Xinwei ZHANG

Ph.D. in Electrical Engineering

Minneapolis, MN Chinese Citizen
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Research Interest

My research focus on contemporary issues in distributed machine learning, including optimization aspect of federated learning, differential privacy for federated learning, and distributed machine learning system design. I am also interested in the inter-discipline of signal processing, machine learning and control theory.

Education Experience

Exp. Aug. 2023 – Sept. 2018 — Ph.D. in Electrical Engineering , University of Minnesota, Minneapolis, MN, U.S.
- Department of Electrical and Computer Engineering
- Doctoral Dissertation Fellowship

GPA : 3.9/4.0

May 2022 – Sept. 2018 — M.S. in Electrical Engineering , University of Minnesota, Minneapolis, MN, U.S.
- Department of Electrical and Computer Engineering

GPA : 4.0/4.0

Jun. 2018 – Sept. 2014 — B.E. in Automation, University of Science and Technology of China, Hefei, Anhui, China
- Department of Automation, School of Information Science and Technology
- Outstanding Undergraduate Dissertation

GPA : 3.30/4.3

Professional Experience

Exp. Aug. 2023 – Exp. May 2023 — Applied Scientist Intern, Amazon Web Services, Inc., Santa Clara, CA. U.S.
- Research on the differentially private optimization for training large neural networks.

Differential Privacy | Optimization | Large-scale Neural Network

Aug. 2022 – May 2022 — Research Intern, MIT-IBM Watson AI Lab, Cambridge, MA, U.S.
- Research on federated learning with graph neural networks.
- Research on Bayesian Optimization with unknown objective and constraints.

Federated Learning | Graph Neural Network | Bayesian Optimization

Sept. 2020 – May 2020 — Research Intern, Alibaba Group (U.S.) Inc., Bellevue, WA, U.S.
- Research on federated learning for training large scale neural networks.

Federated Learning | Large-scale Neural Network

Spring 2022 – Fall 2018 — Graduate Research Assistant, Dept. of ECE, University of Minnesota, Minneapolis, MN, U.S.
- Research on distributed machine learning and federated learning.
- Research on distributed inverter and power grid control

Decentralized Optimization | Federated Learning | Distributed Control | Power Grid Control

May 2021 – Jan. 2021 — Teaching Assistant, Dept. of ECE, University of Minnesota, Minneapolis, MN, U.S.
- EE 3025 - Statistical Methods.

Probability

Aug. 2018 – Mar. 2017 — Undergraduate Research Assistant, Dept. of Automation, University of Science and Technology of China, Hefei, Anhui, China
- Research in embedded machine learning and vision guided UAV control.

Embedded System | UAV control | Computer Vision

Jan. 2018 – Sept. 2017 — Teaching Assistant, Dept. of Automation, University of Science and Technology of China, Hefei, Anhui, China
- C/C++ Programming

Programming

Honors and Awards

Sept. 2022 – May 2023 — Doctoral Dissertation Fellowship
- University of Minnesota.

Dec. 2021 – Dec. 2022 — Meta (Facebook) Research Award - Mathematical Modeling and Optimization for Large-Scale Distributed Systems.
- Meta Platforms, Inc.
- Role : stuent research lead.

Feb. 2020 — Best Student Paper Award (1/43 accepted papers)
- NeurIPS-20 Workshop on Scalability, Privacy, and Security in Federated Learning.

Journal Papers

Accepted — **Zhang, X.**, Hong, M. & Elia, N. *A Unified Framework to Understand Decentralized and Federated Optimization Algorithms : A Multi-Rate Feedback Control Perspective*, SIAM Journal on Optimization, (NeurIPS-2021 Workshop on New Frontiers in Federated Learning. (**Accepted as Contributed Talk**))

2022 — Liu Y., **Zhang X.**, Kang Y., Li L. & Hong M. *FedBCD : A Communication-Efficient Collaborative Learning Framework for Distributed Features*, IEEE Transactions on Signal Processing, 2022, IEEE. `https://ieeexplore.ieee.org/document/9855231`

2021 — **Zhang, X.**, Hong, M., Dhople, S., Yin, W. & Liu, Y. *FedPD : A Federated Learning Framework with Adaptivity to Non-IID Data*, IEEE Transactions on Signal Processing, 2021, IEEE. `https://ieeexplore.ieee.org/document/9556559`, Code : `https://github.com/564612540/FedPD`

2019 — Chang T., Hong M., Wai H., **Zhang X.** & Lu S. *Distributed Learning in the Non-Convex World : From Batch to Streaming Data, and Beyond*, IEEE Signal Processing Magazine Special Issue on Non-Convex Optimization for Signal Processing and Machine Learning, 2019, IEEE. `https://ieeexplore.ieee.org/document/9085431`

Conference Papers

Under Review — **Zhang, X.**, Hong. M, & Chen, J. *GLASU : A Communication-Efficient Algorithm for Federated Learning with Vertically Distributed Graph Data*, Submitted to International Conference on Machine Learning

Under Review — **Zhang, X.**, Yin, W., Hong, M. & Chen, T. *Hybrid Federated Learning for Feature & Sample Heterogeneity : Algorithms and Implementation*, Submitted to International Conference on Machine Learning, also appears in NeurIPS-20 Workshop on Scalability, Privacy, and Security in Federated Learning, 2020, IEEE. Code : `https://github.com/564612540/Hybrid-Federated-Learning`

Under Review — Song, B., Khanduri, P., **Zhang, X.**, Yi, J., & Hong, M. *FedAvg Converges to Zero Training Loss Linearly : The Power of Overparameterized Multi-Layer Neural Networks*, Submitted to International Conference on Machine Learning

2022 — **Zhang, X.**, Song, B., Honarkhah, M., Ding, J., & Hong, M. *Building Large Machine Learning Models from Small Distributed Models : A Layer Matching Approach.* In Workshop on Federated Learning : Recent Advances and New Challenges (in Conjunction with NeurIPS 2022).

2022 — **Zhang, X.**, Hong, M., Dhople S., & Elia, N. *A Stochastic Multi-Rate Control Framework For Modeling Distributed Optimization Algorithms*, International Conference on Machine Learning, 2022. (Accept for Spotlight Presentation) `https://proceedings.mlr.press/v162/zhang22j.html`

2022 — **Zhang, X.**, Chen, X., Hong, M., Wu, Z.S. & Yi, J. *Understanding Clipping for Federated Learning : Convergence and Client-Level Differential Privacy*, International Conference on Machine Learning, 2022. (Accept for Spotlight Presentation) `https://proceedings.mlr.press/v162/zhang22b.html`

2020 — **Zhang X.**, Purba V., Hong M. & Dhople S. *A Sum-of-Squares Optimization Method for Learning and Controlling Photovoltaic Systems*, American Control Conference 2020, IEEE.

2019 — **Zhang X.**, Sartori J., Hong M. & Dhople S. *Implementing First-order Optimization Methods : Algorithmic Considerations and Bespoke Microcontrollers*, Asilomar Conference on Signals, Systems, and Computers, 2019, IEEE.

2019 — Lu S., **Zhang X.**, Sun H. & Hong M. *GNSD : a gradient-tracking based nonconvex stochastic algorithm for decentralized optimization*, IEEE Data Science Workshop, 2019 June, pp. 315-321. IEEE.

2018 — **Zhang X.**, Du Y., Chen F., Qin L. & Ling Q. *Indoor Position Control of a Quadrotor UAV with Monocular Vision Feedback*, Chinese Control Conference, 2018 July, pp. 9760-9765. IEEE.

2018 — Du Y., **Zhang X.**, Qin L., Wu G. & Ling Q. *State estimation of autonomous rotorcraft MAVs under indoor environments*. Chinese Control and Decision Conference, 2018 June, pp. 4420-4424. IEEE.