Ju Sun

Curriculum Vitae

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Education

2011 – 2016 **Doctor of Philosophy**, *Electrical Engineering, Columbia University*, New York, USA.
Advisor: Prof. John Wright

2011 – 2013 **Master of Science**, *Electrical Engineering, Columbia University*, New York, USA.
Advisor: Prof. John Wright

2004 – 2008 **Bachelor of Engineering (ECE, honors) with Minor in Mathematics**, *National University of Singapore*, Singapore.
Advisor: Prof. Loong-Fah Cheong & Prof. Shuicheng Yan

Work/Internship Experience

Sep. 2016 – **Math+X Postdoctoral Scholar**, *Stanford University*, California, USA.
With Prof. Emmanuel Candès

Sep. 2010 – Dec. 2010 **Intern**, *Microsoft Research Asia*, Beijing, China.
With Dr. John Wright & Prof. Yi Ma

Jul. 2008 – Aug. 2011 **Research Engineer**, *Interactive & Digital Media Institute*, National University of Singapore, Singapore.
With Prof. Loong-Fah Cheong & Prof. Shuicheng Yan & Prof. Lawrence Wong

May. 2007 – Aug. 2007 **Undergraduate Intern**, *I^2R Institute*, A-Star, Singapore.
With Dr. Tham Jo-Yew

Research Interests

Intersection of computer vision, machine learning, data science, numerical optimization, signal/image processing, computational imaging, information theory, and compressive sensing.

Publications

Total citations: 2450, H-index: 9 according to Google Scholar as of 8th November, 2018. Please refer to my Google scholar page for updated publication list and citation figures: `http://scholar.google.com/citations?user=V6FaD-UAAAAJ`.

Almost There...

[1] **Ju Sun**. When Nonconvexity Meets Nonsmoothness. *In preparation*, 2018.

[2] David Barmherzig, **Ju Sun**, TJ Lane, and Po-Nan Li. A Mathematical Framework for Block-Reference Coherent Diffraction Imaging. *In preparation*, 2018.

Preprints

[3] Yu Bai, Qijia Jiang, and **Ju Sun**. Subgradient Descent Learns Orthogonal Dictionaries. *arXiv preprint arXiv:1810.10702*, 2018.

[4] Sky C Cheung, John Y Shin, Yenson Lau, Zhengyu Chen, **Ju Sun**, Yuqian Zhang, John N Wright, and Abhay N Pasupathy. Dictionary Learning in Fourier Transform Scanning Tunneling Spectroscopy. *arXiv preprint arXiv:1807.10752*, 2018. Submitted to Nature Communications.

Journals

[5] Tianjian Lu, **Ju Sun**, Ken Wu, and Zhiping Yang. High-Speed Channel Modeling With Machine Learning Methods for Signal Integrity Analysis. *IEEE Transactions on Electromagnetic Compatibility*, 60(6):1957–1964, 2018.

[6] **Ju Sun**, Qing Qu, and John Wright. A Geometric Analysis of Phase Retrieval. *Foundations of Computational Mathematics*, 18(5):1131–1198, 2018. (Citations: 184).

[7] **Ju Sun**, Qing Qu, and John Wright. Complete Dictionary Recovery over the Sphere II: Recovery by Riemannian Trust-region Method. *IEEE Trans. Information Theory*, 63(2):885–914, 2017.

[8] **Ju Sun**, Qing Qu, and John Wright. Complete Dictionary Recovery over the Sphere I: Overview and the Geometric Picture. *IEEE Trans. Information Theory*, 63(2):853–884, 2017. (Citations: 155 [together with II above]).

[9] Qing Qu, **Ju Sun**, and John Wright. Finding a Sparse Vector in a Subspace: Linear Sparsity Using Alternating Directions. *IEEE Trans. Information Theory*, 62(10):5855–5880, 2016.

[10] **Ju Sun**, Yuqian Zhang, and John Wright. Efficient Point-to-Subspace Query in ℓ^1 with Application to Robust Object Instance Recognition. *SIAM Journal on Imaging Sciences*, 7(4):2105–2138, 2014.

[11] Guangcan Liu, Zhouchen Lin, Shuicheng Yan, **Ju Sun**, Yong Yu, and Yi Ma. Robust Recovery of Subspace Structures by Low-Rank Representation. *IEEE Trans. Pattern Anal. Mach. Intell.*, 35(1):171–184, 2013. (Citations: 1386).

Conferences & Workshops

[12] Yu Bai, Qijia Jiang, and **Ju Sun**. Subgradient Descent Learns Orthogonal Dictionaries. In *International Conference on Learning Representations, Under review*, 2018.

[13] David Barmherzig and **Ju Sun**. 1D Phase Retrieval and Spectral Factorization. In *Mathematics in Imaging*, pages JTh1A–4. Optical Society of America, 2018.

[14] David A Barmherzig, **Ju Sun**, TJ Lane, and Po-Nan Li. On Block-Reference Coherent Diffraction Imaging. In *Computational Optical Sensing and Imaging*, pages CTH1B–1. Optical Society of America, 2018.

[15] David Barmherzig and **Ju Sun**. A Local Analysis of Block Coordinate Descent for Gaussian Phase Retrieval. In *NIPS Workshop on Optimization for Machine Learning*, 2017.

[16] **Ju Sun**, Qing Qu, and John Wright. A Geometrical Analysis of Phase Retrieval. In *International Symposium on Information Theory*, 2016.

[17] **Ju Sun**, Qing Qu, and John Wright. When Are Nonconvex Problems Not Scary? In *NIPS Workshop on Non-convex Optimization for Machine Learning: Theory and Practice*, 2015. (Citations: 90).

[18] **Ju Sun**, Qing Qu, and John Wright. Complete Dictionary Recovery over the Sphere. In *International Conf. on Machine Learning*, 2015. (Also appears in SAMPTA'15 and SPARS'15; Best Student Paper Award at SPARS'15).

[19] 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*, pages 3401–3409, 2014.

[20] **Ju Sun**, Yuqian Zhang, and John Wright. Efficient Point-to-Subspace Query in ℓ^1 with Application to Robust Face Recognition. In *European Conference on Computer Vision (ECCV)*, pages 416–429, 2012.

[21] Guangcan Liu, **Ju Sun**, and Shuicheng Yan. Closed-Form Solutions to A Category of Nuclear Norm Minimization Problems. *NIPS Workshop on Low-Rank Methods for Large-Scale Machine Learning*, `http://arxiv.org/abs/1011.4829`, October 2010.

[22] Yuzhao Ni, **Ju Sun**, Xiaotong Yuan, Shuicheng Yan, and Loong Fah Cheong. Robust Low-Rank Subspace Segmentation with Semidefinite Guarantees. In *ICDM Workshop on Optimization Based Methods for Emerging Data Mining Problems (OEDM)*, 2010.

[23] Yadong Mu, **Ju Sun**, Tony X. Han, Loong Fah Cheong, and Shuicheng Yan. Randomized Locality Sensitive Vocabularies for Bag-of-Features Model. In *European Conference on Computer Vision (ECCV)*, pages 748 – 761, 2010.

[24] **Ju Sun**, Yadong Mu, Shuicheng Yan, and Loong Fah Cheong. Activity Recognition using Dense Long-Duration Trajectories. In *International Conference on Multimedia & Expo (ICME)*, pages 322 – 327, 2010.

[25] **Ju Sun**, Xiao Wu, Shuicheng Yan, Loong Fah Cheong, Tat-Seng Chua, and Jintao Li. Hierarchical Spatio-Temporal Context Modeling for Action Recognition. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, pages 2004 – 2011, 2009. (Oral with acceptance rate 4.3%. Citations: 434).

[26] Ching Lik Teo, Shimiao Li, Loong Fah Cheong, and **Ju Sun**. 3D Ordinal Constraint in Spatial Configuration for Robust Scene Recognition. In *International Conference on Pattern Recognition (ICPR)*, pages 1 – 5, 2008.

Thesis

[27] **Ju Sun**. *When Are Nonconvex Optimization Problems Not Scary?* PhD thesis, Columbia University, May 2016.

Unpublished Reports

[28] **Ju Sun**, Qiang Chen, Shuicheng Yan, and Loong Fah Cheong. Selective Image Super-Resolution. *Technical Report*, `http://arxiv.org/abs/1010.5610`, March 2010.

References [Alphabetical order]

- **Prof. Emmanuel Candès** (The Barnum-Simons Chair in Mathematics and Statistics, Stanford University)
  Email: candes@stanford.edu
- **Prof. Weinan E** (Professor in Department of Mathematics and Program in Applied and Computational Mathematics, Princeton University)
  Email: weinan@math.princeton.edu
- **Prof. Donald Goldfarb** (Alexander and Hermine Avanessians Professor, Department of Industrial Engineering and Operations Research, Columbia University)
  Email: goldfarb@columbia.edu
- **Prof. Yi Ma** (Professor, Department of Electrical Engineering and Computer Sciences, UC Berkeley)
  Email: yima@eecs.berkeley.edu, yima@uiuc.edu
- **Prof. John Wright**(Associate Professor, Department of Electrical Engineering & Data Science Institute, Columbia University)
  Email: johnwright@ee.columbia.edu

Honors/Awards

2018 **Honorable Mention of Doctoral Thesis for New World Mathematics Awards 2017**.

2018 **SIAM Early Career Travel Award for SIAM Conference on Imaging Science 2018**.

2015 **Best Student Paper Award on SPARS'15**.
Awarded to the top quality paper authored by a student at Symposium on Signal Processing with Adaptive Sparse Structured Representations, 2015

2011 – 2014 **Wei Family Private Foundation Fellowship**.
Awarded to selected graduate students of Chinese heritage with academic excellence and research potential in electrical engineering, Columbia University

2011 – 2012 **Departmental Scholarship of Electrical Engineering, Columbia University**.
Awarded to selected entering graduate students to provide greater freedom in choice of research topics and advisors.

2004 – 2008 **Singapore Ministry of Education Scholarship for P.R.C. Students**.
Awarded to selected fresh undergraduate students from top universities of P.R. China, providing full tuition, fees, and living stipends

Invited Talks/Tutorials/Lectures

Invited Talks

Taming Nonconvexity: from Smooth to Nonsmooth Problems

- SINE Seminar at CSL, University of Illinois at Urbana–Champaign (Nov 2018)

When Nonconvexity Meets Nonsmoothness

- Annual Allerton Conference on Communication, Control, and Computing at Urbana, USA (Oct 2018)

When Are Nonconvex Optimization Problems Not Scary?

- IDeAS Seminar, Princeton University (Dec 2015)
- ITA Graduation Day, University of California, San Diego (Poster, Feb 2016)
- Prof. Emmanuel Candes' group seminar, Stanford University (Feb 2016)

- Microsoft Research at New York (Feb 2016)
- Prof. Qiang Du's group seminar, Columbia University (Mar 2016)
- ShanghaiTech University, SIST seminar series (Jun 2016)
- Modeling and optimization: theory and applications, Lehigh University (Aug 2016)
- SIAM Conference on Optimization at Vancouver, Bristish Columbia, Canada. (May 2017)
- Harvard ISS Seminar (Jun 2017)
- 2017 Meeting of the International Linear Algebra Society at Iowa State U. (Jul 2017)
- 2017 Asilomar Conference on Signals, Systems, and Computers at Asilomar Grounds in Pacific Grove (Oct 2017)
- SIAM Conference on Applied Linear Algebra at Hong Kong, China (May 2018)
- International Symposium on Mathematical Programming at Bordeaux, France (Jul 2018)

What's Happening in Provable Dictionary Learning?

- SIAM Conference on Imaging Sciences at Bologna, Italy (Jun 2018)

Complete Dictionary Learning over the Sphere

- Statistics student seminar, Columbia University (Mar 2015)
- DTC Seminar Talk, University of Minnesota (Apr 2015)
- Signal Processing with Adaptive Sparse Structured Representations (SPARS'15), University of Cambridge (Jul 2015)

Professional Activities/Services

Event Organization

- Exploiting Low-Complexity Structures in Data Analysis: Theory and Algorithms (A mini-symposium in SIAM Conference on Applied Linear Algebra 2018)

Reviews for Journals

- IEEE Transactions: Information Theory (T-IT), Pattern Analysis and Machine Intelligence (T-PAMI), Circuits and Systems for Video Technology (T-CSVT), Image Processing (T-IP), Signal Processing (T-SP), Selected Topics in Signal Processing (JSTSP), Systems, Man, and Cybernetics (T-SMC)
- SIAM Journals: Imaging Sciences (SIIMS), Matrix Analysis and Applications (SIMAX), Optimization (SIOPT)
- Journal of Machine Learning Research (JMLR)
- Neural Computation
- International Journal of Computer Vision (IJCV)
- Information and Inference (a Journal of the IMA)
- Applied and Computational Harmonic Analysis
- Journal of Visual Communication and Image Representation (JVIS)
- Neurocomputing (Elsevier)
- PLOS ONE

Reviews for Conferences

- Computer Vision: International Conference on Computer Vision (ICCV), European Conference on Computer Vision (ECCV), Asian Conference on Computer Vision (ACCV)
- Machine Learning: Neural Information Processing Systems (NIPS), Algorithmic Learning Theory (ALT)
- Information Theory: International Symposium on Information Theory (ISIT)

(update: 8th Nov, 2018)