Ziheng Cheng

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EDUCATION

B.S. in Mathematics Sep, 2020-Jun, 2024 (Expected)

Peking University, Beijing, China

- GPA: 3.892/4.0, Ranking: 3/50.
- Selected Coursework: Mathematical Analysis III (99), Linear Algebra I (100), Real Analysis (99), Abstract Algebra (99.5), Probability Theory (94), Mathematical Statistics (96), Measure Theory (99), Optimization Methods (96), Data Structure and Algorithm (95).
- Graduate Courses: High-Dimensional Probability (99), Deep Learning and Reinforcement Learning (91), Bayesian Theory and Computation (95).

PUBLICATIONS

(* stands for equal contribution)

- **Momentum Benefits Non-IID Federated Learning Simply and Provably** *(preprint, under review)*
  Ziheng Cheng, Xinmeng Huang*, Pengfei Wu, Kun Yuan*
- **Particle-based Variational Inference with Generalized Wasserstein Gradient Flow** *(NeurIPS 2023)*
  Ziheng Cheng, Shiyue Zhang*, Longlin Yu, Cheng Zhang*
- **Joint Graph Learning and Model Fitting in Laplacian Regularized Stratified Models** *(preprint, under review)*
  Ziheng Cheng, Junzi Zhang*, Akshay Agrawal, Stephen Boyd*

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 an distributed adaptive optimization algorithm based on gradient-clipping and Adam.
- Achieved the state of the art convergence result under this setting.

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.

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 2021

Honors

- May-Fourth Scholarship (top scholarship in School of Mathematical Sciences) 2023
- State Scholarship 2021
- Merit Student of Peking University 2021-2023

TECHNICAL SKILLS

- Programming: Python, Matlab, Latex