Guixian Chen

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Education

University of Michigan, Ann Arbor — Ann Arbor, Michigan
Ph.D. of Industrial and Operations Engineering — *Aug. 2023 – Present*

University of Michigan, Ann Arbor — Ann Arbor, Michigan
Master of Statistics — *Aug. 2021 – April. 2023*

Peking University — Beijing, China
Bachelor of Mathematics — *Sept. 2017 – June. 2021*

Research

Robust Low-rank Covariance Matrix Estimation — Univerisity of Michigan, Ann Arbor
Supervisor: Assistant Professor Salar Fattahi, Ph.D. — *Aug. 2023 – present*

- Develop a robust, efficient and easy-to-implement covariance matrix estimation algorithm under the adversarial contamination model, achieving the sub-optimal rate of accuracy.
- Establish a rank search approach based on incremental learning.
- Extend the algorithm to the de-centralized setting, showing its robustness against Byzantine attacks.
- Implement and compare our algorithm and other competitive covariance estimation estimation algorithms under different corruption patterns and heavy-tailed distributions.

Master Thesis

Distributed Statistical Learning — Univerisity of Michigan, Ann Arbor
Collaborators: Yumeng Wang, Ziwei Zhu, Yichen Zhang — *May. 2022 – April. 2023*

- Develop the one-step Newton's type distributed learning algorithm to improve the communication efficiency while keeping the statistical efficiency based on existing distributed one-step approach.
- Prove the mean square error bound of our averaging Newton estimator theoretically and introduce the ridge penalty to local Hessian Matrix in order to stabilize the performance of estimator numerically.
- Extend the one-step distributed algorithm to multi-step scenario and mathematically prove the convergence rate, as well as introduce subsampling technique to further sharpen the rate.
- Establish Newton's type distributed algorithm in high-dimensional context based on debiasing strategy so as to boost generality of the algorithm.
- Implement and compare our estimator and other competitive distributed estimators under multiple settings, which shows the superiority of our estimator.

Undergraduate Thesis

Numerical Methods for Fractional Laplacian — Peking University
Supervisor: Assistant Professor Shuonan Wu, Ph.D. — *Feb. 2021 – June. 2021*

- This paper is a literature review about a special class of Fractional Laplace equation and corresponding numerical methods, where the fractional order Poisson problem over a finite region is studied.
- This paper uses three different numerical methods to solve the research problem and discusses them from different perspectives such as algorithm implementation and error estimation.
- The numerical experimental part of the paper mainly examines the one-dimensional case of the research problem and provides preliminary measurements of the error and convergence rate of each numerical method.

Awards

- Scholarship of YiZheng Alumni, School of Mathematical Sciences, Peking University, *Sept. 2018 – June. 2019*
- Gold medal of the 32nd Chinese Mathematical Olympiad (CMO), *Nov. 2016*

Skills

Languages: Python · Matlab · R · Bash · Git · LaTeX
Frameworks: PyTorch · Tensorflow · Keras · NumPy · pandas · SciPy · scikit-learn · CVX · Gurobi · Mosek