

# Christopher A. Metzler

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## Academic Appointments and Education

- Since 01/21 **Assistant Professor**, *University of Maryland*, Computer Science and UMI-ACS (Electrical and Computer Engineering by courtesy), College Park, MD.
- 02/19–12/20 **Postdoctoral Researcher**, *Stanford University*, Electrical Engineering, Stanford, CA.  
Advisor: Gordon Wetzstein
- 01/15–1/19 **Doctor of Philosophy**, *Rice University*, Electrical and Computer Engineering, Houston, TX.  
Thesis: Data-driven Computational Imaging with Applications to Imaging Through and Around Obstacles  
Advisors: Richard Baraniuk and Ashok Veeraraghavan
- 08/13–12/14 **Master of Science**, *Rice University*, Electrical and Computer Engineering, Houston, TX.  
Thesis: Denoising-based Approximate Message Passing for Compressed Sensing  
Advisor: Richard Baraniuk
- 08/9–05/13 **Bachelor of Science**, *Rice University*, Electrical and Computer Engineering, Houston, TX.  
*Magna Cumme Laude*

## Research Interests

I develop new systems and algorithms for solving problems in computational imaging, machine learning, and wireless communications.

## Awards

- 2019 **Best Contribution Award**, *International Biomedical and Astronomical Signal Processing Frontiers Workshop*.
- 2019 **Alan Berman Research Publication Award**, *Naval Research Laboratory*.
- 2017 **Runner-up Best Paper**, *International Conference on Computational Photography*.
- 2015 **Top 10% Paper**, *International Conference on Image Processing*.

## Grants and Fellowships

- 2019 **Intelligence Community Postdoctoral Research Fellowship**, *DoE*, \$204k.
- 2018 **Texas Space Grant Consortium Fellowship**, *NASA*, \$5k.
- 2017 **Ken Kennedy Institute High Performance Computing Fellowship**, *Rice University*, \$7.5k.

- 2015 **NSF Graduate Research Fellowship**, *NSF*, \$138k.
- 2014 **NDSEG Fellowship**, *DoD*, \$214k.
- 2013 **Texas Instruments Fellowship**, *Rice University*, \$8k.

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## Industrial and National Lab Positions

- Since 04/19 **Aerospace, Automotive, Defense, and Medical Device Companies**, *Consultant*.
- 06/17-08/17 **Naval Research Laboratory**, *Graduate Research Intern in Applied Optics Branch*, Washington, DC.
- 05/16-07/16 **Ball Aerospace**, *RF Engineering Intern in Mission Systems Group*, Broomfield, CO.
- 05/15-07/15 **Ball Aerospace**, *RF Engineering Intern in Mission Systems Group*, Broomfield, CO.
- 05/14-08/14 **ViaSat**, *Software Engineering Intern*, Carlsbad, CA.
- 05/13-08/13 **National Instruments**, *Hardware Engineering Intern*, Austin, TX.

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## Publications

- 27 **Solving Inverse Problems using Self-supervised Deep Neural Nets**, *Liu, J., Balaji, M., Metzler, C., Asif, M., Rangarajan, P.*, COSI, 2021.
- 26 **Compressive MRI with Approximate Message Passing and Learning**, *Metzler, C., Kitichotkul, R., and Wetzstein, G.*, In Preparation.
- 25 **Depth from Defocus with Learned Optics for Imaging and Occlusion-aware Depth Estimation**, *Ikoma, H., Nguyen, C., Peng, Y., Metzler, C., and Wetzstein, G.*, IEEE International Conference on Computational Photography (ICCP), 2021.
- 24 **D-VDAMP: Denoising-based Approximate Message Passing for Compressive MRI**, *Metzler, C., and Wetzstein, G.*, The International Conference on Acoustics, Speech, & Signal Processing (ICASSP), 2021.
- 23 **SUREmap: Predicting Uncertainty in CNN-based Image Reconstructions using Stein's Unbiased Risk Estimate**, *Kitichotkul, R., Metzler, C., Ong, F., and Wetzstein, G.*, The International Conference on Acoustics, Speech, & Signal Processing (ICASSP), 2021.
- 22 **Deep S<sup>3</sup>PR: Simultaneous Source Separation and Phase Retrieval Using Deep Generative Models**, *Metzler, C., and Wetzstein, G.*, The International Conference on Acoustics, Speech, & Signal Processing (ICASSP), 2021.
- 21 **Deep Optics: Learning Cameras and Optical Computing Systems**, *Wetzstein, G., Ikoma, H., Metzler, C., and Peng, Y.*, IEEE 54th Asilomar Conference on Signals, Systems and Computers, 2020.

- 20 **Deep Learning Techniques for Inverse Problems in Imaging**, *Ongie, G., Jalal, A., Metzler, C., Baraniuk, R., Dimakis, A., Willett, R.*, IEEE Journal on Selected Areas in Information Theory, 2020.
- 19 **Real-Time Unknown-View Tomography Using Recurrent Neural Networks with Applications to Keyhole Imaging**, *Metzler, C., and Wetzstein, G.*, Computational Optical Sensing and Imaging (COSI), 2020.
- 18 **Keyhole Imaging: Non-line-of-sight Imaging and Tracking Along a Single Optical Path**, *Metzler, C., Lindell, D., and Wetzstein, G.*, IEEE Transactions on Computational Imaging, 2020.
- 17 **Deep Optics for Single-shot High-dynamic-range Imaging**, *Metzler, C., Ikoma, H., Peng, Y., and Wetzstein, G.*, Conference on Computer Vision and Pattern Recognition (CVPR) (Oral), 2020.
- 16 **Optimizing Monocular Depth Estimation with Global Depth Histogram Matching Using a Single SPAD Transient**, *Nishimura, M., Lindell, D., Metzler, C., and Wetzstein, G.*, European Conference on Computer Vision (ECCV), 2020.
- 15 **Deep-inverse Correlography: Towards Real-time High-resolution Non-line-of-sight Imaging**, *Metzler, C., Heide, F., Rangarajan, P., Balaji, M., Viswanath, A., Veeraraghavan, A., and Baraniuk, R.*, Optica, 2020. Optica top 10 most cited paper.
- 14 **Inverse Scattering via Transmission Matrices: Broadband Illumination and Fast Phase Retrieval Algorithms**, *Metzler\*, C., Sharma\*, M.K., Nagesh, S., Baraniuk, R., Cossairt, O. and Veeraraghavan, A.*, IEEE Transactions on Computational Imaging, 2019.
- 13 **Unsupervised Learning with Stein’s Unbiased Risk Estimator with Applications to Denoising and Compressed Sensing**, *Metzler, C., Mousavi, A., Heckel, R., and Baraniuk, R.*, International Biomedical and Astronomical Signal Processing Frontiers Workshop (BASP), 2019. Best paper award.
- 12 **Imaging Through Macroscopic Scattering Media**, *Kanaev, A., Watnik, A., Gardner, D., Metzler, C., Judd, K., Lebow, P., Novak, K., and Lindle, J.*, Optics and Photonics News, 2018.
- 11 **Imaging Through Extreme Scattering in Extended Dynamic Media**, *Kanaev, A., Watnik, A., Gardner, D., Metzler, C., Judd, K., Lebow, P., Novak, K., and Lindle, J.*, Optics Letters, 2018.
- 10 **prDeep: Robust Phase Retrieval with a Flexible Deep Network**, *Metzler, C., Schniter, P., Veeraraghavan, A., and Baraniuk, R.*, International Conference on Machine Learning (ICML), 2018.
- 9 **An Expectation-maximization Approach to Tuning Generalized Vector Approximate Message Passing**, *Metzler, C., Schniter, P., and Baraniuk, R.*, ICA/LVA Special Session on Advances in Phase Retrieval and Applications, 2018.

- 8 **Learned D-AMP: Principled Neural-network-based Compressive Image Recovery**, *Metzler, C., Mousavi, A., and Baraniuk, R.*, Neural Information Processing Systems (NeurIPS), 2017.
- 7 **Coherent Inverse Scattering via Transmission Matrices: Efficient Phase Retrieval Algorithms and a Public Dataset**, *Metzler\*, C., Sharma\*, M.K., Nagesh, S., Baraniuk, R., Cossairt, O. and Veeraraghavan, A.*, IEEE International Conference on Computational Photography (ICCP), 2017.  
Best paper honorable mention.
- 6 **BM3D-prGAMP: Compressive Phase Retrieval Based on BM3D Denoising**, *Metzler, C., Maleki, A., and Baraniuk, R.*, IEEE International Conference on Image Processing (ICIP), 2016.
- 5 **From Denoising to Compressed Sensing**, *Metzler, C., Maleki, A., and Baraniuk, R.*, IEEE Transactions on Information Theory, 2016.
- 4 **Iterative Reconstruction from Limited Angle, Limited View Projections for Cryo-electron Tomography**, *Wood, S., Fontenla, E., Metzler, C., Chiu, W., Baraniuk, R.*, IEEE 49th Asilomar Conference on Signals, Systems and Computers, 2015.
- 3 **Dynamic Model Generation for Application of Compressed Sensing to Cryo-electron Tomography Reconstruction**, *Wood, S., Fontenla, E., Metzler, C., Chiu, W., Baraniuk, R.*, IEEE Signal Processing and Signal Processing Education Workshop (SP/SPE), 2015.
- 2 **Optimal Recovery from Compressive Measurements via Denoising-based Approximate Message Passing**, *Metzler, C., Maleki, A., and Baraniuk, R.*, IEEE International Conference on Sampling Theory and Applications (SampTA), 2015.
- 1 **BM3D-AMP: A New Image Recovery Algorithm Based on BM3D Denoising**, *Metzler, C., Maleki, A., and Baraniuk, R.*, IEEE International Conference on Image Processing (ICIP), 2015.  
Top 10% paper.

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## Talks

- 2021 **Invited Talk**, *Designing Imaging Systems with End-to-End Learning*, OSA Imaging and Applied Optics Congress.
- 2021 **Invited Talk**, *Computational Imaging with Physics, Statistics, and Machine Learning*, NIST, Gaithersburg.
- 2021 **Talk**, *D-VDAMP: Denoising-based Approximate Message Passing for Compressive MRI*, ICASSP 2021.
- 2021 **Talk**, *Deep S3PR: Simultaneous Source Separation and Phase Retrieval using Deep Generative Models*, ICASSP 2021.

- 2020 **Invited Talk**, *Approximate Message Passing (AMP) Algorithms for Computational Imaging*, NeurIPS Workshop on Deep Learning and Inverse Problems.
- 2020 **Invited Talk**, *Computational Imaging with Approximate Message Passing and Learning*, Oxford University.
- 2020 **Invited Talk**, *Deep S3PR: Simultaneous Source Separation and Phase Retrieval Using Deep Generative Models*, Asilomar Conference on Signals, Systems, and Computers.
- 2020 **Talk**, *Data-driven Solutions to Challenging Imaging Problems*, Intelligence Community Academic Research Symposium.
- 2020 **Invited Talk**, *Computational Imaging with Physics, Statistics, and Machine Learning*, UC Berkeley.
- 2020 **Invited Talk**, *Deep-Inverse Correlography: Imaging Around Corners with Deep Learning Based Phase Retrieval*, SIAM, IS20 Special Session on Phase Retrieval.
- 2020 **Talk**, *Keyhole Imaging: Non-Line-of-Sight Imaging and Tracking of Moving Objects Along a Single Optical Path*, COSI.
- 2020 **Talk**, *Deep Optics for Single-shot High-dynamic-range Imaging*, CVPR.
- 2020 **Talk**, *Keyhole Imaging: Non-Line-of-Sight Imaging and Tracking of Moving Objects Along a Single Optical Path*, CCD Workshop, CVPR.
- 2020 **Invited Talk**, *Computational Imaging with Physics, Statistics, and Machine Learning*, UMD.
- 2020 **Invited Talk**, *Computational Imaging with Physics, Statistics, and Machine Learning*, MIT.
- 2019 **Invited Talk**, *Extreme Imaging with Statistical Signal Processing*, Information Systems Laboratory Colloquium, Stanford.
- 2018 **Invited Talk**, *Deep Learning for Seeing Around Corners*, Machine Learning Lunch, Rice.
- 2018 **Talk**, *prDeep: Robust Phase Retrieval with a Flexible Deep Network*, ICML.
- 2018 **Invited Talk**, *Imaging Through Scattering Media Using Phase Retrieval*, ICA/LVA Special Session on Phase Retrieval and Applications.
- 2018 **Invited Talk**, *Unsupervised Learning with Stein's Unbiased Risk Estimator: A Practical Approach to Universal Compressive Sensing*, SIAM IS-18 Minisymposium on Computational and Compressive Imaging Technologies and Applications.
- 2018 **Invited Talk**, *Data-driven Computational Imaging: Improved Imaging Through Scattering Media with Visible Light*, Stanford Center for Imaging Systems and Engineering.
- 2018 **Invited Talk**, *Phase Retrieval: Fast, Robust, and Data-driven Algorithms for Computational Imaging*, SPIE Photonics West Quantitative Phase Imaging Workshop IV.

- 2017 **Talk**, *Coherent Inverse Scattering via Transmission Matrices*, ONR EO/IR Imaging Systems Annual Review Meeting.
- 2017 **Invited Talk**, *Unrolling: A Principled Method to Develop Deep Neural Networks*, Rice Geo-Mathematical Imaging Group Project Review.
- 2017 **Talk**, *Coherent Inverse Scattering via Transmission Matrices: Efficient Phase Retrieval Algorithms and a Public Dataset*, ICCP.
- 2016 **Talk**, *BM3D-prGAMP: Compressive Phase Retrieval Based on BM3D Denoising*, ICME MM-SPARSE Workshop.
- 2015 **Invited Talk**, *Connecting Bayesian and Denoising-based Compressed Sensing*, Asilomar.
- 2015 **Talk**, *BM3D-AMP: A New Image Recovery Algorithm Based on BM3D Denoising*, ICIP.

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## Mentorship

- Summer 2021-Present **Graduate Advisor**, *Kevin Zhang, Minyang Xie, and Chenyi Ling*, University of Maryland, College Park.
- Summer 2021-Present **Undergraduate Research Advisor**, *Priyanka Mehta, Tejan Gandhi*, University of Maryland, College Park.
- Spring 2021-Present **Graduate Co-advisor**, *PhD Candidates Brandon Feng and Matthew Ziemann*, University of Maryland, College Park.
- 2020-2021 **Mentor**, *REU Intern Kao Kitichotkul*, Stanford University.
- 2019-2020 **Mentor**, *PhD Candidates Cindy Nguyen, Mark Nishimura, and Hayato Ikoma*, Stanford University.
- Spring 2020 **Mentor**, *Computational Imaging and Display Course Projects*, Stanford University.
- Summer 2019 **Mentor**, *RISE High School Internship Program*, Stanford University.
- Summer 2019 **Mentor**, *STEM to SHTM High School Internship Program*, Stanford University.
- Spring 2019 **Mentor**, *Computational Imaging and Display Course Projects*, Stanford University.
- Spring 2015 **Mentor**, *Signals, Systems, and Learning Course Projects*, Rice University.
- Spring 2015 **Mentor**, *Electrical Engineering Senior Design Project*, Rice University.

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## Teaching

- Fall 2021 **Instructor**, *CMSC848B Selected Topics in Information Processing; Computational Imaging*, University of Maryland, College Park.
- Spring 2021 **Instructor**, *CMSC426: Computer Vision*, University of Maryland, College Park.

- Spring 2019 **Guest Lecturer**, *EE367/CS448I: Computational Imaging and Display*, Stanford University.
- Spring 2015 **Teaching Assistant**, *Fundamentals of Electrical Engineering II*, Rice University.
- Fall 2013 **Teaching Assistant**, *Advanced VLSI*, Rice University.
- Fall 2014 **Guest Speaker**, *4<sup>th</sup> Grade Class in Houston Independent School District*.
- Fall 2011 **Course Assistant**, *Signals, Systems, and Learning*, Rice University.
- Spring 2011 **Course Assistant**, *Fundamentals of Electrical Engineering II*, Rice University.
- Fall 2010 **Course Assistant**, *Fundamentals of Electrical Engineering I*, Rice University.

## Professional Service

**Conference/Workshop Committee Member**, *Computational Optical Sensing and Imaging 2021, NeurIPS Workshop on Deep Learning and Inverse Problems 2021*.

**Grant Reviewer**, *Panel Expert for European Research Council*.

**Signal Processing Reviewer**, *IEEE Signal Processing Magazine; IEEE Transactions on Image Processing; IEEE Transactions on Information Theory; IEEE Transactions on Signal Processing; IEEE Signal Processing Letters; IEEE Journal on Selected Areas in Information Theory; IEEE Journal of Selected Topics in Signal Processing; IEEE Open Journal of Signal Processing; IEEE Wireless Communications Letters; IEEE Sensors Journal; IEEE Transactions on Multimedia; ACM Transactions on Graphics; Nature Scientific Reports; SIAM Journal on Imaging Sciences; Elsevier Digital Signal Processing; Elsevier Signal Processing: Image Communication; Elsevier Journal of Visual Communication and Image Representation; Springer Journal of Circuits, Systems, and Signal Processing; ISIT; SAMPTA; SPAWC; ITW*.

**Machine Learning Reviewer**, *CVPR, NeurIPS, ICML, ICCV, ECCV, UAI, IEEE Journal on Selected Areas in Information Theory Special Issue on Deep Learning*.

**Optics Reviewer**, *Optica, Optics Express, Photonics Research, Applied Optics, IEEE Transactions on Computational Imaging, ACM SIGGRAPH, ACM SIGGRAPH Asia*.

**Other Reviewer**, *Robotics Science and Systems*.

Starting 08/21 **Club Advisor**, *UMD Google Developer Student Club*.

03/19-07/19 **Organizer**, *Imaging and Microscopy Journal Club*.

08/17-05/18 **Professional Development Chair**, *Rice ECE Graduate Student Association*.

08/16-05/17 **Social Chair**, *Rice ECE Graduate Student Association*.

08/14-05/15 **Community Service Committee Member**, *Rice Graduate Student Association*.

08/12-05/13 **Vice President**, *Rice IEEE*.

08/11-05/12 **Treasurer**, *Rice IEEE*.

08/09-05/13 **Member**, *Rice Society of Automotive Engineers*.

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## Media Coverage

2020 **Deep-inverse Correlography: Towards Real-time High-resolution Non-line-of-sight Imaging**, *Featured in Science Magazine, IEEE Spectrum Magazine, The Times of London, The Telegraph, CNET, MSN.com, and more.*

2021 **Keyhole Imaging: Non-Line-of-Sight Imaging and Tracking of Moving Objects Along a Single Optical Path**, *Gizmodo, ExtremeTech, and others. >75K YouTube views.*