

# Gongguo Tang

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RESEARCH INTERESTS	Apply convex and non-convex optimization methods to model and solve problems in signal and information processing, physical sciences, and machine learning. Especially interested in designing optimization procedures that come with theoretical performance guarantees and that are scalable to large data sets.	
PROFESSIONAL PREPARATION	<b>Visiting Scholar, Big Data</b> University of California, Berkeley Simons Institute for the Theory of Computing	2013
	<b>Postdoctoral Scholar, Optimization</b> University of Wisconsin, Madison Department of Computer Science Advisors: Prof. Benjamin Recht & Prof. Robert Nowak	2011 – 2013
	<b>PhD, Electrical Engineering</b> Washington University in St. Louis Department of Electrical and Systems Engineering Advisor: Prof. Arye Nehorai	2006 – 2011
	<b>M.S., Control &amp; Systems Science</b> Chinese Academy of Sciences Academy of Mathematics and Systems Science Advisor: Prof. Lei Guo	2003 – 2006
	<b>B.S., Mathematics</b> Shandong University School of Mathematics	1999 – 2003
ACADEMIC APPOINTMENT	<b>Assistant Professor</b> <b>Colorado School of Mines</b> Electrical Engineering & Computer Science	2014 – present
	<b>Visiting Scholar</b> <b>University of California, Berkeley</b> Simons Institute for the Theory of Computing	2013
	<b>Postdoctoral Scholar</b> <b>University of Wisconsin-Madison</b> Wisconsin Institute for Discovery Advisors: Prof. Benjamin Recht and Prof. Robert Nowak	2011 – 2013
JOURNAL PUBLICATIONS	<ul style="list-style-type: none"><li>• Q. Li, Z. Zhu, and G. Tang, “Geometry of factored nuclear norm regularization,” arXiv preprint arXiv:1704.01265, 2017.</li><li>• Z. Zhu, Q. Li, G. Tang, and M. Wakin, “The global optimization geometry of nonsymmetric matrix factorization and sensing,” arXiv preprint arXiv:1703.01256, 2017.</li><li>• S. Li, D. Yang, G. Tang, and M. Wakin, “Atomic norm minimization for modal analysis from random and compressed samples,” arXiv preprint arXiv:1703.00938, 2017.</li><li>• Z. Zhu, Q. Li, G. Tang, and M. Wakin, “Global optimality in low-rank matrix optimization,” arXiv preprint arXiv:1702.07945, 2017.</li><li>• Q. Li and G. Tang, “The nonconvex geometry of low-rank matrix optimizations with general objective functions,” arXiv preprint arXiv:1611.03060, 2016.</li></ul>	

- C. Fernandez-Granda, G. Tang, X. Wang, and L. Zhang, "Demixing sines and spikes: Robust spectral super-resolution in the presence of outliers," arXiv preprint arXiv:1609.02247, 2016.
- Q. Li and G. Tang, "Approximate support recovery of atomic line spectral estimation: A tale of resolution and precision," Preprint, 2016.
- Q. Li, A. Prater, L. Shen, and G. Tang, "Overcomplete tensor decomposition via convex optimization," arXiv preprint arXiv:1602.08614, 2016.
- D. Yang, G. Tang, and M. B. Wakin, "Super-resolution of complex exponentials from modulations with unknown waveforms," *IEEE Trans. on Information Theory*, vol. 62, no. 10, pp. 5809-5830, Oct. 2016.
- L. Yeh, J. Dong, J. Zhong, L. Tian, M. Chen, G. Tang, M. Soltanolkotabi, and L. Waller, "Experimental robustness of Fourier Ptychography phase retrieval algorithms," *Optics Express*, vol. 23, no. 26, pp. 33214-33240, 2016.
- G. Tang and A. Nehorai, "Semidefinite programming for computable performance bounds on block-sparsity recovery," *IEEE Trans. Signal Processing*, vol. 64, no. 17, pp. 4455-4468, Sept. 1, 2016.
- G. Tang, B. Bhaskar, and B. Recht, "Near minimax line spectral estimation," *IEEE Trans. Information Theory*, vol. 61, no. 1, pp. 499-512, Jan. 2015.
- G. Tang and A. Nehorai, "Computable performance bounds on sparse recovery," *IEEE Trans. Signal Processing*, vol. 63, no. 1, pp. 132-141, Jan. 2015.
- G. Tang, B. Bhaskar, P. Shah, and B. Recht, "Compressed sensing off the grid," *IEEE Trans. Information Theory*, vol. 59, no. 11, pp. 7465-7490, Nov. 2013.
- M. Malloy, G. Tang, and R. Nowak, "The sample complexity of search over multiple populations," *IEEE Trans. Information Theory*, vol. 59, no. 8, pp. 5039-5050, Aug. 2013.
- B. Bhaskar, G. Tang, and B. Recht, "Atomic norm denoising with applications to line spectral estimation," *IEEE Trans. Signal Processing*, vol. 61, no. 23, pp. 5987-5999, Dec. 2013.
- P. Yang, G. Tang, and A. Nehorai, "A game-theoretic approach for optimal time-of-use electricity pricing," *IEEE Trans. on Power Systems*, vol. 28, no. 2, pp. 884-892, May 2013.
- G. Tang and A. Nehorai, "The stability of low-rank matrix reconstruction: a constrained singular value view," *IEEE Trans. Information Theory*, vol. 58, no. 9, pp. 6079-6092, Sept. 2012.
- G. Tang and A. Nehorai, "Performance analysis of sparse recovery based on constrained minimal singular values," *IEEE Trans. Signal Processing*, vol. 59, no. 12, pp. 5734-5745, Dec. 2011.
- W. Zhang, G. Tang, D. Dai, and A. Nehorai, "Estimation of reflectance from camera responses by regularized local linear model," *Optics Letters*, vol. 36, no. 19, pp. 3933-3935, Oct. 2011.
- G. Tang and A. Nehorai, "Constrained Cramér–Rao bound for robust principal component analysis," *IEEE Trans. Signal Processing*, vol. 59, no. 10, pp. 5070-5076, Oct. 2011.
- G. Tang and A. Nehorai, "Lower bounds on mean-squared error for low-rank matrix reconstruction," *IEEE Trans. Signal Processing*, vol. 59, no. 10, pp. 4559-4571, Oct. 2011.
- S. Sen, G. Tang, and A. Nehorai, "Multi-objective optimized OFDM radar waveform for target detection in multipath scenarios," *IEEE Trans. Signal Processing*, vol. 59, no. 2, pp. 639-652, Feb. 2011.
- G. Tang and A. Nehorai, "Performance analysis for sparse support recovery," *IEEE Trans. Information Theory*, vol. 56, no. 3, pp. 1383-1399, Mar. 2010.
- G. Tang and L. Guo, "Convergence of a class of multi-agent systems in probabilistic framework," *Journal of Systems Science and Complexity*, vol. 20, no. 2, pp. 173-197, Jun. 2007.

BOOK  
CHAPTERS

- Q. Li, G. Tang, and A. Nehorai, “Robust principal component analysis based on low-rank and block-sparse matrix decomposition,” *Handbook of Robust Low-Rank and Sparse Matrix Decomposition: Applications in Image and Video Processing*, CRC Press, 2016.
- G. Tang and A. Nehorai, “Bounds on Estimation,” *Encyclopedia of Systems and Control*, Springer, 2014.
- S. Sen, G. Tang, and A. Nehorai, “Designing OFDM radar waveform for target detection using multi-objective optimization,” *Advances in Heuristic Signal Processing and Applications*, A. Chatterjee, H. Nobahari, and P. Siarry, Eds. Springer, 2013.

CONFERENCE  
PUBLICATIONS

- Y. Xie, S. Li, G. Tang, and M. Wakin, “Radar signal demixing via convex optimization,” *International Conference on Digital Signal Processing (DSP)*, London, UK, Aug. 2017.
- Q. Li and G. Tang, “Approximate support recovery of atomic line spectral estimation: A tale of resolution and precision,” *IEEE GlobalSIP*, Washington, DC, 2016.
- Z. Zhu, G. Tang, P. Setlur, S. Gogineni, M. B. Wakin, and M. Rangaswamy, “Super-resolution in SAR imaging: Analysis with the atomic norm,” *IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM)*, Rio de Janeiro, 2016, pp. 1-5.
- D. Yang, G. Tang, and M. B. Wakin, “Non-stationary blind super-resolution,” *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Shanghai, 2016, pp. 4727-4731.
- P. Shah, N. Rao, and G. Tang, “Sparse and low-rank tensor decomposition,” *Annual Conference on Neural Information Processing Systems (NIPS)*, Montréal, Canada, 2015.
- Q. Li, A. Prater, L. Shen, and G. Tang, “Overcomplete tensor decomposition via convex optimization,” submitted to *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, 2015.
- G. Tang and P. Shah, “Guaranteed tensor decomposition: a moment approach,” *International Conference on Machine Learning (ICML)*, Lille, France, Jul. 2015.
- G. Tang, “Resolution limits for atomic decompositions via Markov-Bernstein type inequalities,” *International Conf. on Sampling Theory and Applications (SampTA)*, Washington, DC, May 2015.
- G. Tang, P. Shah, B. Bhaskar, and B. Recht, “Robust line spectral estimation,” *Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, Nov. 2014.
- P. Stoica, G. Tang, Z. Yang, and D. Zachariah, “Gridless compressive-sensing methods for frequency estimation: Points of tangency and links to basics,” *European Signal Processing Conference (EUSIPCO)*, Lisbon, Portugal, Sept. 2014.
- G. Tang and B. Recht, “Convex blind deconvolution from random masks,” *Computational Optical Sensing and Imaging*, Kohala Coast, HI, June 2014.
- G. Tang, B. Bhaskar, and B. Recht, “Sparse recovery over continuous dictionaries: Just discretize,” *Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, Nov. 2013.
- N. Rao, G. Tang, and R. Nowak, “Adaptive sampling on Markov trees,” *Signal Processing with Adaptive Sparse Structured Representations*, EPFL, Lausanne, France, July 2013.
- N. Rao, G. Tang, and R. Nowak, “Adaptive sensing on hidden Markov trees,” *IEEE Inter. Conf. Acoustics, Speech, and Signal Processing*, Vancouver, Canada, May 2013.
- G. Tang, B. Bhaskar, and B. Recht, “Near minimax line spectral estimation,” *Conf. Information Sciences and Systems*, Baltimore, MD, Mar. 2013.
- P. Shah, B. Bhaskar, G. Tang, and B. Recht, “Linear system identification via atomic norm regularization,” *IEEE Conf. Control and Decision*, Maui, HI, Dec. 2012.

- G. Tang, B. Bhaskar, P. Shah, and B. Recht, "Compressed sensing off the grid," *Allerton Conf. Communications, Control, and Computing*, Monticello, IL, Oct. 2012.
- P. Yang, G. Tang, and A. Nehorai, "Optimal time-of-use electricity pricing using game theory," *IEEE Inter. Conf. Acoustics, Speech, and Signal Processing*, Kyoto, Japan, Mar. 2012.
- M. Malloy, G. Tang, and R. Nowak, "Quickest search for a rare distribution," *Conf. Information Sciences and Systems*, Princeton, NJ, Mar. 2012.
- G. Tang and A. Nehorai, "Computable performance analysis for block-sparsity recovery," *Workshop on Computational Advances in Multi-Sensor Adaptive Processing*, San Juan, PR, Dec. 2011.
- P. Yang, G. Tang, and A. Nehorai, "Sparsity enforced regression based on overcomplete dictionary," *Workshop on Computational Advances in Multi-Sensor Adaptive Processing*, San Juan, PR, Dec. 2011.
- G. Tang and A. Nehorai, "Verifiable and computable  $\ell_\infty$  performance evaluation of  $\ell_1$  sparse signal recovery," *Conf. Information Sciences and Systems*, Baltimore, MD, Mar. 2011.
- G. Tang and A. Nehorai, "Robust principal component analysis based on low-rank and block-sparse matrix decomposition," *Conf. Information Sciences and Systems*, Baltimore, MD, Mar. 2011.
- S. Sen, G. Tang, and A. Nehorai, "Sparsity-based estimation for target detection in multipath scenarios," *IEEE Radar Conference*, Kansas City, MO, May 2011.
- G. Tang and A. Nehorai, "Computable quantification of the stability of sparse signal reconstruction," *Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, Nov. 2010.
- S. Sen, G. Tang, and A. Nehorai, "Multi-objective optimized OFDM radar waveform for target detection in multipath scenarios," *Asilomar Conf. Signals, Systems, and Computers*, Pacific Grove, CA, Nov. 2010.
- M. M. Nikolić, G. Tang, and A. Nehorai, "3D electromagnetic imaging using compressive sensing," *IEEE Sensor Array and Multichannel Signal Processing Workshop*, Jerusalem, Israel, Oct. 2010.
- M. M. Nikolić, G. Tang, and A. Nehorai, "Electromagnetic imaging using compressive sensing," *Allerton Conf. Communication, Control, and Computing*, Monticello, IL, Sept. 2010.
- G. Tang and A. Nehorai, "The stability of low-rank matrix reconstruction: a constrained singular value perspective," *Allerton Conf. Communication, Control, and Computing*, Monticello, IL, Sept. 2010.
- G. Tang and A. Nehorai, "Support recovery for source localization based on overcomplete signal representation," *IEEE Inter. Conf. Acoustics, Speech, and Signal Processing*, Dallas, TX, Mar. 2010.
- G. Tang and A. Nehorai, "Performance analysis for support recovery with joint sparsity constraints," *Allerton Conf. on Communication, Control, and Computing*, Monticello, IL, Sept. 2009.
- G. Tang and L. Guo, "Convergence of a class of multi-agent systems in probabilistic framework," *IEEE Conf. Decision and Control*, New Orleans, LA, Dec. 2007.
- G. Tang and L. Guo, "Convergence analysis of linearized Vicsek's model," *Chinese Control Conference*, Harbin, China, Aug. 2006.
- G. Tang and L. Guo, "Adaptive stabilization of unknown linear systems under communication constraints," *Chinese Control Conference*, Guangzhou, China, Jul. 2005.

COURSES TAUGHT	• EENG 311 Information Systems II	Spring 2017
	• EENG 411 Digital Signal Processing	Spring 2017

- EENG 515 Mathematical Methods for Signals and Systems Fall 2016
- EENG 511 Convex Optimization and its Engineering Applications Spring 2016
- EENG 515 Mathematical Methods for Signals and Systems Fall 2015
- EENG 411 Digital Signal Processing Spring 2015
- EENG 515 Mathematical Methods for Signals and Systems Fall 2014
- EENG 411 Digital Signal Processing Spring 2014

RESEARCH SUPPORT & HONORS • *CIF:Medium:Convex Optimization for Blind Inverse Problems.* National Science Foundation. \$ 752,998. 07/01/2017-06/30/2021.

- *Air Force Visiting Faculty Research Program.* Summer 2017.
- *Junior Faculty Research Award.* Colorado School of Mines. 2016.
- *Air Force Summer Faculty Fellowship Extension Grant.* \$20,000. 09/01/2015-12/31/2015.
- *Air Force Summer Faculty Fellowship.* Summer 2015.
- *CRII: CIF: Measure Estimation from Moments: Theory, Algorithms, and Applications.* National Science Foundation. \$ 170,000. 05/01/2015-04/30/2017.

#### INVITED TALKS

1. Signal Processing with Adaptive Sparse Structured Representations (SPARS), Lisbon, Portugal, June, 2017.
2. Talk at University of Oxford, May, 2017.
3. Imperial College London, May, 2017.
4. The Alan Turing Institute, May, 2017.
5. EE Colloquium, Colorado School of Mines, April, 2017.
6. London Workshop on Sparse Signal Processing, Imperial College London, Sept. 2016.
7. Air Force Research Lab, WPAFB, OH, June 2016.
8. The Ohio State University, Department of Electrical and Computer Engineering, June 2016.
9. University of Chicago, Departments of Statistics and Mathematics, May 2016.
10. Tutorial Talk at International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Shanghai, China, Mar. 2016.
11. The Alan Turing Institute, London, UK, May 2017.
12. Washington University in St. Louis, Department of Electrical and System Engineering, St. Louis, CO, Jan. 2017.
13. Special Session Organizer for “Super-Resolution and Atomic Norms”, CAMSAP, Cancun, Mexico, Dec. 2015.
14. University of Colorado, Boulder, Department of Mathematics, Nov. 2015.
15. International Symposium on Optimization, Pittsburgh, PA, Jul. 2015.
16. International Conference on Machine Learning (ICML), Lille, France, Jul. 2015.
17. Signal Processing with Adaptive Sparse Structured Representations (SPARS), Cambridge, UK, Jul. 2015.
18. Washington University in St. Louis, Department of Electrical and System Engineering, St. Louis, CO, Mar. 2015.

19. ICERM Workshop on Approximation, Integration, and Optimization, Brown University, Sep. 2014.
20. Computational Imaging Boot Camp, University of California, Berkeley, Aug. 2014.
21. SIAM Conference on Optimization, San Diego, CA, May 2014.
22. Signal Processing Seminar, University of California, Berkeley, Dec. 2013.
23. Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, Nov. 2013
24. Caltech, Department of Computing & Mathematical Sciences, Jun. 2013.
25. SILO Seminar, University of Wisconsin-Madison, Mar. 2013.
26. Colorado School of Mines, Department of Electrical Engineering & Computer Science, Feb. 2013.
27. Information Theory and Applications Workshop, San Diego, CA, Feb. 2013.
28. Mitsubishi Electric Research Laboratories, Boston, MA, Apr. 2012.
29. The Ohio State University, Department of Electrical and Computer Engineering, May 2012.
30. SILO Seminar, University of Wisconsin-Madison, Dec. 2011.
31. Rice University, Department of Computational and Applied Mathematics, Nov. 2011.