Zhihui   Zhu

Johns Hopkins University	Phone: (720) 472-8171
Center for Imaging Science	Email: zzhu29@jhu.edu
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RESEARCH INTERESTS

- Mathematical analysis of non-convex optimization algorithms, and their applications in data analysis, machine learning, and signal processing

- Signal processing and data analysis using concise, low-dimensional signal models

- Approximation theory and computational harmonic analysis

EDUCATION

2017	Ph.D. in Electrical Engineering	Colorado School of Mines
	(Dr. Michael Wakin, advisor), winner of Graduate Research Award	
2012	B.Sc. in Telecommunications Engineering	Zhejiang University of Technology
		Jianxing Honors College
	(Dr. Gang Li, advisor), winner of Best Bachelor's Thesis Award (1/125)	

Positions

2018-present	Postdoctoral Fellow	Johns Hopkins University
		Center for Imaging Science
		Mathematical Institute for Data Science
2014-2017	Research Assistant	Colorado School of Mines
		Dept. of Electrical Engineering
2013-2014	Teaching Assistant	Colorado School of Mines
		Dept. of Electrical Engineering
2010-2013	Research Assistant	Zhejiang University of Technology
		Zhejiang Key Lab. for Signal Processing

HONORS

2018	Electrical Engineering Graduate Research Award	Colorado School of Mines
2016	Travel grant for the February Fourier Talks	Norbert Wiener Center
2013	National Scholarship	Ministry of Education of PRC
2012	Outstanding Graduate	ZJUT
2012	Best Bachelor's Thesis Award (1/125)	ZJUT
	for the Thesis "On The Sparse Representation of Signals in Compressive Sensing"	
2011	Meritorious Winner of MCM/ICM	COMAP
2009,2010	First Prize of the 1st&2nd National Undergraduate Mathematical Contest	

PREPRINTS

1. Z. Zhu, D. Soudry, Y. C. Eldar, and M. B. Wakin, "The Global Optimization Geometry of Shallow Linear Neural Networks," preprint, 2018.

2. Z. Zhu and X. Li, "Convergence Analysis of Alternating Nonconvex Projections," preprint, 2018.

3. Z. Zhu and M. B. Wakin, "Time-Limited Toeplitz Operators on Abelian Groups: Applications in Information Theory and Subspace Approximation," preprint, 2017.

4. Q. Li, Z. Zhu, and G. Tang, "Geometry of Factored Nuclear Norm Regularization," preprint, 2017.

5. Z. Zhu, Q. Li, G. Tang, and M. B. Wakin, "The Global Optimization Geometry of Nonsymmetric Matrix Factorization and Sensing," preprint, 2017.

JOURNAL PUBLICATIONS

1. Z. Zhu, S. Karnik, M. Wakin, M. Davenport, and J. Romberg, "ROAST: Rapid Orthogonal Approximate Slepian Transform,", to appear in *IEEE Transactions on Signal Processing.*

2. Q. Li, Z. Zhu, and G. Tang, The Non-convex Geometry of Low-rank Matrix Optimization, to appear in *Information and Inference: A Journal of the IMA.*

3. S. Karnik, Z. Zhu, M. B. Wakin, J. Romberg, and M. A. Davenport, "The Fast Slepian Transform," to appear in *Applied and Computational Harmonic Analysis.*

4. C. Wang, Z. Zhu, H. Gu, X. Wu, and S. Liu, "Hankel Low-Rank Approximation for Seismic Noise Attenuation," to appear in *IEEE Transactions Geoscience and Remote Sensing.*

5. Z. Zhu, G. Li, J. Ding. Q. Li, and X. He, "On Collaborative Compressive Sensing Systems: The Framework, Design and Algorithm," *SIAM Journal on Imaging Sciences*, vol 11, no. 2, pp. 1717-1758, 2018.

6. Z. Zhu, Q. Li, G. Tang, and M. B. Wakin, "Global Optimality in Low-rank Matrix Optimization," *IEEE Transactions on Signal Processing*, vol 66, no. 13, pp. 36143628, July 2018.

7. T. Hong and Z. Zhu, "Online Learning Sensing Matrix and Sparsifying Dictionary Simultaneously for Compressive Sensing," *Signal Processing*, vol 153, no. 188-196, December 2018.

8. T. Hong and Z. Zhu, "An Efficient Method for Robust Projection Matrix Design," *Signal Processing*, vol. 143, pp. 200-210, February 2018.

9. G. Li, Z. Zhu, X. Wu, and P. Hou, "On Joint Optimization of Sensing Matrix and Sparsifying Dictionary for Robust Compressed Sensing Systems," Digital Signal Processing, vol. 73, pp. 62-71, February 2018.

10. Z. Zhu, S. Karnik, M. A. Davenport, J. K. Romberg, and M. B. Wakin, "The Eigenvalue Distribution of Discrete Periodic Time-Frequency Limiting Operators," *IEEE Signal Processing Letters*, vol. 25, no. 1, pp. 95–99, January 2018.

11. Z. Zhu and M. B. Wakin, "Approximating Sampled Sinusoids and Multiband Signals Using Multiband Modulated DPSS Dictionaries," *Journal of Fourier Analysis and Applications*, vol. 23, no. 6, pp. 1263–1310, December 2017.

12. Z. Zhu and M. B. Wakin, "On the Asymptotic Equivalence of Circulant and Toeplitz Matrices," *IEEE Transactions on Information Theory*, vol. 63, no. 5, pp. 2975-2992, May, 2017.

13. B. Hou, Z. Zhu, G. Li, and A. Yu, "An Efficient Algorithm for Overcomplete Sparsifying Transform Learning with Signal Denoising," *Mathematical Problems in Engineering*, 1-13, 2016.

14. G. Li, Z. Zhu, D. Yang, L. Chang, and H. Bai, "On Projection Matrix Optimization for Compressive Sensing Systems," *IEEE Transactions on Signal Processing*, vol. 61, no. 11, pp. 2887-2898, June, 2013.

CONFERENCE PUBLICATIONS

1. Z. Zhu, Y. Wang, D. P. Robinson, D. Naiman, R. Vidal, and M. C. Tsakiris, "Dual Principal Component Pursuit: Improved Analysis and Efficient Algorithms," *Neural Information Processing Systems (NIPS)*, December 2018.

2. Z. Zhu, X. Li, K. Liu, and Q. Li, "Dropping Symmetry for Fast Symmetric Nonnegative Matrix Factorization," *Neural Information Processing Systems (NIPS)*, December 2018.

3. Z. Zhu, M. Lopez-Santillana, and M. B. Wakin, "Super-Resolution of Complex Exponentials from Modulations with Known Waveforms," *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, Curacao, Dutch Antilles, December 2017.

4. Z. Zhu, Q. Li, G. Tang, and M. B. Wakin, "Global Optimality in Low-rank Matrix Optimization," *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, Montreal, Quebec, Canada, November 2017.

5. Z. Zhu, D. Yang, M. B. Wakin, and G. Tang, "A Super-resolution Algorithm for Multiband Signal Identification," *51st Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, California, October 2017.

6. Z. Zhu, S. Karnik, M. B. Wakin, M. A. Davenport, and J. K. Romberg, "Fast Orthogonal Approximations of Sampled Sinusoids and Bandlimited Signals," *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, New Orleans, March 2017.

7. G. Li, Z. Zhu, H. Bai, and A. Yu, "A New Framework for Designing Incoherent Sparsifying Dictionaries," *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, New Orleans, March 2017.

8. Q. Li, S. Li, H. Mansour, M. Wakin, D. Yang, and Z. Zhu, "JAZZ: A Companion to MUSIC for Frequency Estimation with Missing Data," *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, New Orleans, March 2017.

9. S. Karnik, Z. Zhu, M. B. Wakin, J. K. Romberg, and M. A. Davenport, "Fast Computations for Approximation and Compression in Slepian Spaces," *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, Greater Washington, D.C., December 2016.

10. Z. Zhu and M. B. Wakin, "On the Dimensionality of Wall and Target Return Subspaces in Through-theWall Radar Imaging," *4th International Workshop on Compressed Sensing Theory and its Applications to Radar, Sonar and Remote Sensing (CoSeRa)*, Aachen, Germany, September 2016.

11. Z. Zhu, G. Tang, P. Setlur, S. Gogineni, M. Wakin, and M. Rangaswamy, "Super-Resolution in SAR Imaging: Analysis With the Atomic Norm," *IEEE Sensor Array and Multichannel Signal Processing (SAM) Workshop*, Rio de Janeiro, Brazil, July 2016.

12. Z. Zhu and M. B. Wakin, "New Analysis of Multiband Modulated DPSS Dictionaries," *Workshop on Signal Processing with Adaptive Sparse Structured Representations ?SPARS'15*, Cambridge, England, July 2015.

13. Z. Zhu and M. B. Wakin, "Wall Clutter Mitigation and Target Detection Using Discrete Prolate Spheroidal Sequences," *3rd International Workshop on Compressed Sensing Theory and its Applications to Radar, Sonar and Remote Sensing (CoSeRa)*, Pisa, Italy, June 2015.

14. Z. Zhu and M. B. Wakin, "Detection of Stationary Targets Using Discrete Prolate Spheroidal Sequences," *International Review of Progress in Applied Computational Electromagnetics (ACES)*, Williamsburg, Virginia, March 2015.

15. H. Bai, Z. Zhu, G. Li, and S. Li, "Design of Optimal Measurement Matrix for Compressive Detection," *Proc. of the 10th International Symposium on Wireless Communication Systems (ISWCS 2013)*, Ilmenau, Germany, August 2013.

16. S. Li, Z. Zhu, G. Li, L. Chang, and Q. Li, "Projection matrix optimization for block-sparse compressive sensing," IEEE International Conference on Signal Processing, Communication and Computing (ICSPCC 2013), KunMing, August 2013.

17. Q. Li, Z. Zhu, S. Tang, L. Chang, and Gang Li, "Projection matrix optimization based on SVD for compressive sensing systems," *32nd Chinese Control Conference (CCC)*, July 2013.

18. Q. Li, Z. Zhu, G. Li, and Liping Chang, "Robust projection matrix optimization from the MSE view for compressive sensing systems", *IEEE International Conference on Signal Processing, Communication and Computing (ICSPCC 2013)*, KunMing, August, 2013.

19. D. Yang, G. Li, and Z. Zhu, "A novel structure for adaptive blind channel equalization," in *Proc. 7th IEEE Int. Conf. on Wireless Communications, Networking and Mobile Computing (WiCOM)*, Wuhan, September 2011.

20. Z. Zhu, D. Yang, G. Li, and C. Huang, "Stable 2nd order adaptive IIR filter structure for blind deconvolution," *Proc. 4th Int. Conf. on Image and Signal Processing (CISP)*, Shanghai, October 2011.

PRESENTATIONS

1. "A Super-resolution Algorithm for Multiband Signal Identification," *51st Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, October 2017.

2. "Fast Orthogonal Approximations of Sampled Sinusoids and Bandlimited Signals," *Graduate Research And Discovery Symposium (GRADS), Colorado School of Mines*, April 2017.

3. "Fast Orthogonal Approximations of Sampled Sinusoids and Bandlimited Signals," *Computing-Mines Affiliates Partnership Program (C-MAPP) Award Event*, January 2017.

4. "Wall Clutter Mitigation and Target Detection in Through-the-Wall Radar Imaging," *Graduate Research And Discovery Symposium (GRADS), Colorado School of Mines*, March 2016.

5. "On the Asymptotic Equivalence of Circulant and Toeplitz Matrices", *2016 February Fourier Talks – FFT 2016, Norbert Wiener Center for Harmonic Analysis and Applications, Department of Mathematics, University of Maryland*, College Park, Maryland, February 2016.

6. "SAR Radar Imaging of Targets Through the Wall," *Graduate Research And Discovery Symposium (GRADS), Colorado School of Mines*, January 2016.

7. "New Analysis of Multiband Modulated DPSS Dictionaries," *Zhejiang Key Laboratory for Signal Processing*, May 2015.

8. "SAR Radar Imaging of Targets Through the Wall", *Graduate Research And Discovery Symposium (GRADS), Colorado School of Mines*, April 2015.

TEACHING EXPERIENCE

Sep. 2016   One week as the Course Instructor for *Information Systems Science II* (EENG 311)

2013-2014   Leading a laboratory session for *Digital Logic* (EENG 284) as Teaching Assistant

Fall 2012   Teaching Assistant for *Signals and Systems*

PROFESSIONAL ACTIVITIES

Technical Program Committees

IEEE International Conference on Digital Signal Processing (DSP), 2017
IEEE International Conference on Communication Technology, 2017,2018.

Reviewer for the Following Journals

Applied Computational and Harmonic Analysis
Bikhause Springer Series on Harmnois Analysis
Digital Signal Processing
Frontiers in Applied Mathematics and Statistics
IEEE Geoscience and Remote Sensing Letters
IEEE Journal of Selected Topics in Signal Processing
IEEE Signal Processing Letters
IEEE Transactions on Information Theory
IEEE Transactions on Signal Processing
Information and Inference
International Journal of Computer Vision
Patter Recognition Letters
Signal Processing

Reviewer for the Following Conferences

IEEE Radar Conference (RadarConf)
IEEE Int. Conference on Digital Signal Processing (DSP)
IEEE Int. Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)
Neural Information Processing Systems (NIPS)

SERVICES

2010-2012   President of Mathematical Modeling Association, ZJUT

2011-2012   Counselor Assistant, Jianxing Honors College, ZJUT

2010-2012   Class Monitor, ZJUT

2012   Principal Organizer for the Graduation Party, ZJUT (Jianxing Honors College)