

Nachuan Xiao

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Education

Academy of Mathematics and Systems Sciences

Chinese Academy of Sciences, Beijing, China

September 2016 – June 2021

Ph.D. in Computational Mathematics

Advisor: Prof. Ya-xiang Yuan

School of Mathematical Science

Fudan University, Shanghai, China

September 2012 – June 2016

B.S. in Mathematics

Academic Experience

Institute of Operations Research and Analytics (IORA)

National University of Singapore, Singapore

August 2021 – present

Research Fellow

Advisor: Prof. Kim-Chuan Toh

Research Interests

- Optimization over Riemannian manifolds
- Nonsmooth optimization
- Constrained optimization

My research interests include numerical methods for optimization problems on Riemannian manifolds arisen from statistics and machine learning problems. I am also interested in designing algorithms for minimizing nonsmooth functions with constraints, especially for those problems related to deep learning.

Publications

1. **Nachuan Xiao**, Xin Liu*, Ya-xiang Yuan, Exact penalty function for $\ell_{2,1}$ norm minimization over the Stiefel manifold, *SIAM Journal on Optimization*, 2021, 31(4): 3097-3126. (link)
2. **Nachuan Xiao**, Xin Liu*, Ya-xiang Yuan, A class of smooth exact penalty function methods for optimization problems with orthogonality constraints. *Optimization Methods and Software*, 2022, 37:4, 1205-1241. (link)
3. **Nachuan Xiao**, Xin Liu, Kim-Chuan Toh*, Dissolving constraints for Riemannian optimization, *Mathematics of Operations Research* (to appear). (link)
4. Xiaoyin Hu, **Nachuan Xiao***, Xin Liu, Kim-Chuan Toh, An improved unconstrained approach for bilevel optimization, *SIAM Journal on Optimization*, 2023, 33(4): 2801-2829. (link)
5. **Nachuan Xiao**, Xin Liu*, Solving optimization problems over the Stiefel manifold by smooth exact penalty function, *Journal of Computational Mathematics* (to appear). (link)
6. Xiaoyin Hu, **Nachuan Xiao***, Xin Liu, Kim-Chuan Toh, A constraint dissolving approach for nonsmooth optimization over the Stiefel manifold, *IMA Journal on Numerical Analysis* (to appear). (link)
7. Xiaoyin Hu, **Nachuan Xiao***, Xin Liu, Convergence Properties of Stochastic Proximal Subgradient Method in Solving a Class of Composite Optimization Problems with Cardinality Regularizer, *Journal of Industrial and Management Optimization*(to appear). (link).

Preprints

1. Xin Liu, **Nachuan Xiao***, Ya-xiang Yuan, A penalty-free infeasible approach for a class of nonsmooth optimization problems over the Stiefel manifold, submitted. arXiv:2103.03514

2. **Nachuan Xiao**, Xiaoyin Hu*, Xin Liu, Kim-Chuan Toh, CDOpt: A Python package for a class of Riemannian optimization, submitted. arXiv:2212.02698
3. **Nachuan Xiao**, Xin Liu*, Kim-Chuan Toh, A partial exact penalty function approach for constrained optimization, submitted. arXiv:2304.01467
4. Tianyun Tang, Kim-Chuan Toh, **Nachuan Xiao***, Yinyu Ye, A Riemannian dimension-reduced second order method with application to sensor network localization, submitted. arXiv:2304.10092
5. **Nachuan Xiao**, Xiaoyin Hu*, Xin Liu, Kim-Chuan Toh, Adam-family methods for nonsmooth optimization with convergence guarantees, submitted. arXiv:2305.03938
6. **Nachuan Xiao**, Xiaoyin Hu*, Kim-Chuan Toh, Convergence Guarantees for Stochastic Subgradient Methods in Nonsmooth Nonconvex Optimization, submitted. arXiv:2307.10053
7. Kuangyu Ding, **Nachuan Xiao***, Kim-Chuan Toh, Adam-family Methods with Decoupled Weight Decay in Deep Learning, submitted. arXiv:2310.08858

Software

- CDOpt: A Python Package for a Class of Riemannian Optimization. (website)
- STOP: A toolbox for STiefel manifold OPTimization. (website)

Presentations

- The 8th Youth Symposium on Scientific and Engineering Computing of Scientific Computing Forum, 2022.12, Beijing, China.
- The 17th Annual Meeting of China Society for Industrial and Applied Mathematics, 2019.09, Foshan, China.
- The 12th International Conference on Numerical Optimization and Numerical Linear Algebra, 2019.04, Shangrao, China.

Honors & Awards

- Second Prize in Tianchi Competition on Algorithm Design for Fabric Packing Problems (2/832).
- Excellence Award in Alibaba Global Mathematics Competition, 2018.

Referred Journals

- Mathematical Programming Computation.
- SIAM Journal on Optimization.
- Journal of Industrial and Management Optimization.
- Journal of Scientific Computation.
- Journal of Global Optimization