Ziheng Cheng

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EDUCATION

Ph.D. in Industrial Engineering and Operations Research   Sep, 2024-

UC Berkeley, CA, USA

B.S. in Mathematics   Sep, 2020-Jun, 2024

Peking University, Beijing, China

PUBLICATIONS & MANUSCRIPTS

(* stands for equal contribution)

- Convergence of Distributed Adaptive Optimization with Local Updates
  Ziheng Cheng, *Margalit Glasgow*
  (**ICLR 2025**)

- Functional Gradient Flows for Constrained Sampling
  Shiyue Zhang*,Longlin Yu*, **Ziheng Cheng***, *Cheng Zhang*
  (**NeurIPS 2024**)

- Kernel Semi-Implicit Variational Inference
  Ziheng Cheng*, *Longlin Yu*, Tianyu Xie, Shiyue Zhang, Cheng Zhang*
  (**ICML 2024**)

- Reflected Flow Matching
  Tianyu Xie*, Yu Zhu*, Longlin Yu*, Tong Yang, **Ziheng Cheng**, *Shiyue Zhang, Xiangyu Zhang, Cheng Zhang*
  (**ICML 2024**)

- The Limits and Potentials of Local SGD for Distributed Heterogeneous Learning with Intermittent Communication
  Kumar Kshitij Patel, Margalit Glasgow, Ali Zindari, Lingxiao Wang, Sebastian U Stich, **Ziheng Cheng**, *Nirmit Joshi, Nathan Srebro*
  (**COLT 2024**)

- Momentum Benefits Non-IID Federated Learning Simply and Provably
  Ziheng Cheng*, *Xinmeng Huang*, Pengfei Wu, Kun Yuan*
  (**ICLR 2024**)

- Particle-based Variational Inference with Generalized Wasserstein Gradient Flow
  Ziheng Cheng*, *Shiyue Zhang*, Longlin Yu, Cheng Zhang*
  (**NeurIPS 2023**)

- Joint Graph Learning and Model Fitting in Laplacian Regularized Stratified Models
  Ziheng Cheng*, *Junzi Zhang*, Akshay Agrawal, Stephen Boyd*
  (*preprint, under review*)

RESEARCH EXPERIENCE

Distributed Adaptive Optimization   Jun, 2023 - Oct, 2023

Advisor: Prof. Tengyu Ma, Department of Computer Science, Stanford University

- Studied the benefits of local iterations to reduce communication in distributed setting.
- Proposed a distributed adaptive optimization algorithm based on gradient-clipping and Adam.
- Achieved the convergence result of Adam in distributed setting for the first time.

Optimization Theory of Federated Learning   Mar, 2023 - Jun, 2023

Advisor: Prof. Kun Yuan, Center for Machine Learning Research, Peking University

- Studied the theoretical benefits of momentum in federated learning with heterogeneous clients
- Proved that momentum can accelerate the convergence of FedAvg and Scaffold without additional assumption.
- Achieved the state of the art convergence result under this setting.

Multi-task Learning / Stratified Models   Oct, 2022 - May, 2023

Advisor: Prof. Stephen Boyd, Department of Electrical Engineering, Stanford University

- Studied and improved the method to jointly learn both the graph and the model in Laplacian Regularized stratified models.
- Proposed an optimization algorithm for the joint learning framework and proved its convergence under nonconvex setting.
- Conducted related empirical analysis to validate our method based on both synthetic and real data.

Particle-based Variational Inference   May, 2022 - May, 2023

Advisor: Prof. Cheng Zhang, School of Mathematical Sciences, Peking University

- Studied general Wasserstein gradient flow in probability space to propose a general particle-based VI algorithm with functional gradient.
- Established the first convergence guarantee of particle-based VI in this setting and exhibited the advantages over traditional sampling methods such as Langevin Monto Carlo.
- Conducted numerical experiments on Bayesian inference and confirmed the effectiveness of our method.

AWARDS AND HONORS

Awards
- Honorable Mention in Alibaba Global Mathematics Competition   2022, 2023
- Bronze Medal in S.-T. Yau College Student Mathematics Contest   2022
- Meritorious Winner in Mathematical Contest in Modeling   2022

Honors
- May-Fourth Scholarship (top scholarship in Peking University, 0.5%)   2023
- National Scholarship (top 0.2% nation-wide)   2021
- Merit Student of Peking University   2021-2023