Xin Zhang

Ph.D. student in Statistics

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Research Interests

Statistical Machine Learning, Statistical Computation, Clustering Analysis, Differential Privacy, Distributed Optimization, Deep Learning, Reinforcement Learning.

Education

Iowa State University, Ames, IA *08/2016 - 05/2021*
Ph.D. student, Statistics
Advisors: Prof. Zhengyuan Zhu (STAT Dept.) and Prof. Jia Liu (CS Dept.)

Iowa State University, Ames, IA *08/2016 - 12/2018*
Master of Science, Statistics
Advisor: Prof. Zhengyuan Zhu

Fudan University, Shanghai, China *09/2012 - 06/2016*
Bachelor of Science, Mathematics and Applied Mathematics

Research Projects

Spatial Coefficient Clustering Analysis for MODIS Data
Supervisors : Prof. Zhengyuan Zhu and Prof. Jia Liu *01/2019 - Current*

- Developed an adaptive fused-lasso coefficient clustering approach for clustering spatial regression model.
- Design a decentralized alternating direction method of multiplier algorithm for parallelly computing.
- Applied the clustering models on the MODIS Data to find the spatial group patterns.

Divide and Conquer approach for Large-Scale Spatial Data
Supervisors : Prof. Zhengyuan Zhu *09/2018 - 12/2018*

- Studied the Divide and Conquer approach for the estimation of the spatial covariance parameter.
- Developed the distributed adaptive method for the large-scale spatial semiparapetric linear model.
- Proposed the Block partition method to improve the efficiency of the nonparametric estimation.

Network Optimization: Efficient Communication and Data Privacy
Supervisor : Prof. Jia Liu *06/2018 - Current*

- Proposed the differential compression decentralized graident descent algorithm.
- Designed ternary/sparse-hybird operator to maximally reduce the communication load.
- Developed the differentially private network algorithm for the empirical risk minimization.

Distributed Algorithms for Large-Scale Empirical Risk Minimization
Supervisor : Prof. Jia Liu *12/2017 - Current*

- Analyzed the Distributed Stochastic Gradient Descent (SGD) with stale information on non-convex empirical risk minimization.
- Developed the Lipschitz-inspired coordinate-wise median SGD to mitigate Byzantine attacks in distributed deep learning.
- Proposed the multi-hierarchical signSGD for efficient communication and robust deep learning.

Deep Learning on Road Image Segmentation
Supervisor : Prof. Zhengyuan Zhu; With Lei Zhou, Haozhe Zhang *11/2017 - 08/2018*

- Applied deep learning methods (Unet and GANs) to detect new roads from the NRI satellite images.
- Preliminary Result: 80% accuracy is achieved based on Unet model but the continuity of detected roads cannot be gauranteed.

Spatial Weak Signal Detection for FMRI

Supervisor : Prof. Zhengyuan Zhu *12/2016 - 05/2018*

- Proposed a detection method (Spatial CUSUM) to detect weak spatial signals based on the CUSUM procedure and false discovery rate control.
- Developed theoretical properties of the method showing the abnormal region can identified w.h.p.
- Applied to fMRI data to identify the active regions.
- Main Result: more irregular weak spatial signals are detected in the fMRI images compared to some existing methods.

Publications

- **Zhang, X.**, Liu, J., Zhu, Z., and Bentley, E. S. (2019). Communication-Efficient Network-Distributed Optimization with Differential-Coded Compressors. Accepted by *IEEE INFOCOM 2020.*
- **Zhang, X.**, Liu J. and Zhu, Z.. Distributed Linear Model Clustering over Networks: A Tree-Based Fused-Lasso ADMM Approach. arXiv preprint arXiv:1905.11549 (2019).
- Yang, H., **Zhang, X.**, Fang M. and Liu J. Byzantine-Resilient Stochastic Gradient Descent for Distributed Learning. Accepted by *IEEE CDC 2019.*
- **Zhang, X.**, Liu, J., Zhu, Z. and Bentley, E.S., 2019, April. Compressed Distributed Gradient Descent: Communication-Efficient Consensus over Networks. In *IEEE INFOCOM 2019-IEEE Conference on Computer Communications* (pp. 2431-2439). IEEE.
- **Zhang, X.**, Zhu, Z., 2019. Spatial CUSUM for Signal Region Detection. arXiv preprint arXiv:1904.03246.
- **Zhang, X.**, Liu, J. and Zhu, Z., 2018. Taming Convergence for Asynchronous Stochastic Gradient Descent with Unbounded Delay in Non-Convex Learning. arXiv preprint arXiv:1805.09470.
- **Zhang, X.**, Li, L., Ng, M.K. and Zhang, S., 2017. Drug–target interaction prediction by integrating multiview network data. *Computational biology and chemistry*, 69, pp.185-193.
- **Zhang, X.**, Gao, W.G. and Su, Y., 2015. Electricity consumer archetypes study based on functional data analysis and k-means algorithm. *Power System Technology*, 39, pp.3153-3162.

Papers In Progress

- Private and Communication-Efficient Edge Learning: A Sparse Differential Gaussian-Masking Distributed SGD Approach.

Awards

- **The Holly C. and E. Beth Fryer Award**, Department of Statistics, Iowa State University, 2018. This award is for a top second-year Ph.D. student in the department.
- **Outstanding Graduate of Fudan Unversity**, Fudan University, 2016.
- **First Prize of the scholarship for Outstanding Students at Fudan University** (5%), Fudan University, 2015.
- **Third Prize of the scholarship for Outstanding Students at Fudan University** , Fudan University, 2013-2014.

Skills

Projects in: R, Python, Matlab, LATEX, Markdown.
Familiar with: Unix shell, SAS, SQL, HTML, Microsoft Office, Tensorflow, Pytorch.
Language: Proficient in English. Native in Chinese.