

# Ju Sun

## Curriculum Vitae

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Jul. 2019 – **Assistant Professor**, *Computer Science & Engineering, University of Minnesota at Twin Cities*  
current (UMN), Minnesota, USA.

### Work Experience

Sep. 2016 – **Math+X Postdoctoral Scholar**, *Stanford University*, California, USA.  
Jun. 2019 With Prof. Emmanuel Candès  
Jul. 2008 – **Research Engineer**, *Interactive & Digital Media Institute*, National University of Singapore,  
Aug. 2011 Singapore.  
With Prof. Loong-Fah Cheong & Prof. Shuicheng Yan & Prof. Lawrence Wong

### 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

### Research Interests

foundations of machine learning, data sciences, and numerical optimization, with application to computer vision, signal/image processing, and computational imaging

### Publications

Total citations: 3418, H-index: 11 according to Google Scholar as of 22<sup>nd</sup> March, 2020. Please refer to my [Google scholar page](#) for updated publication list and citation figures.

#### Preprints

- [1] Kshitij Tayal, Chieh-Hsin Lai, Vipin Kumar, and **Ju Sun**. [Inverse Problems, Deep Learning, and Symmetry Breaking](#). *arXiv preprint arXiv:2003.09077*, 2020.
- [2] David Barmherzig, **Ju Sun**, Emmanuel J. Candès, TJ Lane, and Po-Nan Li. [Dual-Reference Design for Holographic Coherent Diffraction Imaging](#). *arXiv preprint arXiv:1902.02492*, 2019.
- [3] Yu Bai, Qijia Jiang, and **Ju Sun**. [Subgradient Descent Learns Orthogonal Dictionaries](#). *Submitted to Journal of Machine Learning Research, arXiv preprint arXiv:1810.10702*, 2018.

#### Journals

- [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](#). *Nature Communications*, 11(1081), 2020.

- [5] David Barmherzig, **Ju Sun**, Po-Nan Li, TJ Lane, and Emmanuel J. Candès. [Holographic Phase Retrieval and Reference Design](#). *Inverse Problems*, 35(9):094001, 2019.
- [6] 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.
- [7] **Ju Sun**, Qing Qu, and John Wright. [A Geometric Analysis of Phase Retrieval](#). *Foundations of Computational Mathematics*, 18(5):1131–1198, 2018.
- [8] **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.
- [9] **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.
- [10] 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.
- [11] **Ju Sun**, Yuqian Zhang, and John Wright. [Efficient Point-to-Subspace Query in  \$\ell^1\$  with Application to Robust Object Instance Recognition](#). *SIAM Journal on Imaging Sciences*, 7(4):2105–2138, 2014.
- [12] 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.

#### Conferences & Workshops

- [13] David Barmherzig, **Ju Sun**, Emmanuel J. Candès, TJ Lane, and Po-Nan Li. [Dual-Reference Design for Holographic Coherent Diffraction Imaging](#). In *Sampling Theory and Applications*, 2019.
- [14] Yu Bai, Qijia Jiang, and **Ju Sun**. [Subgradient Descent Learns Orthogonal Dictionaries](#). In *International Conference on Learning Representations*, 2019.
- [15] David Barmherzig and **Ju Sun**. [1D Phase Retrieval and Spectral Factorization](#). In *Mathematics in Imaging*, pages JTh1A–4. Optical Society of America, 2018.
- [16] 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.
- [17] 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.
- [18] **Ju Sun**, Qing Qu, and John Wright. [A Geometrical Analysis of Phase Retrieval](#). In *International Symposium on Information Theory*, 2016.
- [19] **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.
- [20] **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).
- [21] 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.

- [22] **Ju Sun**, Yuqian Zhang, and John Wright. [Efficient Point-to-Subspace Query in  \$\ell^1\$  with Application to Robust Face Recognition](#). In *European Conference on Computer Vision (ECCV)*, pages 416–429, 2012.
- [23] 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.
- [24] 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.
- [25] 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.
- [26] **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.
- [27] **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.
- [28] 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

- [29] **Ju Sun**. [When Are Nonconvex Optimization Problems Not Scary?](#) PhD thesis, Columbia University, May 2016.

#### Unpublished Reports

- [30] **Ju Sun**, Qiang Chen, Shuicheng Yan, and Loong Fah Cheong. [Selective Image Super-Resolution](#). *Technical Report*, <http://arxiv.org/abs/1010.5610>, March 2010.

### Teaching

- Machine Learning (Spring 2021)
- Think Deep Learning (Fall 2020)
- Think Deep Learning (Spring 2020)

### 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.**
- 2011 – 2014 **Wei Family Private Foundation Fellowship.**
- 2011 – 2012 **Departmental Scholarship of Electrical Engineering, Columbia University.**
- 2004 – 2008 **Singapore Ministry of Education Scholarship for P.R.C. Students.**

### Invited Talks/Tutorials/Lectures

## Invited Talks

### *Toward a robust and practical holographic phase retrieval system*

- SIAM Conference on Mathematics of Data Science at Cincinnati, Ohio (May 2020)

### *Taming Nonconvexity: from Smooth to Nonsmooth Problems*

- SINE Seminar at CSL, University of Illinois at Urbana–Champaign (Nov 2018)
- Center for Signal and Information Processing (CSIP) Seminar, Georgia Tech (Nov 2018)

### *When Nonconvexity Meets Nonsmoothness*

- INFORMS Annual Meeting at Seattle, USA (Oct 2019)
- 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, British 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)

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## Professional Activities/Services

### Professional Association

- IEEE/ACM/SIAM/INFORMS/OSA

### 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), Mathematics of Data Science (SIMODS), Scientific Computing (SISC)
- 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
- Mathematical Programming
- 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), Computer Vision and Pattern Recognition (CVPR), Asian Conference on Computer Vision (ACCV)
- Machine Learning: Neural Information Processing Systems (NIPS), International Conference on Machine Learning (ICML), Algorithmic Learning Theory (ALT)
- Information Theory: International Symposium on Information Theory (ISIT)