Qing Qu

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Research Interest

Data Science, Optimization, Machine Learning, Signal Processing, and Computational Imaging.

PROFESSIONAL EXPERIENCE

Assistant Professor Jan. 2021 – present
ECE division of EECS Dept., University of Michigan - Ann Arbor, MI, USA

Moore-Sloan Research Fellow Dec. 2018 – Dec. 2020
Center for Data Science, New York University, NY, USA
non-tenure track research assistant professor position

Research Intern May 2016 – Aug. 2016
Microsoft Research, Redmond, WA, USA
Machine learning group, Advisor: Xiao Lin

Research Assistant Jun. 2012 – Aug. 2013
U.S. Army Research Laboratory, Adelphi, MD, USA
Hyperspectral imaging analysis, Advisor: Nasser M. Nasrabadi

EDUCATION

Ph.D. Electrical Engineering Oct. 2018
Columbia University in the City of New York, New York, USA
Thesis: Nonconvex recovery of low-dimensional models [link], Advisor: Prof. John N. Wright

M.S.E. Electrical & Computer Engineering May 2013
Johns Hopkins University, Baltimore, USA
Research focus: compressed sensing and sparse representations, Advisor: Prof. Trac D. Tran

B.E. Electronic Engineering Jul. 2011
Tsinghua University, Beijing, China

HONORS AND AWARDS

Top Reviewer for NeurIPS & ICML 2018-2020
Recognized as top 33% reviewer for ICML'20, top 400 (10%) reviewer for NeurIPS'19, and top 30% reviewer for NeurIPS'18

NYU Moore-Sloan Data Science Fellowship 2018 – present

Microsoft Research Ph.D. Fellowship Sept. 2016 – May 2018
Only 12 Ph.D. graduate students in EECS across North Amercia were awarded annually.

Best Student Paper Award in SPARS'15 2015
Joint with Ju Sun and John Wright

Dean Robert H. Roy Fellowship 2011
Prestigious fellowship from the Whiting School of Engineering, the Johns Hopkins University

First Class Award for Student Research Training 2010
Awarded for top 3 of over 700 undergraduate research projects across school, Tsinghua University

Project: sparse signal recovery for compressed sensing, Advisor: Prof. Yuantao Gu

Huang Yi-Cong, Kangli Scholarship 2009

The top academic award for top 25/300 in Electronic Engineering, Tsinghua University

PUBLICATIONS

Total citations: 1341, H-index: 13, according to Google Scholar as of December 12, 2020. Please refer to my Google Scholar [link] for updated citations. Published in top journals such as FoCM (1), IEEE TIT (4), IEEE JSTSP (1), and top ML conferences such as NeurIPS (4), ICML (1), ICLR (2).

Preprints

[1] Chong You†, Zhihui Zhu†, **Qing Qu**, and Yi Ma. Robust recovery via implicit bias of discrepant learning rates for double over-parameterization. *In Submission*, 2020 [link] [pdf].

[2] Yuqian Zhang, **Qing Qu**, and John Wright. Geometry and symmetry in nonconvex optimization. *In Submission to Proceedings of IEEE*, 2020 [link] [pdf].

[3] **Qing Qu**†, Zhihui Zhu†, Xiao Li, M. C. Tsakiris, John Wright, and René Vidal. Finding the sparsest vectors in a subspace: theory, algorithms, and applications. *In Submission to IEEE Signal Processing Magazine*, 2020 [link] [pdf].

[4] **Qing Qu**, Yuexiang Zhai, Xiao Li, Yuqian Zhang, and Zhihui Zhu. Analysis of the optimization landscapes for overcomplete representation learning. *Submitted to Foundations of Computational Mathematics*, 2020 (ICLR'20 **oral, full review score, top 48/2598 ≈ 1.9%**) [link] [pdf].

[5] Yenson Lau†, **Qing Qu**†, Han-Wen Kuo, Pengcheng Zhou, Yuqian Zhang, and John Wright. Short-and-sparse deconvolution — A geometric approach. *In Submission to IEEE Trans. on Pattern Analysis & Machine Intelligence (accepted at ICLR'20)*, 2020 [link] [pdf] [code] [website].

[6] Ju Sun, **Qing Qu**, and John Wright. When are nonconvex problems not scary? *arXiv preprint arXiv:1510.06096*, 2016 [link] [pdf].

† indicates equal contributions.

Journals

[1] Xiao Li†, Shixiang Chen†, Zengde Deng, **Qing Qu**, Zhihui Zhu, and Anthony Man Cho So. Riemannian algorithms for nonsmooth optimization over Stiefel manifold. *Major Revision at SIAM Journal on Optimization*, 2020 [link] [pdf] [code].

[2] **Qing Qu**, Xiao Li, and Zhihui Zhu. Exact recovery of multichannel sparse blind deconvolution via gradient descent. *Accepted at SIAM Journal on Imaging Sciences*, 2020 (NeurIPS'19 **spotlight, top 200/6743 ≈ 3%**) [link] [pdf] [code].

[3] **Qing Qu**, Yuqian Zhang, Yonina C. Eldar, and John Wright. Convolutional phase retrieval via gradient descent. *IEEE Trans. on Information Theory*, 66(3):1785–1821, 2020 [link] [pdf].

[4] Ju Sun, **Qing Qu**, and John Wright. A geometric analysis of phase retrieval. *Foundations of Computational Mathematics*, 18(5):1131–1198, 2018 [link] [pdf].

[5] **Qing Qu**, Ju Sun, and John Wright. Finding a sparse vector in a subspace: Linear sparsity using alternating directions. *IEEE Trans. on Information Theory*, 62(10):5855–5880, 2016 [link] [pdf].

[6] Ju Sun, **Qing Qu**, and John Wright. Complete dictionary recovery over the sphere I: Overview and the geometric picture. *IEEE Trans. on Information Theory*, 63(2):853–884, 2016 [link] [pdf].

[7] Ju Sun, **Qing Qu**, and John Wright. Complete dictionary recovery over the sphere II: Recovery by Riemannian trust-region method. *IEEE Trans. on Information Theory*, 63(2):885–914, 2016 [link] [pdf].

[8] **Qing Qu**, Nasser M. Nasrabadi, and Trac D. Tran. Subspace vertex pursuit: A fast and robust near-separable nonnegative matrix factorization method for hyperspectral unmixing. *IEEE Journal of Selected Topics in Signal Processing*, 9(6):1142–1155, 2015 [link] [pdf].

[9] **Qing Qu**, Nasser M. Nasrabadi, and Trac D. Tran. Abundance estimation for bilinear mixture models via joint sparse and low-rank representation. *IEEE Trans. on Geoscience and Remote Sensing*, 52(7):4404–4423, 2013 [link] [pdf].

[10] Xiaoxia Sun, **Qing Qu**, Nasser M. Nasrabadi, and Trac D. Tran. Structured priors for sparse-representation-based hyperspectral image classification. *IEEE Geoscience and Remote Sensing Letters*, 11(7):1235–1239, 2013 [link] [pdf].

[11] Jian Jin, **Qing Qu**, and Yuantao Gu. Robust zero-point attraction least mean square algorithm on near sparse system identification. *IET Signal Processing*, 7(3):210–218, 2013 [link].

[12] **Qing Qu**, Jian Jin, and Yuantao Gu. An improved l_0-LMS algorithm for sparse system identification. *Journal of Electronics and Information Technology*, 33(3):604–609, 2011 [link].

Conference Proceedings

[1] Chong You†, Zhihui Zhu†, **Qing Qu**, and Yi Ma. Robust recovery via implicit bias of discrepant learning rates for double over-parameterization. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2020 (**spotlight, top 4%**) [link].

[2] **Qing Qu**, Yuexiang Zhai, Xiao Li, Yuqian Zhang, and Zhihui Zhu. Geometric analysis of nonconvex optimization landscapes for overcomplete learning. In *International Conference on Learning Representations (ICLR)*, 2020 (**oral, the highest review score, top 1.9%**) [Link].

[3] Yenson Lau†, **Qing Qu**†, Han-Wen Kuo, Pengcheng Zhou, Yuqian Zhang, and John Wright. Short and sparse deconvolution — A geometric approach. In *International Conference on Learning Representations (ICLR)*, 2020 [Link].

[4] **Qing Qu**, Xiao Li, and Zhihui Zhu. A nonconvex approach for exact and efficient multichannel sparse blind deconvolution. In *Advances in Neural Information Processing Systems (NeurIPS)*, 2019 (**spotlight, top 3%**) [Link].

[5] **Qing Qu**, Yuqian Zhang, Yonina Eldar, and John Wright. Convolutional phase retrieval. In *Advances in Neural Information Processing Systems (NeurIPS)*, pages 6086–6096, 2017 [Link].

[6] Ju Sun, **Qing Qu**, and John Wright. A geometric analysis of phase retrieval. In *2016 IEEE International Symposium on Information Theory (ISIT)*, pages 2379–2383. IEEE, 2016 [Link].

[7] Ju Sun, **Qing Qu**, and John Wright. Complete dictionary recovery using nonconvex optimization. In *International Conference on Machine Learning (ICML)*, pages 2351–2360, 2015 [link].

[8] Ju Sun, **Qing Qu**, and John Wright. Complete dictionary recovery over the sphere. In *2015 International Conference on Sampling Theory and Applications (SampTA)*, 2015 [link].

[9] **Qing Qu**, Ju Sun, and John Wright. Finding a sparse vector in a subspace: Linear sparsity using alternating directions. In *Advances in Neural Information Processing Systems (NeurIPS)*, pages 3401–3409, 2014 [link].

[10] **Qing Qu**, Xiaoxia Sun, Nasser M. Nasrabadi, and Trac D. Tran. Subspace vertex pursuit for separable non-negative matrix factorization in hyperspectral unmixing. In *2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 8115–8119. IEEE, 2014.

[11] **Qing Qu**, Nasser M. Nasrabadi, and Trac D. Tran. Hyperspectral abundance estimation for the generalized bilinear model with joint sparsity constraint. In *2013 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 2129–2133. IEEE, 2013 [link].

Workshop Paper

[1] **Qing Qu**, Xiao Li, and Zhihui Zhu. Exact and efficient multichannel sparse blind deconvolution - A nonconvex approach. In *Asilomar Conference on Signals, Systems, and Computers*, 2019.

[2] Yenson Lau†, **Qing Qu**†, Han-Wen Kuo, Pengcheng Zhou, Yuqian Zhang, and John Wright. Short-and-sparse deconvolution — A geometric approach. In *Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS)*, 2019.

[3] **Qing Qu**, Yuqian Zhang, Yonina C. Eldar, and John Wright. Convolutional phase retrieval via gradient descent. In *Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS)*, 2017 (**oral**).

[4] Ju Sun, **Qing Qu**, and John Wright. When are nonconvex problems not scary? In *NeurIPS Workshop on Nonconvex Optimization for Machine Learning: Theory and Practice*, 2015.

[5] Ju Sun, **Qing Qu**, and John Wright. Complete dictionary recovery over the sphere. In *Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS)*, 2015 (**oral, best student paper**).

GRANTS

NSF DMS, Award # 2009752 2020
Mathematical analysis of super-resolution via nonconvex optimization and machine learning
Budget: $ 340,000, Period Covered: 08/01/2020 - 07/31/2023
PI: Carlos Fernandez-Granda, Co-PI: **Qing Qu**

Travel Awards 2014 - 2019
Travel awards for NeurIPS'14, ICML'15, SAHD'15, NeurIPS'19

TEACHING AND MENTORSHIP

Teaching Experience

Project Supervisor New York University
CDS-GA-1006: Capstone Project in Data Science, Fall 2019, Fall 2020
Leading four master students on a research project of data science.

Course Advisor New York University
CDS-GA 1009: Practical Training for Data Science, Fall 2019 - Fall 2020 (4 consecutive semesters)
Academic advisor for 10 master students for their data science internship in top tech companies in NYC.

Teaching Assistant Columbia University
ELEN 6886: Sparse Representation and High-Dimensional Geometry, Fall 2015, Spring 2017
Mentored final course research projects, held office hours, and designed homework.

Guest Lecturer Columbia University
ELEN 6886: Sparse Representation and High-Dimensional Geometry, Spring 2017
Delivered several talks in the class on nonconvex optimization theory.

Mentorship Experience

Bonnie Deng, Haotian Guan, Xavier Xin, Bolin Yang (M.S. at New York University) Fall 2020
Capstone Project: Sparse deconvolution methods for microscopy imaging data analysis

Sheng Liu (Ph.D. candidate at New York University) Fall 2019 - present
Project: Normalization Design for Convolutional Neural Network, and Capstone projects

Xiao Li (M.S. at New York University) Fall 2019 - present
Project: Normalization Design for Convolutional Neural Network, and Capstone projects

Xiao Li (Ph.D. CUHK EE, now faculty at CUHK SZ) Spring 2019 - Summer 2020
Project: Nonconvex optimization for sparse blind deconvolution and convolutional dictionary learning
One paper accepted as NeurIPS'19 spotlight, one paper accepted as ICLR'20 oral

Yuexiang Zhai (Ph.D. candidate at UC Berkeley) Spring 2018 - present
Project: Analyzing nonconvex optimization landscape for overcomplete dictionary learning
One paper accepted as ICLR'20 oral

Mentor for new in ML workshop (first forum for newcomers to ML in NeurIPS'19) Dec. 2019
Conduct paper review and provide guidance for newcomers to machine learning.

Zian Chen, Xiao Li, Xingyu Wang, Kuixian Zhu (M.S. at New York University) Fall 2019
Capstone Project: Sparse deconvolution methods for microscopy imaging data analysis

SELECTED PRESENTATIONS

Learning Low-Complexity Models from Data Feb. 2020 - Apr. 2020
Invited seminar talks at Michigan State U. CMSE, Northeastern U. ECE, University of Maryland College Park ECE, University of Michigan ECE, University of British Columbia ECE, University of Colordao Boulder ECEE, Penn. State U. EE, Darmouth U. CS, University of Florida CISE & ECE

Sparse Deconvolution: Geometry, Methods & Applications Nov. 2019 - Jan. 2020
Invited talk in Prof. Yi Ma's group at UC Berkeley, EECS
Invited lunch seminar talk at Johns Hopkins University, MINDS
Lunch seminar talk at Prof. Joan Bruna's group at NYU, Center for Data Science
Invited seminar talk at Department of Electronic Engineering, Tsinghua University
2019 Workshop on Numerical Algebra in High-Dimensional Data Analysis, Xiamen University
Invited seminar talk at Department of Electrical & Computer Engineering, NYU Tandon

Nonconvex Optimization for Multichannel Sparse Blind Deconvolution Aug. - Dec. 2019
Invited talk in the Sixth International Conference on Continuous Optimization (ICCOPT).
Poster presentation at IMA Computational Imaging workshop, University of Minnesota.
Spotlight representation in Advances in Neural Information Processing Systems (NeurIPS).

Short-and-Sparse Deconvolution – A Geometric Approach Aug. - Oct. 2019
Contributed talk in the Sixth International Conference on Continuous Optimization (ICCOPT).
Poster presentation at IMA Computational Imaging workshop, University of Minnesota.

Nonconvex Recovery of Low-Complexity Models for Data Science Jan. 2019
Invited talk at NYU CDS lunch seminar, Purdue University ECE, JHU MINDS.

Nonconvex Recovery of Low-Complexity Models Jan. - Mar. 2018
Invited talk at JHU BME, UIUC ISE, UCSB ECE, Columbia Stats Seminar.

Convolutional Phase Retrieval Jun. 2017
Talk in Workshop on Signal Processing with Adaptive Sparse Structured Representations (SPARS).

A Geometric Analysis of Phase Retrieval Jul. 2016
Oral presentation in 2016 IEEE International Symposium on Information Theory (ISIT).

When Are Nonconvex Optimization Not Scary? Apr. - Jul. 2016
Invited talks at Tsinghua University, IBM Watson Research, and Microsoft Research.

Finding a Sparse Vector in a Subspace Feb. 2014
Oral presentation in New York Symposium on Machine Learning.

PROFESSIONAL SERVICES

Workshop Organized/Organizing

Nonconvex Optimization Working Group Spring 2019
Co-organized with Shuyang Ling and Aida Khajavirad
WWH 1314 Wed. 2pm - 3pm, weekly research seminar at Courant Institute of Mathematical Sciences

Workshop on Seeking Low-dimensionality in Deep Neural Networks (SLowDNN) Nov. 2020
Co-organized with Atlas Wang, Zhihui Zhu, Chong You, Jeremias Sulam, Yi Ma
Website: `https://sites.google.com/view/slowdnn/`,
Talk Videos: `https://www.youtube.com/playlist?list=PL7P834wcUN3eSh7Nn4wzPBjEnme4Rls7n`

Journal Reviewer

SIAM Journal on Imaging Sciences (SIIMS), SIAM Journal on Optimization (SIOPT), Applied and Computational Harmonic Analysis (ACHA), Journal of Machine Learning Research (JMLR), Operations Research, IEEE Transactions on Pattern Recognition and Machine Intelligence (TPAMI), IEEE Transactions on Information Theory (TIT), IEEE Transactions on Image Processing (TIP), IEEE Transactions on Signal Processing (TSP), IEEE Transactions on Computational Imaging (TCI), IEEE Transactions on Geoscience and Remote Sensing (TGRS), IEEE Trans. on Circuit and System

for Video Technology (TCSVT), IEEE Journal of Selected Topics on Signal Processing (JSTSP), IEEE Signal Processing Letters (SPL), Signal Processing (SP), Neurocomputing, Pattern Recognition (PR), PLOS One

Conference Reviewer

Neural Information Processing Systems (NeurIPS), International Conference on Learning Representations (ICLR), International Conference on Machine Learning (ICML), International Conference on Artificial Intelligence and Statistics (AISTATS), AAAI Conference on Artificial Intelligence (AAAI), International Symposium on Information Theory (ISIT), International Conference on Acoustics, Speech and Signal Processing (ICASSP), IEEE Global Conference on Signal and Information Processing (GlobalSIP)