 2022. [PDF](#)
18. Ruixiang Tang, Mengnan Du, Yuening Li, **Zirui Liu** and Xia Hu. “*Mitigating Gender Bias in Captioning Systems*”, The 32nd Web Conference (**WWW**) 2021. [PDF](#)
19. **Zirui Liu**, Haifeng Jin, Ting-Hsiang Wang, Kaixiong Zhou and Xia Hu. “*DivAug: Plug-in Automated Data Augmentation with Explicit Diversity Maximization*”, The 18th International Conference on Computer Vision (**ICCV**), 2021. [PDF](#)
20. **Zirui Liu**, Qingquan Song, Kaixiong Zhou, Ting-Hsiang Wang, Ying Shan, and Xia Hu. “*Detecting Interactions from Neural Networks via Topological Analysis*”, The 35th Conference on Neural Information Processing Systems (**NeurIPS**), 2021. [PDF](#)
21. Ting-Hsiang Wang , Qingquan Song, Xiaotian Han, **Zirui Liu**, Haifeng Jin, and Xia Hu. “*AutoRec: An Automated Recommender System*”, The 15th ACM Conference on Recommender Systems (Demo track) (**RecSys Demo paper**), 2021. [PDF](#)
22. Zhigang Qu, Liqun Wu, Bin Yue, Yang An, **Zirui Liu**, Pengfei Zhao, Jikui Luo, Yuedong Xie, Ying Liu, Qiuyu Wang, Zhiyuan Wang, Rui Dai, and Wuliang Yin. “*Eccentric triboelectric nanosensor for monitoring mechanical movements*”, Nano Energy, 2019. [PDF](#)
23. Ming Yang, Na Chai, **Zirui Liu**, Boyang Ren, and Dianguo Xu. “*Motor speed signature analysis for local bearing fault detection with noise cancellation based on improved drive algorithm*”, IEEE Transactions on Industrial Electronics, 2019. [PDF](#)
24. Ming Yang, **Zirui Liu**, Jiang Long, Wanying Qu, and Dianguo Xu. “*An algorithm for online inertia identification and load torque observation via adaptive Kalman observer-recursive least squares*”, Energies, 2019. [PDF](#)
25. **Zirui Liu**, Ming Yang, Jiang Long, Dianguo Xu. “*Speed measurement error reduction via adaptive strong tracking Kalman filters*”, IEEE Transportation Electrification Conference and Expo, Asia-Pacific, (**ITEC Asia-Pacific**), 2017. [PDF](#)
26. Yingqiang Li, Ming Yang, Jiang Long, **Zirui Liu**, and Dianguo Xu. “*Current sensorless predictive control based on extended Kalman filter for PMSM drives*”, IEEE Transportation Electrification Conference and Expo, Asia-Pacific, (**ITEC Asia-Pacific**), 2017. [PDF](#)
27. **Zirui Liu**, Ming Yang, and Dianguo Xu. “*A novel algorithm for on-line inertia identification via adaptive recursive least squares*”, The 43rd Annual Conference of the IEEE Industrial Electronics Society, **IECON** 2017. [PDF](#)

RECOGNITION & AWARDS

- | | |
|---|------------|
| • Rice Graduate Fellowship | 2021 |
| • The GMCC’s Scholarship (Corporation Scholarship) | 2015 |
| • The MOONS’ Scholarship (Corporation Scholarship) | 2013 |
| • First Prize of Excellent Student Scholarship of HIT | 2012, 2013 |

INVOLVED RESEARCH GRANTS

NSF Medium: Towards Effective Detection and Mitigation for Shortcut Learning: A Data Modeling Framework

\$1200,000, Lead PI: Xia (Ben) Hu,

Jun. 2022

Led the research proposal writing on the research objectives of “Shortcut Detection via A Data-centric Framework”, which is directly based on my NeurIPS paper.

NSF FAI: Towards Fairness in Deep Neural Networks with Learning Interpretation

\$900,000, Lead PI: Xia (Ben) Hu,

Sep. 2021

Led the research proposal writing on the research objectives of “Enhancing Fairness via Feature Interpretation”, which is directly based on my WWW paper.

Visa Research Award: Scalable Representation Learning Frameworks To Model Sophisticated Interactions In Large-Scale Graph And Tabular Data

\$100,000, Lead PI: Xia (Ben) Hu,

Jun. 2022

Led the research proposal writing on the research objectives of “Very Large-Scale Graph Training”, which is directly based on my ICLR & TMLR paper.

TEACHING

- Guest Lecturer, COMP 640: Graduate Seminar In Machine Learning, Rice University 2023
- Guest Lecturer, COMP 631: Introduction to Information Retrieval, Rice University 2023
- Teaching Assistant, COMP 631: Introduction to Information Retrieval, Rice University 2022, 2023

SELECTED MENTORSHIP

- **Keyu Duan** **Fall 2021 – Present**
Ph.D. Student, National University of Singapore *Large-Scale Machine Learning, Neurips 2022*
- **Guanchu Wang** **Fall 2021 – Present**
Ph.D. Student, Rice University *Memory-Efficient Machine Learning, ICML 2023*
- **Shengyuan Chen** **Summer 2022 – Present**
Ph.D. Student, The Hong Kong Polytechnic University *Efficient Machine Learning, ICML 2023*
- **Henry Zhong** **Fall 2022 – Present**
Ph.D. Student, Rice University *Efficient Machine Learning, NeurIPS 2023*
- **Jiayi Yuan** **Fall 2022 – Present**
Ph.D. Student, Rice University *Machine Learning for Healthcare, AMIA*
- **Khushbu Pahwa** **Fall 2023 – Present**
Ph.D. Student, Rice University *Machine Learning for Healthcare, ongoing*
- **Duy Le** **Fall 2023 – Present**
Undergraduate, Case Western Reserve University *Large-Scale Machine Learning, SDM’24 in submission*

SERVICE

- **Program Committee Member:** NeurIPS, ICML, ICLR, KDD, ICCV
- **Journal Reviewers:** TPAMI, TKDD, TMLR