

# KYLE GILMAN

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## EDUCATION

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### University of Michigan

*Sept 2017 - December 2022*

Ph.D., Graduate Research Assistant  
Department of Electrical and Computer Engineering: Systems  
Doctoral research advisor: Laura Balzano  
Dissertation: “Scalable Algorithms Using Optimization on Orthogonal Matrix Manifolds.”

### University of Michigan

*Awarded August 2019*

M.S., Electrical and Computer Engineering: Computer Vision Cumulative GPA: 3.8/4.0

### University of Wyoming

*Sept 2012 - May 2017*

B.S., Electrical Engineering Cumulative GPA: 4.0/4.0

*Summa Cum Laude*

Department of Electrical and Computer Engineering

## RESEARCH INTERESTS

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My research is in unsupervised machine learning and optimization. I specialize in developing and analyzing scalable algorithms to process big, messy data with missing, corrupted, and noisy entries. All of my work is motivated by real applications for important problems in signal processing, computer vision, medical imaging, environmental sensing, data science, and more—but also is driven through principled, theoretical study. In particular, my work focuses on

- Nonconvex and constrained optimization
- Scalable online algorithms
- Low-rank matrix and tensor factorization for missing data completion
- Heteroscedastic noise models
- Optimization on Riemannian manifolds

## EXPERIENCE

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### Member of Technical Staff

*June 2024 - Present*

*MIT Lincoln Laboratory, Lexington, MA*

- Machine learning research for RF signal processing.

### Senior Associate, Applied AI/ML Modeling

*January 2023 - April 2024*

*JPMorgan Chase, Columbus, OH*

- Applied research in optimization and signal processing for forecasting large-scale time series data with missing, corrupted, and noisy entries.

### Graduate Research Assistant

*Sept 2017 - December 2022*

*University of Michigan Signal Processing Algorithm Design and Analysis Lab* *Ann Arbor, MI*

- Published in top research venues on unsupervised machine learning, nonconvex and constrained optimization, scalable online algorithms, and low-rank matrix and tensor factorization for signal processing and missing data completion.
- Applications include computer vision, medical imaging, environmental sensing, and other signal processing problems.

## Scalable Modeling & Algorithms Graduate Research Intern

*Sandia National Laboratories*

June - August 2021

*Livermore, CA*

- Developed fast majorize-minimize algorithms to optimize online Generalized Canonical Polyadic tensor decompositions. Achieved superior speedup and parameter estimation over stochastic gradient descent with ADAM. Mentored by Eric Phipps.

## Student Instructor: Computational Data Science and Machine Learning

*University of Michigan*

Fall 2019 & 2020

*Ann Arbor, MI*

- Led discussion lectures and lab sections, held office hours, graded exams, and answered online forum questions for a graduate level machine learning course taught by Dr. Raj Nadakuditi.
- Received Graduate Student Instructor Honorable Mention for Fall 2020.

## Research Intern

*United States Air Force Research Laboratory*

May 2017 - August 2017

*Dayton, OH*

- Filled elastomer image processing. Mentored by Jennifer Pierce and Craig Przybyla.

## Research Intern

*United States Air Force Research Laboratory*

June 2016 - August 2016

*Dayton, OH*

- Polymer matrix composite (PMC) image processing. Mentored by Michael Uchic.

## PREPRINTS

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Gilman, K., Hong, D., Fessler, J. A., & Balzano, L. Streaming Probabilistic PCA for Missing Data with Heteroscedastic Noise. *arXiv preprint arXiv:2310.06277*. (2023).

## JOURNAL PUBLICATIONS

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Gilman, K., Burer, S. & Balzano, L. A Semidefinite Relaxation for Sums of Heterogeneous Quadratic Forms on the Stiefel Manifold. *ArXiv Preprint ArXiv:2205.13653*. To appear in *SIAM Journal on Matrix Analysis and Applications*. (2025).

Gilman, K., Tarzanagh, D. & Balzano, L. Grassmannian Optimization for Online Tensor Completion and Tracking With the t-SVD. *IEEE Transactions On Signal Processing*. **70** pp. 2152-2167 (2022).

Hong, D., Gilman, K., Balzano, L. & Fessler, J. HePPCAT: Probabilistic PCA for Data With Heteroscedastic Noise. *IEEE Transactions On Signal Processing*. **69** pp. 4819-4834 (2021).

## CONFERENCE PUBLICATIONS

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Gilman, K. & Balzano, L. Online Tensor Completion and Free Submodule Tracking with the t-SVD. *ICASSP 2020-2020 IEEE International Conference On Acoustics, Speech And Signal Processing (ICASSP)*. pp. 3282-3286 (2020).

Gilman, K. & Balzano, L. Panoramic Video Separation with Online Grassmannian Robust Subspace Estimation. *Proceedings Of The IEEE/CVF International Conference On Computer Vision Workshops*. pp. 0-0 (2019).

## LECTURES AND POSTERS AT CONFERENCES, WORKSHOPS AND SYMPOSIUMS

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“A Tight SDP Relaxation for Heteroscedastic PCA,” SIAM Mathematics of Data Science Conference 2022, San Diego, CA, September 2022.

“Algorithms for Nonconvex Probabilistic PCA for Data With Heteroscedastic Noise,” INFORMS Optimization Society Conference 2022, Greenville, South Carolina, March 2022.

“Streaming Probabilistic PCA for Missing Data with Heteroscedastic Noise”, Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS) 2022, University of Michigan, March 2022.

“HePPCAT: Probabilistic PCA for Data with Heteroscedastic Noise,” 2021 Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS), University of Michigan, February 2021.

“Grassmannian Optimization for Online Tensor Completion and Tracking in the t-SVD Algebra,” *Institute of Advanced Studies Workshop on Missing data*, 2020.

“Online Tensor Completion and Free Submodule Tracking with the t-SVD,” *2020 International Conference on Acoustics, Speech, and Signal Processing*. Barcelona, Spain. 2020.

“Panoramic Video Separation with Online Grassmannian Robust Subspace Estimation,” *International Conference on Computer Vision 2019 Workshop on Robust Subspace Learning and Applications in Computer Vision*. Seoul, South Korea. 2019.

## LOCAL TALKS

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“Scalable Algorithms Using Optimization on Orthogonal Matrix Manifolds,” Thesis Defense, University of Michigan, October 2022.

“Majorize-Minimize Algorithms for Generalized Canonical Polyadic Tensor Decompositions,” SOLSTICE Research Group Meeting, Sandia National Laboratories, August 2021.

“Scalable Algorithms using Optimization on Orthogonal Matrix Manifolds,” Thesis Proposal, *University of Michigan*, May 2021.

“Nonconvex Landscape of Heteroscedastic Probabilistic Principal Component Analysis,” *University of Michigan*, Signal Processing Algorithm Design and Analysis lab presentation, 2020.

“Online Tensor Completion and Tracking of Free Submodules with the t-SVD,” UNIVERSITY OF MICHIGAN Statistical Machine Learning Reading Group Student Presentations. Ann Arbor, MI. 2019.

“Panoramic Video Separation with Fast Grassmannian Robust Subspace Tracking,” UNIVERSITY OF WISCONSIN-MADISON Midwest Machine Learning Symposium Student Poster Session. Madison, WI. 2019.

“Sketched Gauss-Newton Optimization for Neural Networks,” UNIVERSITY OF MICHIGAN EECS 598 Deep Learning Student Poster Session. Ann Arbor, MI. 2019.

“Foreground-Background Separation in Panoramic Video with Robust Principal Component Analysis Methods,” UNIVERSITY OF MICHIGAN Ph.D. candidacy examination. Ann Arbor, MI. January 2019.

“Microstructure Characterization of PR-2200 Filled Elastomer Sealant from Image Analysis,” U.S. AIR FORCE RESEARCH LABORATORY composites research group and Student Poster Presentations. Dayton, OH. 2017.

“Assessment of Computer Vision and Image Processing Pipelines for Fiber Quantification in PMC Laminates from Optical Images,” UNIVERSITY OF WYOMING Senior Design Presentations and Poster Session. Laramie, WY. 2017.

“Assessment of Image Processing Pipelines for Fiber Quantification in PMC Laminates from Optical Images,” U.S. AIR FORCE RESEARCH LABORATORY composites research group. Dayton, OH. 2016.

## HONORS

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2022 UNIVERSITY OF MICHIGAN Michigan Student Symposium for Interdisciplinary Statistical Sciences (MSSISS) Honorable Mention.

2021 UNIVERSITY OF MICHIGAN Graduate Student Instructor Honorable Mention for Fall 2020.  
2017 UNIVERSITY OF MICHIGAN ECE Departmental Ph.D. Fellowship  
2017 INNOVATIVE SIGNAL ANALYSIS \$4,000 Signal Processing Scholarship  
2017 Tau Beta Pi \$10,000 Graduate Fellowship  
2017 UNIVERSITY OF WYOMING Best Overall Senior Design Project  
2017 Wyoming Engineering Society \$2,000 Scholarship  
2016 Tau Beta Pi \$2,000 Scribner Scholarship  
2012-2016 UNIVERSITY OF WYOMING Trustee's and Hathaway Scholarships (Full scholarship)

## TECHNICAL STRENGTHS

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**Languages:** Julia and Python  
**Tools:** PySpark, SQL, MATLAB, Jupyter Notebooks, L<sup>A</sup>T<sub>E</sub>X, Git version control

## PROFESSIONAL ACTIVITIES

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IEEE Transactions on Signal Processing reviewer  
Journal of Machine Learning Research reviewer

## REFERENCES

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Professor Laura Balzano, Associate Professor of EECS at the University of Michigan.  
Email: girasole@umich.edu.

Professor Jeffrey A. Fessler, William L. Root Collegiate Professor of EECS at the University of Michigan.  
Email: fessler@umich.edu.

Professor Sam Burer, Tippie Rollins Professor in the Department of Business Analytics at the University of Iowa. Email: samuel-burer@uiowa.edu.