Guannan Liang

Contact Information

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Research Interests

Machine Learning; Mathematical Optimization; Statistics; Federated Learning;Differential Privacy; Deep Learning; Recommender System.

Education

University of Connecticut, Storrs, CT *January 2016 ∼ May 2021*
Ph.D. in Machine Learning, Department of Computer Science and Engineering
Advisor: Dr. Jinbo Bi

University of California, Davis, CA *September 2014 ∼ December 2015*
M.S.in Statistics, Department of Statistics

Zhengzhou University, Zhengzhou, PRC *September 2009 ∼ June 2013*
B.S. in Mathematics, School of Mathematics and Statistics

Professional Experience

Teaching Assistant for Intro to Computer Architecture *January 2021 ∼ May 2021*

- Hold office hours and labs, answer questions on Piazza, and help students debug MIPS code.
- Collaborating with other TAs to implement more efficient ways to coordinate classes for over a hundred students online.

Research Intern at Rakuten USA, CA *September 2020 ∼ December 2020*

- Focus on developing new recommender system with cold start item. SharedNetwork model, which is compact and can be trained faster. For CiteULike data, the number of training epochs decreased by 80% compared to Hybrid Neural Collaborative Filtering methods
- Proposed SharedNetwork_attention model to further improve the performance of item cold start recommender system. The test recall increased by 3% compared to Dropoutnet for CiteULike data.

Research Assistant at Laboratory of Machine Learning & Health Informatics, UCONN *January 2016 ∼ May 2021*

- Developed new machine learning algorithms, such as efficient sparse learning algorithms (AAAI2020&ICDM2020), stochastic contextual bandit algorithm (AAAI2021), differential private (DP) distributed ADMM algorithms (CIKM2020&AAAI2021), matrix completion algorithm for recommender systems (Neurips 2016), parallel Quasi-Newton algorithm(Parallel Computing 2021), efficient Adam algorithms,and federated learning algorithms.
- Collaborate across labs to identify new composite traits for alcohol dependence.

Graduate Assistant at Eversource Energy Center, UCONN *May 2017 ∼ May 2021*

- Proposed new machine learning and deep learning methods to improve the performance of existing operational system, such as LSTM model to capture the sequence information in weather.
- Implemented weather forecasting (WRF 3.7, WRF 3.8 and ICLAMS systems) , Flooding forecasting (CREST system) and machine learning models for power

outage predictions for Eversource Energy (CT, MA, NH areas) and The United Illuminating Company (UI) on the HPC resources at UConn.

Projects   Effective algorithms for non-convex non-smooth regularized learning problems (Publication [7])

- Proposed a group of stochastic proximal gradient methods based on arbitrary sampling to solve a family of non-convex non-smooth regularized empirical risk minimization problems.
- Presented a new analytic approach to investigate the convergence and computational complexity of the proposed methods, which helps compare the different sampling schemes.

Faster algorithm for nonconvex sparse learning problems (Publication [2])

- Proposed a hard thresholding method based on stochastically controlled stochastic gradients (SCSG-HT) to solve a family of sparsity-constrained empirical risk minimization problems.
- Proved that the new method has a strong guarantee to recover the optimal sparse estimator and its computational complexity is independent of sample size n, which enhances the scalability.

Effective ADAM-type optimizers to speed up (Federated) Deep Learning training process (Preprints [12, 13])

- Designed a new (Fed) ADAM-typed method by calibrating the A-LR with a softplus function.
- Conducted experiments to show that the proposed methods outperform existing (Fed)ADAM-typed methods and generalize even better than S-Momentum in multiple deep learning tasks.

Matrix completion problem with application in recommender system (Publication [8])

- Proposed a new algorithm which utilize side information to improve existing matrix completion methods.
- Designed experiments show that our new proposed approach outperforms three state-of-the-art methods both in simulations and on real world datasets.

Multi-party differential private machine learning algorithms with privacy guarantees (Publications [1, 5, 10])

- Developed differentially private decentralized ADMM algorithms.
- Designed stochastic differentially private hard thresholding algorithms for non-convex sparse learning problems.

Prediction of weather-caused power outages for Connecticut, Massachusetts and New Hampshire (Publication [6])

- Developed outage prediction model (OPM) for thunderstorm, extratropical storms and snow event, via building models based on numerical weather prediction outputs, leaf area index (LAI), infrastructure, land cover, soil type, elevation and spatial information of historical outage.

Conference and Journal Publications

(1) Jiahao Ding, Guannan Liang, Jinbo Bi and Miao Pan. "Differentially Private and Communication Efficient Collaborative Learning." In Proceedings of the AAAI Conference on Artificial Intelligence. 2021.(AAAI 2021)

(2) Tan Zhu, Guannan Liang, Chun Jiang Zhu and Jinbo Bi. "Adaptive Strategies for Deep Stochastic Contextual Bandits." In Proceedings of the AAAI Conference on Artificial Intelligence. 2021.(AAAI 2021)

(3) Tong, Qianqian, Guannan Liang, Xingyu Cai, Chunjiang Zhu, and Jinbo Bi. "Asynchronous parallel stochastic Quasi-Newton methods." Parallel Computing 101 (2021): 102721.

(4) Guannan Liang, Qianqian Tong, Jiahao Ding, Miao Pan and Jinbo Bi. "Effective Proximal Methods for Non-convex Non-smooth Regularized Learning." In 2020 IEEE International Conference on Data Mining (ICDM), pp. 342-351. IEEE, 2020.

(5) Ding, Jiahao, Jingyi Wang, Guannan Liang, Jinbo Bi, and Miao Pan. "Towards Plausible Differentially Private ADMM Based Distributed Machine Learning." In Proceedings of the 29th ACM International Conference on Information & Knowledge Management, pp. 285-294. 2020.

(6) Alpay, Berk A., David Wanik, Peter Watson, Diego Cerrai, Guannan Liang, and Emmanouil Anagnostou. "Dynamic modeling of power outages caused by thunderstorms." Forecasting 2, no. 2 (2020): 151-162.

(7) Guannan Liang, Qianqian Tong, Chunjiang Zhu, and Jinbo Bi. "An Effective Hard Thresholding Method Based on Stochastic Variance Reduction for Nonconvex Sparse Learning." In Proceedings of the AAAI Conference on Artificial Intelligence, vol. 34, no. 02, pp. 1585-1592. 2020.(AAAI 2020)

(8) Lu, Jin, Guannan Liang, Jiangwen Sun, and Jinbo Bi. "A sparse interactive model for matrix completion with side information." Advances in neural information processing systems 29 (2016): 4071. (Neurips 2016)

(9) Shaochun Chen, Guannan Liang and Hongru Chen , The Convergence of Zienkiewicz Element Under Un-anisotropic Grid, Mathematica Numerica Sinica (2013)

Preprints and Manuscripts Under Review

(10) Guannan Liang, Qianqian Tong, Jinbo Bi. Stochastic Privacy-Preserving Methods for Nonconvex Sparse Learning, submitted to Information Sciences.

(11) Guannan Liang, Qianqian Tong, Chun Jiang Zhu and Jinbo Bi. Escaping Saddle Points with SCSG Methods, arXiv(2021).

(12) Qianqian Tong, Guannan Liang and Jinbo Bi, Calibrating the Adaptive Learning Rate to Improve Convergence of ADAM , submitted to Neurocomputing

(13) Qianqian Tong, Guannan Liang and Jinbo Bi, Effective Federated Adaptive Gradient Methods with Non-IID Decentralized Data, arXiv(2020)

(14) Qianqian Tong, Guannan Liang, Tan Zhu, Jinbo Bi. Federated Nonconvex Sparse Learning, arXiv(2021)

Certificates	National Computer Rank Examination Database Engineer Certificate (China, 2011) National Computer Rank Examination C Language Certificate (China, 2010)
Honors	Research Fellowship, Department of Computer Science and Engineering, UCONN, 2020 Doctoral Student Travel Fellowship, University of Connecticut, 2020 Eversource Energy Center Graduate Fellowship, University of Connecticut, 2017-2020 Merit Student Scholarship, Zhengzhou University, 2010-2013 Natural Sciences 1st Prize in Zhengzhou University, National College Student Challenge Cup Competition, 2013 Outstanding Graduate of Zhengzhou University, 2013 Outstanding Student Union Leader of Zhengzhou University, 2012 Outstanding University Student of Henan Province, 2012
Professional Services	Program Committee Member of IJCAI 2021 Program Committee Member of AAAI 2021
Technical Presentations	○ Efficient and Privacy-preserving Algorithms for Nonconvex Sparse Learning Problems. At **University of Connecticut 2021**. ○ Effective Proximal Methods for Non-convex Non-smooth Regularized Learning. At **ICDM 2020**. ○ An Effective Hard Thresholding Method Based on Stochastic Variance Reduction for Nonconvex Sparse Learning. At **AAAI 2020**.