Yihua Zhang

Ph.D. Student in Computer Science

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Personal Information

I am a second-year Ph.D. student in computer science at Michigan State University, where I am advised by **Dr. Sijia Liu**. I am interested in the optimization foundation of **trustworthy and scalable machine learning**, including the optimization theories to improve the robustness, explainability, fairness, and scalability of current machine learning algorithms.

Education

Doctor of Computer Science 01 2022 — Present
Michigan State University, East Lansing, USA
Advisor: Dr. Sijia Liu
OPTML Lab

Bachelor of Engineering 09 2015 — 06 2019
Huazhong University of Science and Technology, Wuhan, China

Awards

Scholarly Awards
- Best Paper Runner-up Award of UAI 2022 2022
- NeurIPS Scholar Award 2022
- NeurIPS Top Reviewer 2022
- UAI Student Scholarship 2022

Travel Grants
- AAAI 2023 Travel Award 2023
- Travel Grant Award of ICML 2022 2022

Undergraduate Award
- National Scholarship, by Ministry of Education of China (Top 2%, 5/300) 2017
- National Scholarship, by Ministry of Education of China (Top 2%, 5/300) 2016

Publications

Conference Papers
(* represents equal contributions)

[1] **Y. Zhang***, Y. Yao*, P. Ram, P. Zhao, T. Chen, M. Hong, Y. Wang, S. Liu, "Advancing Model Pruning via Bi-level Optimization", 36th Conference on Neural Information Processing Systems (NeurIPS'22), [PDF], [Code].

[2] **Y. Zhang***, G. Zhang*, Y. Zhang, W. Fan, Q. Li, S. Liu, S. Chang "Fairness Reprogramming", 36th Conference on Neural Information Processing Systems (NeurIPS'22), [PDF].

[3] G. Zhang*, S. Lu*, **Y. Zhang**, X. Chen, P. Chen, Q. Fan, L. Martie, M. Hong , S. Liu, "Distributed Adversarial Training to Robustify Deep Neural Networks at Scale", 38th Conference on Uncertainty in Artificial Intelligence (*UAI'22 - Oral, Best Paper Runner-up Award*), [PDF], [Code], [Poster], [Slides], [Award].

[4] **Y. Zhang***, G. Zhang*, P. Khanduri, M. Hong, S. Chang, S. Liu, "Fast-BAT: Revisiting and Advancing Fast Adversarial Training through the Lens of Bi-level Optimization", 39th International Conference on Machine Learning (*ICML'22*), [PDF], [Code], [Poster], [Slides], [Talk].

[5] **Y. Zhang***, T. Chen*, Z. Zhang*, S. Chang , S. Liu , Z. Wang "Quarantine: Sparsity Can Uncover the Trojan Attack Trigger for Free", Computer Vision and Pattern Recognition Conference 2022 (*CVPR'22*), [PDF], [Code], [Poster], [Project Website].

Papers under Submission

[6] **Y. Zhang**, R. Cai, T. Chen, G. Zhang, P. Chen, H. Zhang, S. Chang, W. Zhang, S. Liu "Robust Mixture-of-Expert Training for Convolutional Neural Networks", submitted to CVPR 2023.

[7] **Y. Zhang**, P. Sharma, P. Ram, M. Hong, K. R. Varshney, S. Liu "What Is Missing in IRM Training and Evaluation? Challenges and Solutions", [link], submitted to ICLR 2023 (rating 6.67).

[8] B. Hou, J. Jia, **Y. Zhang**, G. Zhang, Y. Zhang, S. Liu, S. Chang "TextGrad: Advancing Robustness Evaluation in NLP by Gradient-Driven Optimization", [link], submitted to ICLR 2023 (rating 6.25).

[9] P. Khanduri, I. Tsaknakis, **Y. Zhang**, J. Liu, S. Liu, J. Zhang, M. Hong "Linearly Constrained Bilevel Optimization: A Smoothed Implicit Gradient Approach", [link], submitted to ICLR 2023 (rating 6.75).

[10] H. Li, S. Zhang, M. Wang, **Y. Zhang**, P. Chen, S. Liu "Theoretical Characterization of Neural Network Generalization with Group Imbalance", [link], submitted to ICLR 2023 (rating 6.6).

Research of Interest

Bilevel Optimization in Deep Learning: Theory, Algorithm, and Application 02 2019 - Present

Bi-level optimization (BLO) is a challenging mathematical problem, while many of the deep learning tasks can be naturally formulated as a BLO and thus, the effective and efficient algorithms to solve BLO is cherished by the research community. My research in this direction are as follows:

- Summarize different BLO formulations and corresponding theories/algorithms in deep learning. Develop a ToolBox for BLO in Python (current work) .
- Design effective and efficient BLO algorithms for specific deep learning tasks, such as pruning [1] and adversarial training [4, 8].
- Provide new perspectives to interpret the current deep learning tasks and possible existing algorithms from the lens of BLO.

Related publications/submissions: [1, 4, 9]

Trustworthy Machine Learning: Robust, Interpretable, and Fair 02 2019 - Present

The robustness of the deep learning models have become a research hotspot in the last decade. However, to build a trustworthy machine learning algorithm requires more than robustness. My research interest in this topic is summarized as follows:

- Design effective, efficient, and scalable robust training algorithm [3, 4, 8] to improve the adversarial robustness.
- Improve the fairness of the model [2].
- Design defense strategy against backdoor attacks [5].

Related publications/submissions: [2, 3, 4, 5, 6, 8]

Tutorials/Invited Talks

- **02/2023**: "Bi-level Optimization in Machine Learning: Foundations and Applications", **AAAI 2023 (Tutorial)**
- **11/2022**: "Invariant Risk Minimization through Bi-level Optimization and Beyond", **Invited Talk in UMN**
- **10/2022**: "Revisiting and Advancing Fast Adversarial Training through the Lens of Bi-level Optimization", **INFORMS Annual Meeting (2022)**
- **04/2022**: "Adversarial Training via Bi-level Optimization", **Invited Talk in UCSB**.

Professional Activities

- **Reviewer**: NeurIPS'22, AISTATS'23, ICLR'23, ICASSP'23, CVPR'23, TMRL
- **TPC** for KDD'22 Workshop 4th Workshop on Adversarial Learning Methods for Machine Learning and Data Mining.
- **Student Chair** for ICML'22 Workshop AdvML: New Frontiers in Adversarial Machine Learning.
- **TPC** for NeurIPS'21 Workshop NFFL: New Frontiers in Federated Learning: Privacy, Fairness, Robustness, Personalization and Data Ownership.

Skills

Programming Languages Python, C++, Java, C
Libraries PyTorch, OpenCV, NumPy, Matplotlib.

Last updated: January 11, 2023.