Kaiyi Ji

Work Address
University at Buffalo
CSE Department
#308G Davis Hall
Buffalo, New York 14260

Contact Information
Email: kaiyiji@buffalo.edu
Gmail: kaiyiji93@gmail.com (preferred)
http: https://cse.buffalo.edu/~kaiyiji/

Current Position

Assistant Professor, Computer Science and Engineering
University at Buffalo, State University of New York, NY, USA *Sep 2022 – Present*
Affiliated with **Institute for Artificial Intelligence and Data Science**

- Research Focus: Fundamental Theories and Algorithms for Machine Learning, Optimization, Deep Learning and Wireless Networking

Education

The Ohio State University **Columbus, OH, USA**
Ph.D., Electrical and Computer Engineering *Sep 2016 – Dec 2021*

- Advisor: Prof. Yingbin Liang
- Thesis: *Bilevel optimization for machine learning: Algorithm design and convergence analysis.* 2021.
- Thesis Committee: Yingbin Liang, Ness B. Shroff, Philip Schniter, Cathy Xia

University of Science and Technology of China **Anhui, China**
B.S., Electronic Engineering and Information Science *Sep 2012 – Jun 2016*

Professional & Industrial Experience

Postdoctoral Research Fellow, Electrical Engineering and Computer Science
University of Michigan, Ann Arbor, MI, USA *Sep 2021 – Sep 2022*
Affiliated Postdoc Member with **NSF AI-EDGE Institute**

- Mentor: Prof. Lei Ying
- Topic: Bilevel Learning for Edge Computing

Visiting Student Research Collaborator, Electrical and Computer Engineering
Princeton University, NJ, USA *Mar 2020 – Apr 2020*

- Mentor: Prof. H. Vincent Poor
- Topic: Optimization Foundations for Meta-Learning

Research Intern (Database Team)
Alibaba DAMO Academy (US Group), CA, USA *May 2019 – Aug 2019*

- Topic: Deep Learning for Database System

Research Interests

- **Hierarchical Machine Learning**: bilevel optimization, meta-learning, hyperparameter optimization, imperative learning
- **Multi-Objective Learning**: multi-objective optimization, multi-task learning, model fusion

- **Knowledge Transfer and Unlearning**: continual learning, fine-tuning, machine unlearning

Grants and Contracts

Summary of Research Funding Since 2023:

Funding Category	Total	My Share
Total Funded Research	$1, 100, 000	$550, 190

Current Funding

- "Collaborative Research: CIF: Small: New Theory, Algorithms and Applications for Large-Scale Bilevel Optimization," Lead PI: Kaiyi Ji, 08/01/2023 - 07/31/2026, CIF program, Division of CCF, $599,739 (my share: 50%)

- "Collaborative Research: Distributed Bilevel Optimization in Multi-Agent Systems," PI: Kaiyi Ji, 08/15/2023 - 07/31/2026, EPCN-Energy-Power-Ctrl-Netwrks, Division of ECCS, $500,000 (my share: 50%)

Publications

Citations: 1623 (h-index: 18, i-index: 29)
Google Scholar: `https://scholar.google.com/citations?user=E0A3lSIAAAAJ&hl=en`
ORCID: orcid.org/0000-0002-9533-0058

Theses

"Bilevel optimization for machine learning: Algorithm design and convergence analysis", Doctoral thesis, The Ohio State University, 2021.

Refereed Proceedings Articles (*presenter name underlined; *: advised student*)

30. Q. Zhang, P. Xiao*, S. Zou, K. Ji. "First-Order Minimax Bilevel Optimization," in *International Conference on Learning Representations* . **[ICLR 2025]**.

29. Y. Yang*, H. Ban*, M. Huang, S. Ma, K. Ji. "Tuning-Free Bilevel Optimization: New Algorithms and Convergence Analysis," in *International Conference on Learning Representations* . **[ICLR 2025]**.

28. Y. Yang*, Z. Si, S. Lyu, K. Ji. "First-Order Minimax Bilevel Optimization," in *Conference on Neural Information Processing Systems*. **[NeurIPS 2024]**.

27. M. Ding*, K. Ji, D. Wang, J. Xu. "Understanding Forgetting in Continual Learning with Linear Regression," in *International Conference on Machine Learning*. **[ICML 2024]**.

26. H. Ban*, K. Ji. "Fair Resource Allocation in Multi-Task Learning," in *International Conference on Machine Learning*. **[ICML 2024]**.

25. P. Xiao*, K. Ji. "Communication-Efficient Federated Hypergradient Computation via Aggregated Iterative Differentiation," in *International Conference on Machine Learning*. **[ICML 2023]**.

24. R. Sharma*, K. Ji, Z. Xu, C. Chen. "AUC-CL: A Batchsize-Robust Framework for Self-Supervised Contrastive Representation Learning," *International Conference on Learning Representations.* **[ICLR 2024]**.

23. P Xiao*, H. Ban*, K. Ji. "Direction-oriented Multi-objective Learning: Simple and Provable Stochastic Algorithms," in *Conference on Neural Information Processing Systems*. [**NeurIPS 2023**].

22. Y. Yang*, P. Xiao*, K. Ji. "SimFBO: Towards Simple, Flexible and Communication-efficient Federated Bilevel Learning," in *Conference on Neural Information Processing Systems*. [**NeurIPS spotlight, 2023**] [**5% acceptance rate**].

21. Y. Yang*, P. Xiao*, K. Ji. "Achieving $O(\epsilon^{-1.5})$ Complexity in Hessian/Jacobian-free Stochastic Bilevel Optimization," in *Conference on Neural Information Processing Systems*. [**NeurIPS 2023**].

20. S. Lin, D. Sow, K. Ji, Y. Liang, N. Shroff. "Non-Convex Bilevel Optimization with Time-Varying Objective Functions," in *Conference on Neural Information Processing Systems*. [**NeurIPS 2023**].

19. J. Hao, K. Ji, M. Liu. "Bilevel Coreset Selection in Continual Learning: A New Formulation and Algorithm," in *Conference on Neural Information Processing Systems*. [**NeurIPS 2023**].

18. K. Ji and Lei Ying. "Network Utility Maximization with Unknown Utility Functions: A Distributed, Data-Driven Bilevel Optimization Approach," International Symposium on Theory, Algorithmic Foundations, and Protocol Design for Mobile Networks and Mobile Computing. [**MobiHoc 2023**].

17. M. Huang*, D. Zhang*, K. Ji. "Achieving Linear Speedup in Non-IID Federated Bilevel Learning," in *International Conference on Machine Learning*. [**ICML 2023**].

16. P. Xiao*, K. Ji. "Communication-Efficient Federated Hypergradient Computation via Aggregated Iterative Differentiation," in *International Conference on Machine Learning*. [**ICML 2023**].

15. D. Sow, K. Ji, Y. Liang. "On the Convergence Theory for Hessian-Free Bilevel Algorithms," in *35nd Conference on Neural Information Processing Systems*. [**NeurIPS, 2022**].

14. K. Ji, M. Liu, Y. Liang, L. Ying. "Will Bilevel Optimizers Benefit from Loops ," in *35nd Conference on Neural Information Processing Systems*. [**NeurIPS spotlight, 2022**] [**5% acceptance rate**].

13. S. Ma, Z. Chen, Y. Zhou, K. Ji, Y. Liang. "Data Sampling Affects the Complexity of Online SGD over Dependent Data ," in *Conference on Uncertainty in Artificial Intelligence*. [**UAI 2022**].

12. J. Yang, K. Ji, Y. Liang. "Provably Faster Algorithms for Bilevel Optimization," in *35nd Conference on Neural Information Processing Systems*. [**NeurIPS spotlight, 2021**] [**3% acceptance rate**].

11. K. Ji, J. Yang, Y. Liang. "Bilevel Optimization: Convergence Analysis and Enhanced Design," in *38th International Conference on Machine Learning*. [**ICML 2021**].

10. K. Ji, J. Lee, Y. Liang, H. Poor. "Convergence of Meta-Learning with Task-Specific Adaptation over Partial Parameters," in *34nd Conference on Neural Information Processing Systems*. [**NeurIPS 2020**].

9. K. Ji, Z. Wang, Y. Zhou, Y. Liang. "History-Gradient Aided Batch Size Adaptation for Variance Reduced Algorithms," *in 37th International Conference on Machine Learning*. [**ICML 2020**].

8. Y. Zhou, Z. Wang, K. Ji, Y. Liang. "Proximal Gradient Algorithm with Momentum and Flexible Parameter Restart for Nonconvex Optimization," *International Joint Conference on Artificial Intelligence*. [**IJCAI 2020**].

7. Z. Guan, K. Ji, D. Bucci Jr, T. Hu, J. Palombo, M. Liston, Y. Liang. "Robust Stochastic Bandit Algorithms under Probabilistic Unbounded Adversarial Attack," in *34th AAAI Conference on Artificial Intelligence*. [**AAAI spotlight, 2020**].

6. Z. Wang, K. Ji, Y. Zhou, Y. Liang, V. Tarokh. "SpiderBoost and Momentum: Faster Stochastic Variance Reduction Algorithms," in *33nd Conference on Neural Information Processing Systems*. [**NeurIPS 2019**].

5. K. Ji, Z. Wang, Y. Zhou, Y. Liang. "Improved Zeroth-Order Variance Reduced Algorithms and Analysis for Nonconvex Optimization," in *36th International Conference on Machine Learning*. [**ICML 2019**].

4. K. Ji, Y. Liang. "Minimax Estimation of Neural Net Distance," in *32nd Conference on Neural Information Processing Systems*. [**NeurIPS 2018**].

3. K. Ji, G. Quan, J. Tan. "Miss Ratio for LRU Caching with Consistent Hashing," in *IEEE International Conference on Computer Communications*, 2018. [**INFOCOM 2018**].

2. G. Quan, K. Ji, J. Tan. "LRU Caching with Dependent Competing Requests," in *IEEE International Conference on Computer Communications*, 2018. [**INFOCOM 2018**].

1. J. Tan, G. Quan, K. Ji, N. Shroff. "On Resource Pooling and Separation for LRU Caching," in *International Conference on Measurement and Modeling of Computer Systems*, 2018. [**SIGMETRICS 2018**]. An extended version has been published in the journal *PACM on Measurement and Analysis of Computing Systems*. [**POMACS 2018**].

Refereed Journal Articles (**: graduate student; $^{+}$: undergraduate student*)

Published

11. M. Huang, K. Ji, S. Ma, L. Lai. "Efficiently Escaping Saddle Points in Bilevel Optimization." Journal of Machine Learning Research, 2025. [**JMLR 2025**]

10. Y. Zhang, Y. Zhou, K. Ji, and M. M. Zavlanos. "Boosting one-point derivative-free online optimization via residual feedback." IEEE Transactions on Automatic Control, 2024. [**TAC 2025**]

9. K. Ji and Y. Liang. "Lower Bounds and Accelerated Algorithms for Bilevel Optimization." Journal of Machine Learning Research 24 (2023): 22-1. [**JMLR 2023**]

8. K. Ji, J. Yang, Y. Liang. "Theoretical Convergence of Multi-Step Model-Agnostic Meta-Learning," Journal of Machine Learning Research, 2021. [**JMLR 2021**]

7. K. Ji, Y. Zhou, Y. Liang. "Understanding Estimation and Generalization Error of Generative Adversarial Networks," IEEE Transactions on Information Theory, 2021. [**TIT 2021**]

6. Y. Zhang, Y. Zhou, K. Ji, M. Zavlanos. "A New One-Point Residual-Feedback Oracle For Black-Box Learning and Control ," Automatica, 2021. [**Automatica 2021**]

5. T. Xu, Y. Zhou, K. Ji, Y. Liang. "When Will Gradient Methods Converge to Max-margin Classifier under ReLU Models ?" Stat, Special Issue of Deep Learning from Statistical Perspective, 2021.

4. K. Ji, J. Tan, Y. Chi, J. Xu. "Learning Latent Features with Pairwise Penalties in Matrix Completion," IEEE Transactions on Signal Processing, 2020. [**TSP 2020**]

In Review

1. D. Sow, K. Ji, Z. Guan, Y. Liang. "A Primal-Dual Approach to Bilevel Optimization with Multiple Inner Minima ," Transaction on Machine Learning Research, In First Review, 2023.

Honors and Awards

CSE Junior Faculty Research Award, UB *2024*

AISTATS Top Reviewer Award *2023*

Presidential Fellowship, OSU (1-3 per department, highest honor for graduates) *2020-2021*

Outstanding Reviewer Award (**Top 8%**) in NeurIPS, ICML *2020, 2021*

University Fellowship, OSU (top honor for fresh graduates) *2016-2019*

Outstanding Student Scholarship (**1st prize**), USTC *2012-2016*

Technical Presentations

Invited Talks

Efficient Bilevel Optimization for Modern Machine Learning

- Computer Science Seminar Series, Johns Hopkins University *Dec 2024*

Federated Bilevel Optimization

- INFORMS Annual Meeting, Seattle *Oct 2024*

Multi-Objective Learning: Algorithms and Opportunities

- CSE Department Advisory Board Meeting, University at Buffalo *Apr 2024*

Bilevel Optimization for Machine Learning: Theory and Algorithms

- ECSE, Rensselaer Polytechnic Institute, NY *Dec 2023*

Bilevel Optimization in Continual Learning

- Asilomar, Pacific Grove, CA *Nov 2023*

Network Utility Maximization via Bilevel Optimization

- ACM MobiHoc, Washington, DC *Oct 2023*

Bilevel Optimization in Continual Learning

- INFORMS Annual Meeting, Phoenix, Arizona *Oct 2023*

Stochastic Bilevel Optimization and Application in Continual Learning

- SIAM Conference on Optimization, Seattle, Washington *Jun 2023*

Bilevel Stochastic Methods for Optimization and Learning

- INFORMS Annual Meeting, Indianapolis, IN *Oct 2022*

Co-organizer and Speaker of Invited Session on "Bilevel Machine Learning"

- Conference on Information Sciences and Systems (CISS) virtually *Mar 2022*

Optimization Theory and Faster Algorithms on Bilevel Learning

- Next Generation Transportation Systems (NGTS) Seminar, virtual *Dec 2021*

Meta-Learning: Theoretical Convergence and Algorithms.

- Presidential Fellowship Winner Seminar, OSU, virtual *Oct 2020*
- University of Michigan, Ann Arbor, virtual *Aug 2021*

Meta-Learning with Task-Specific Adaptation over Partial Parameters.

- Neural Information Processing Systems (NeurIPS), spotlight presentation, virtual *Dec 2020*
- Machine Learning Seminar, OSU *Dec 2020*

Learning Latent Features with Pairwise Penalties in Matrix Completion.

- IEEE SAM invited talk, virtual *Jul 2020*

History-Gradient Aided Batch Size Adaptation.

- International Conference of Machine Learning (ICML), oral presentation, virtual *Jul 2020*

Zeroth-Order (Gradient-Free) Variance Reduced Algorithms.

- Machine Learning Seminar, OSU *May 2019*
- International Conference of Machine Learning (ICML), oral presentation, virtual *Jun 2019*

Minimax Estimation of Neural Net Distance in GANs.

- Machine Learning Seminar, OSU *Oct 2018*

Miss Ratio for LRU Caching with Consistent Hashing.

- IEEE INFOCOM, Honolulu, HI, USA *Apr 2018*

Supervised Students

Dissertations/Theses in Progress

Peiyao Xiao **NY, USA**
Ph.D. student, CSE of University at Buffalo *Jan 2023 – Present*

- Work on multi-objective optimization, bilevel optimization and multi-task learning
- **Achievements:** three papers at NeurIPS 2023 and one paper at ICML 2023

Yifan Yang **NY, USA**
Ph.D. student, CSE of University at Buffalo *Jan 2023 – Present*

- Work on federated learning and bilevel optimization
- **Achievements:** two papers at NeurIPS 2023 with one **spotlight** presentation!

Meng Ding **NY, USA**
Ph.D. student, CSE of University at Buffalo *Jan 2024 – Present*

- Work on continual learning and machine unlearning
- **Achievements:** one paper at ICML 2024

Hao Ban **NY, USA**
Ph.D. student, CSE of University at Buffalo *Jan 2024 – present*

- Work on multi-task learning and large-scale model fusion
- **Achievements:** one paper at NeurIPS 2023 and one paper at ICML 2024

Yujie Zhu **NY, USA**
Ph.D. student, CSE of University at Buffalo *Sep 2024 – present*

- Work on continual learning and LLMs
- **Achievements:** Presidential Fellowship

Gokul Ram Subramani — **NY, USA**
Master Student — *Jun 2024 – Present*
- Work on sparse multi-task learning

Adikavya Gupta — **NY, USA**
Master Student — *Jan 2023 – May 2023*
- graduated with master degree
- Work on online meta-learning
- **Achievements:** completed one project on online meta-learning

Manaswi Mancha — **NY, USA**
Undergraduate Student — *Sep 2024 – Present*
- Work on Kolmogorov-Arnold Networks (KAN) neural networks

Teaching Experience

CSE 676, *Deep Learning* — **University at Buffalo**, *Spring 2024*
- Responsibility: Lecture and instructor

CSE 676, *Deep Learning* — **University at Buffalo**, *Fall 2023*
- Responsibility: Lecture and instructor

CSE 701, *Some Recent Progresses in Machine Learning* — **University at Buffalo**, *Spring 2023*
- Responsibility: Lecture and instructor

CSE 712, *Optimization for Modern Machine Learning* — **University at Buffalo**, *Fall 2022*
- Responsibility: Lecture and instructor

ECE 8001, *Advanced Topics in Communications* — **The Ohio State University**, *Fall 2019*
- Responsibility: Guest Lecturer

ECE 7005, *Information Theory* — **The Ohio State University**, *Spring 2019*
- Responsibility: Guest Lecturer

Professional Activities

Leadership

Conference on Information Sciences and Systems (CISS)
- Co-organizer Invited Session on "Bilevel Machine Learning", 2022

Other Service

Conference Reviewer:
- Artificial Intelligence and Statistics Conference (AISTATS) (top reviewer'23)
- International Symposium on Theory, Algorithmic Foundations, and Protocol Design for Mobile Networks and Mobile Computing (MobiHoc) (TPC member'23)
- Conference on Neural Information Processing Systems (NeurIPS) (19,**top reviewer**'20/21,22,23,24)
- International Conference on Learning Representations (ICLR) (20,21,22,23,24)

- International Conference on Machine Learning (ICML) (19,20, **expert reviewer**'21,22,23,24)
- International Joint Conference on Artificial Intelligence (IJCAI) (20, program committee)
- International Conference on Computer Communications (INFOCOM) (18,19)
- Conference on Measurement and Modeling of Computer Systems (SIGMETRICS) (18,19)
- International Conference on Very Large Data Bases (VLDB) (21)

Journal Reviewer:

- IEEE Transactions on Network Science and Engineering
- IEEE Transactions on Intelligent Systems and Technology
- IEEE Transactions on Information Theory
- IEEE Transactions on Mobile Computing
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Signal Processing
- IEEE/ACM Transactions on Networking
- Stat
- Automatica
- SIAM Journal on Optimization

Membership in Professional and Honor Societies

- MobiHoc, Technical Program Committee, Member, March 2023 - present
- INFORMS, member, August 2023 - present

Membership in Professional and Honor Societies

- MobiHoc, Technical Program Committee, Member, March 2023 - present
- INFORMS, member, August 2023 - present

University Service

Department Committees

- **Committee Member**, Faculty Hiring Committee, September 2024 - Present
- **Associate Chair**, Student Admission Committee, September 2024 - Present
- **Organization Committee Member**, CSExplore Summer Camp, July 10 - 12th, 2024.
- **Chair**, Colloquium + UpBeat Committee, September 2023 - Present
- **Member**, Grad Admissions Committee, September 2023 - Present
- **Member**, Colloquium + UpBeat Committee, September 2022 - May 2023
- **Member**, Grad Admissions Committee, September 2022 - May 2023