LAURA BALZANO

1301 Beal Ave
Ann Arbor, MI
734-615-9451

girasole@umich.edu
http://web.eecs.umich.edu/~girasole

EMPLOYMENT HISTORY

Associate Professor of Electrical Engineering and Computer Science
University of Michigan, September 2019 – present.

Visiting Scholar and Member
Institute for Advanced Study, Princeton NJ, September 2019 – July 2020.

Assistant Professor of Electrical Engineering and Computer Science
University of Michigan, January 2013 – August 2019.

Visiting Researcher
University of Wisconsin, Madison and Duke University, June - December 2012.

Graduate Research Assistant
University of Wisconsin, Madison, January 2008 – May 2012.

Visiting Researcher
École Polytechnique Fédérale de Lausanne (EPFL), June – December 2007.

Graduate Research Assistant
University of California, Los Angeles, September 2004 – June 2007.

Software Developer
Applied Signal Technology, Inc, June 2002 – June 2004.

EDUCATION

05/2012	University of Wisconsin, Madison

PhD in Electrical and Computer Engineering

Thesis title: "Handling Missing Data in High-Dimensional Subspace Modeling."
Thesis advisers: Robert Nowak (ECE) and Benjamin Recht (CS)

Major Area: Signal Processing	Minor Area: Mathematics

03/2007	University of California, Los Angeles

Master of Science in Electrical Engineering

Major Area: Communications	Minor Areas: Optimization, Statistics

12/2001	Rice University

Bachelor of Science in Electrical and Computer Engineering

Major Area: Computer Engineering	Minor Areas: Signal Processing, Networking

RESEARCH FUNDING

Qing Qu, Laura Balzano, Albert Berahas, Eunshin Byon, and Salar Fattahi. University of Michigan START: Next Generation Data Science: from High Dimensional Statistics to Nonconvex Optimization. $75,000, May 2022-May 2023.

Laura Balzano and Hessam Mahdavifar. Department of Energy (DoE): Get Non-Real: Randomized Sketching for High-Dimensional Non-Real-Valued Data. $300,000, September 2021–August 2023.

Laura Balzano. Fulbright Commission Portugal: New Regularizers for Low-Dimensional Modeling of High-Dimensional Data. €10,250, May-July 2020. (Canceled due to COVID, encouraged to reapply at a future date.)

Laura Balzano. National Science Foundation (NSF) CAREER: Robust, Interpretable, and Efficient Unsupervised Learning with K-set Clustering. $596,792, May 2019-April 2024.

Laura Balzano, Yuekai Sun, and Sonja Starr. University of Michigan MCubed: Fairness and Legality in Algorithmic Decision Making. $60,000, January 2019-December 2020.

Laura Balzano. Air Force Office of Scientific Research (AFOSR) YIP: Non-convex Optimization Algorithms and Theory for Matrix Factorization with Dynamic Massive Data. $450,000, January 2019-December 2021.

Clay Scott, Jeff Fessler, Mert Pilanci, and Laura Balzano. NSF BIGDATA: Random and Adaptive Projections for Scalable Optimization and Learning. $1,000,000, January 2019-Dec 2021.

Laura Balzano. Army Research Office (ARO) YIP: Mathematics for Learning Nonlinear Generalizations of Subspace Models in High Dimensions. $360,000, November 2018-October 2021.

Laura Balzano. 3M NTFA: Algorithms for Low-Dimensional Modeling of High-Dimensional Data. $30,000, May 2018-May 2028.

Jason Corso, Laura Balzano. DARPA D3M: SPIDER: Subspace Primitives that are Interpretable and Diverse. $1,320,000, March 2017-October 2020.

Jun Li, Anna Gilbert, Clay Scott, Gagnon Bartsch, Roman Vershynin, Laura Balzano, Max Wicha, Sue Hammoud, Gil Omenn, Justin Colacino, Ebrahim Azizi, Diane Simone, Dana Dolinoy, Yuanfang Guan. University of Michigan MIDAS: Michigan Center for Single-Cell Genomic Data Analytics. $1,249,233, March 2017-April 2020.

Laura Balzano. NVIDIA hardware award, Titan X GPU $4000 MSRP. October 2016.

Laura Balzano, Eric Schwartz, Alfred Hero. University of Michigan MCubed: Consumer preference learning from limited feedback. $60,000, September 2016-December 2017.

Laura Balzano. Intel Early Career Fellowship. $25,000, September 2015-October 2025.

Johanna Mathieu, Laura Balzano. NSF Energy, Power, and Control Networks: Inferring the behavior of distributed energy resources from incomplete measurements, $399,452, July 2015-June 2018.

Laura Balzano. ARO: Subspace Methods for Massive and Messy Data. $344,959, September 2014-August 2017.

Laura Balzano. NSF BRIGE: Simultaneous Modeling and Calibration for Environmental Sensor Data. $174,996, September 2013-August 2016.

Laura Balzano, Branko Kerkez, Don Scavia. University of Michigan MCubed: A mathematical, scientific, and measurement framework for the assessment of water balance and water quality. $60,000, September 2013-December 2014.

AWARDS	

AWARDS

MLK Spirit Award, University of Michigan North Campus Deans Award, February 2023

Vulcans Education Excellence Award, University of Michigan, January 2020

Fulbright U.S. Scholar Award, awarded February 2019 but withdrawn due to COVID

National Science Foundation CAREER Award, February 2019

Air Force Office of Scientific Research Young Investigator Award, October 2018

Army Research Office Young Investigator Award, May 2018

3M Non-Tenured Faculty Award, May 2018.

Intel Early Career Faculty Honor Program Award, August 2015.

University of Wisconsin, Electrical and Computer Engineering Department, **Best Dissertation Award**, 2012.

University of Wisconsin **Peer Mentor Award**, 2012.

3M Fellowship for Graduate Study, 2009-2012.

Innovative Signal Analysis Graduate Scholarship, 2008.

University of California, Los Angeles, Electrical Engineering Department, **Outstanding Master's Degree Award**, 2007.

PUBLICATIONS SUBMITTED OR IN PREPARATION

P. Wang, R. Jiang, Q. Kong, L. Balzano. "**Proximal DC Algorithm for Sample Average Approximation of Chance Constrained Programming: Convergence and Numerical Results**." Submitted to SIOPT. Preprint available at https://arxiv.org/abs/2301.00423.

K. Gilman, S. Burer, and L. Balzano, "**A Semidefinite Relaxation for Sums of Heterogeneous Quadratics on the Stiefel Manifold**." Submitted to SIMAX. Preprint available at https://arxiv.org/abs/2205.13653.

C. Blocker, H. Raja, J. Fessler, and L. Balzano, "**Geodesic Dynamic Subspace Estimation**." In preparation. Preprint available at https://arxiv.org/abs/2303.14851.

D.A. Tarzanagh and L. Balzano, "**Online Bilevel Learning: Dynamic Regret Analysis of Alternating First-Order Methods**." In preparation. Preprint available at https://arxiv.org/abs/2207.02829.

D.A. Tarzanagh, L. Balzano, and A.O. Hero, "**Fair Structure Learning in Heterogeneous Graphical Models**." Submitted to JMLR. Preprint at https://arxiv.org/abs/2112.05128v1.

A. Ritchie, L. Balzano, and C. Scott, "**Supervised PCA: A Multiobjective Approach**." Submitted to IEEE Transactions on Signal Processing. Preprint available at https://arxiv.org/abs/2011.05309.

JOURNAL PUBLICATIONS	

1) D. Hong, L. Balzano, and J. Fessler, "**Optimally Weighted PCA for High-dimensional Heteroscedastic Data**." *SIAM Journal on Mathematics of Data Science* 5, no. 1 (2023): 222-250.

2) Z. Du, L. Balzano, and N. Ozay, "**Mode Reduction for Markov Jump Systems**." *IEEE Open Journal of Control Systems* 1 (2022): 335-353.

3) K. Gilman, D.A. Tarzanagh, and L. Balzano, "**Grassmannian Optimization for Online Tensor Completion and Tracking with the t-SVD**." *IEEE Transactions on Signal Processing* (2022).

4) D. Hong, K. Gilman, L. Balzano, and J. Fessler, "**HePPCAT: Probabilistic PCA for Data with Heteroscedastic Noise.**" *IEEE Transactions on Signal Processing* (2021).

5) G. Ongie, D. Pimentel-Alarcon, R. Nowak, R. Willett, and L. Balzano, "**Tensor Methods for Nonlinear Matrix Completion**." *SIAM Journal of the Mathematics of Data Science,* 3, no. 1 (2021): 253-279.

6) John Lipor, David Hong, Yan Shuo Tan, Laura Balzano, "**Subspace clustering using ensembles of K-subspaces**." *Information and Inference: A Journal of the IMA*, 10 no. 1 (2021). https://doi.org/10.1093/imaiai/iaaa031.

7) H. Lyu, D. Needell, and L. Balzano, "**Online Matrix Factorization for Markovian Data and Applications to Network Dictionary Learning**." *Journal of Machine Learning Research,* 21, no. 251 (2020): 1-49.

8) T. Thong, Y. Wang, M.D. Brooks, C. Lee, C. Scott, L. Balzano, M.S. Wicha, J.A. Colacino, "**Hybrid stem cell states: Insights into the relationship between mammary development and breast cancer using single-cell transcriptomics**." *Frontiers in Cell and Developmental Biology* 8 (2020): 288.

9) J. Lipor and L. Balzano, "**Clustering Quality Metrics for Subspace Clustering**." *Pattern Recognition* 104 (2020): 107328.

10) A. Eftekhari, G. Ongie, L. Balzano, and M. Wakin, "**Streaming Principal Component Analysis from Incomplete Data**." *Journal of Machine Learning* Research 20, no. 86 (2019): 1-62.

11) A. Gitlin, B. Tao, L. Balzano, and J. Lipor, "**Improving K-Subspaces via Coherence Pursuit**." *IEEE Journal of Selected Topics in Signal Processing* 12, no. 6 (2018): 1575-1588.

12) L. Balzano, Y. Chi, and Y. Lu, "**Streaming PCA and subspace tracking: The missing data case.**" Proceedings of the IEEE 106, no. 8 (2018): 1293-1310.

13) G.S. Ledva, L. Balzano, and J.L. Mathieu, "**Real-Time Energy Disaggregation of a Distribution Feeder's Demand Using Online Learning**." *IEEE Transactions on Power Systems* 33, no. 5 (2018): 4730-4740.

14) D. Hong, L. Balzano, and J. Fessler, "**Asymptotic performance of PCA for high-dimensional heteroscedastic data**." *Journal of Multivariate Analysis*, 167 (2018): 435-452.

15) J. Lipor, B. Wong, D. Scavia, B. Kerkez, L. Balzano, "**Distance-Penalized Active**

Learning for Spatial Sampling." *IEEE Transactions on Signal Processing* 65, no. 20 (2017): 5453-5465.

16) A. Eftekhari, L. Balzano, and M. Wakin, "**What to Expect when you are Expecting on the Grassmannian.**" *IEEE Signal Processing Letters* 24, no. 6 (2017): 872-876.

17) R. Kennedy, L. Balzano, S.J. Wright, and C.J. Taylor, "**Online Algorithms for Factorization-Based Structure from Motion**," *Journal for Computer Vision and Image Understanding* 150 (2016): 139-152.

18) L. Balzano and S. Wright, "**Local Convergence of an Algorithm for Subspace Identification from Partial Data**,'' *Journal for Foundations on Computational Mathematics (FOCM)* 15, no. 5 (2015): 1279-1314.

19) J. He, D. Zhang, L. Balzano, and T. Tao, "**Iterative Grassmannian Optimization for Robust Image Alignment**," *Journal of Image and Vision Computing* 32, no. 10 (2014): 800-813.

20) V. Tan, L. Balzano, and S. Draper, "**Rank Minimization over Finite Fields: Fundamental Limits and Coding-Theoretic Interpretations**,'' *IEEE Transactions on Information Theory* 58, no. 4 (2012): 2018-2039.

21) K. Ni, N. Ramanathan, M.N. Hajj Chehade, L. Balzano, S. Nair, S. Zahedi, G. Pottie, M. Hansen, and M. Srivastava, "**Sensor Network Data Fault Types**," *ACM Transactions on Sensor Networks* 5, no. 3 (2009): 25.

22) S. Ganeriwal, L. Balzano, and M. Srivastava, "**Reputation-based Framework for High Integrity Sensor Networks**," *ACM Transactions on Sensor Networks* 4, no. 3 (2008): 15.

23) V. Gambiroza, P. Yuan, L. Balzano, Y. Liu, S. Sheafor, and E. Knightly, "**Design, Analysis, and Implementation of DVSR: A Fair, High Performance Protocol for Packet Rings**," *IEEE/ACM Transactions on Networking* 12, no. 1 (2004): 85-102.

CONFERENCE PUBLICATIONS

1) A. Xu, L. Balzano, J. Fessler. "**HeMPPCAT: Mixtures of Probabilistic Principal Component Analysers for Data with Heteroscedastic Noise**," Proceedings of ICASSP, 2023.

2) C. Yaras*, P. Wang*, Z. Zhu, L. Balzano, and Q. Qu. "**Neural Collapse with Normalized Features: A Geometric Analysis over the Riemannian Manifold**," Proceedings of Neurips, 2022.

3) R. Naik, N. Trivedi, D.A. Tarzanagh, L. Balzano, "**Truncated Matrix Completion - An Empirical Study**." Proceedings of EUSIPCO, special session on missing data, 2022.

4) P. Wang, H. Liu, A. Man-Cho So, and L. Balzano, "**Recovery Guarantee of K-Subspaces Method for Subspace Clustering**." Proceedings of ICML, 2022.

5) Z. Du, Y. Sattar, D.A. Tarzanagh, L. Balzano, S. Oymak, and N. Ozay. "**Certainty equivalent quadratic control for Markov jump systems**." Proceedings of the American Control Conference (ACC), 2022

6) Y. Sattar, Z. Du, D.A. Tarzanagh, L. Balzano, N. Ozay, and S. Oymak. "**Data-Driven Control of Markov Jump Systems: Sample Complexity and Regret Bounds**." Proceedings of the American Control Conference (ACC), 2022.

7) L. Balzano, "**On the Equivalence of Oja's Algorithm and GROUSE**." Proceedings of Artificial Intelligence and Statistics (AI Stats), March 2022.

8) A. Bower and L. Balzano, "**Preference Modeling with Context-Dependent Salient Features**." Proceedings of the International Conference on Machine Learning (ICML, oral presentation 22% acceptance), July 2020.

9) K. Gilman and L. Balzano, "**Online Tensor Completion and Free Submodule Tracking with the t-SVD**." Proceedings of the International Conference of Conference for Acoustics, Speech, and Signal Processing (ICASSP), May 2020.

10) Z. Du, N. Ozay, and L. Balzano, "**Mode Clustering for Markov Jump Systems**." Proceedings of the IEEE Conference on Computational Advances in Multi-Sensor Array Processing (CAMSAP), December 2019. **Best student paper, 3rd place.**

11) D. Hong, L. Balzano, and J. Fessler, "**Probabilistic PCA for Heteroscedastic Data**."

Proceedings of the IEEE Conference on Computational Advances in Multi-Sensor Array Processing (CAMSAP), December 2019.

12) D. Hong, S. Lei, J.L. Mathieu, and L. Balzano, "**Exploration of tensor decomposition applied to commercial building baseline estimation.**" Proceedings of the IEEE Global Conference on Signal and Information Processing (GlobalSIP), November 2019.

13) K. Gilman and L. Balzano, "**Panoramic Video Separation with Online Grassmannian Robust Subspace Estimation.**" International Conference on Computer Vision (ICCV), Workshop on Robust Subspace Learning and Applications in Computer Vision, 2019.

14) A. Ritchie, C. Scott, L. Balzano, D. Kessler, C. Sripada, "**Supervised Principal Component Analysis via Manifold Optimization.**" IEEE Data Science Workshop (DSW), June 2019.

15) D. Zhang, T. Zhao, and L. Balzano. "**Information Maximization Auto-Encoding.**" Workshop on Bayesian Deep Learning, NeurIPS 2018.

16) J. Lipor and L. Balzano, "**Clustering Quality Metrics for Subspace Clustering**," Proceedings of the Asilomar Conference on Signals, Systems, and Computers, 2018.

17) G.S. Ledva, L. Balzano, and J. Mathieu, "**Exploring Connections between a Multiple Model Kalman Filter and Dynamic Fixed Share with Applications to Demand Response.**" Proceedings of the IEEE Conference on Control Technology and Applications (CCTA), 2018.

18) D. Hong, R. Malinas, J. Fessler, and L. Balzano, "**Learning Dictionary-Based Unions of Subspaces for Image Denoising.**" Proceedings of the European Signal Processing Conference (EUSIPCO) 2018.

19) Z. Du, L. Balzano, and N. Ozay, "**A Robust Algorithm for Online Switched System Identification.**" Proceedings of the Symposium on System Identification (SYSID) 2018.

20) G. Ongie, D. Hong, D. Zhang, and L. Balzano, "**Online Estimation of Coherent Subspaces with Adaptive Sampling.**" Proceedings of the SSP Workshop 2018.

21) D. Zhang, J. Katz-Samuels, M. Figueiredo, and L. Balzano, "**Simultaneous Sparsity and Parameter Tying for Deep Learning using Ordered Weighted ℓ_1 Regularization**," Proceedings of the SSP Workshop 2018.

22) G. Ongie, N. Murthy, L. Balzano, and J. Fessler, "**Memory-efficient Splitting Algorithms for Large-Scale Sparsity Regularized Optimization.**" Proceedings of the International Conference on Image Formation in X-Ray Computed Tomography (CT Meeting) 2018.

23) A. Bower, L. Jain, and L. Balzano, "**The Landscape of Nonconvex Quadratic Feasibility.**" Proceedings of the International Conference for Acoustics, Speech, and Signal Processing (ICASSP) 2018.

24) D. Zhang, H. Wang, M. Figueiredo, and L. Balzano, "**Learning to Share: Simultaneous Parameter Tying and Sparsification for Deep Learning.**" Proceedings of the International Conference on Learning Representations (ICLR, 32% acceptance) 2018.

25) G. Ongie, S. Dewangan, J. Fessler, and L. Balzano, "**Online Dynamic MRI Reconstruction via Robust Subspace Tracking.**" Proceedings of the IEEE Global Conference on Signal and Information Processing (GlobalSIP), November 2017.

26) G. Ongie, D. Hong, D. Zhang, and L. Balzano, "**Enhanced Online Subspace Estimation Via Adaptive Sensing.**" Proceedings of the Asilomar Conference on Signals, Systems, and Computers, November 2017.

27) D. Pimentel-Alarcon, G. Ongie, L. Balzano, R. Nowak, and R. Willett, "**Low Algebraic Dimension Matrix Completion.**" Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2017.

28) J. Lipor and L. Balzano, "**Leveraging Union of Subspace Structure to Improve Constrained Clustering.**" Proceedings of the International Conference on Machine Learning (ICML, oral presentation 26% acceptance), August 2017.

29) G. Ongie, L. Balzano, R. Nowak, and R. Willett, "**Algebraic Variety Models for High-Rank Matrix Completion.**" Proceedings of the International Conference on Machine Learning (ICML, oral presentation 26% acceptance), August 2017.

30) D. Pimentel Alarcon, L. Balzano, R. Marcia, R. Nowak, and R. Willett, "**Mixture**

Regression as Subspace Clustering.” Proceedings of the Sampling Theory and Applications Conference (SampTA), July 2017.

31) D. Zhang and L. Balzano, “**Matched Subspace Detection using Compressively Sampled Data**.” Proceedings of the International Conference for Acoustics, Speech, and Signal Processing (ICASSP), March 2017.

32) N. Rao, R. Ganti, L. Balzano, R. Willett, and R. Nowak, “**On Learning High-Dimensional Structured Single Index Models**.” Proceedings of the conference of the Association for the Advancement of Artificial Intelligence (AAAI, oral presentation 25% acceptance), February 2017.

33) D. Hong, L. Balzano, and J. Fessler, “**Towards a Theoretical Analysis of PCA for Heteroscedastic Data**.” Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2016.

34) P. Xiao and L. Balzano, “**Online Sparse and Orthogonal Subspace Estimation from Partial Information**.” Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2016.

35) D. Pimentel Alarcon, L. Balzano, and R. Nowak, “**Necessary and Sufficient Conditions for Sketched Subspace Clustering**.” Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2016.

36) D. Pimentel Alarcon, L. Balzano, R. Marcia, R. Nowak, and R. Willett, “**Group-Sparse Subspace Clustering with Missing Data**.” Proceedings of the IEEE Statistical Signal Processing (SSP) Workshop, July 2016.

37) N. Rao, R. Ganti, L. Balzano, R. Willett, and R. Nowak, “**On Learning High-Dimensional Structured Single Index Models**.” Workshop on Advances in non-convex analysis and optimization at the International Conference on Machine Learning (ICML), June 2016.

38) D. Zhang and L. Balzano, “**Global Convergence of a Grassmannian Gradient Descent Algorithm for Subspace Estimation.**” Proceedings of Artificial Intelligence and Statistics (AI Stats, poster presentation 31% acceptance), May 2016.

39) R. Ganti, L. Balzano, and R. Willett, “**Matrix Completion under Monotonic Single Index Models**,” Proceedings of the conference for Neural Information Processing Systems (NeurIPS, Poster presentation 22% acceptance), December 2015.

40) J. Lipor and L. Balzano, “**Margin-Based Active Subspace Clustering**,” Proceedings of the IEEE Conference on Computational Advances in Multi-Sensor Array Processing (CAMSAP), December 2015.

41) J. Lipor, L. Balzano, B. Kerkez, and D. Scavia, “**Quantile-search: A Distance-Penalized Active Learning Algorithm for Spatial Sampling**,” Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2015.

42) G.S. Ledva, L. Balzano, and J.L. Mathieu, “**Inferring the Behavior of Distributed Energy Resources with Online Learning**,” Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2015.

43) R. Kennedy, C.J. Taylor, and L. Balzano, “**Online Completion of Ill-Conditioned Low-Rank Matrices**,’’ IEEE Global Conference on Signal and Information Processing (GlobalSIP), December 2014.

44) J. Lipor and L. Balzano, “**Robust Blind Calibration via Least Squares**,’’ IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), May 2014.

45) R. Kennedy, L. Balzano, S.J. Wright, and C.J. Taylor, “**Online Algorithms for Factorization-Based Structure from Motion**,” IEEE Winter Conference on Applications of Computer Vision (WACV), March 2014.

46) D. Pimentel, R. Nowak, and L. Balzano, “**On the Sample Complexity of Subspace Clustering with Missing Data,**’’ Proceedings of the Statistical Signal Processing Workshop (SSP), June 2014.

47) L. Balzano and S. Wright, “**On GROUSE and the ISVD**,’’ Proceedings of the IEEE Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP), special session on New Sensing and Inference Methods for Large-Scale Data, December 2013.

48) J. He, D. Zhang, L. Balzano, and T. Tao, “**Iterative Online Subspace Learning for**

Robust Image Alignment," IEEE Automatic Face and Gesture Recognition conference, April 2013.

49) L. Balzano, A. Szlam, B. Recht, and R. Nowak, "**k-Subspaces with Missing Data**," Proceedings of the Statistical Signal Processing Workshop (SSP), August 2012.

50) J. He, L. Balzano, and A. Szlam, "**Incremental Gradient on the Grassmannian for Online Foreground and Background Separation in Subsampled Video,**" Proceedings of the conference on Computer Vision and Pattern Recognition (CVPR, oral presentation 5% acceptance), June 2012.

51) L. Balzano, B. Eriksson, and R. Nowak, "**High-Rank Matrix Completion**," Proceedings of the conference on Artificial Intelligence and Statistics (AISTATS, poster presentation 35% acceptance), April 2012.

52) V. Tan, L. Balzano, and S. Draper, "**Rank Minimization in Finite Fields**," Proceedings of the International Symposium on Information Theory (ISIT), August 2011.

53) L. Balzano, R. Nowak, and M. Roughan, "**On the Success of Network Inference using a Markov Random Walk Model**," Proceedings of the International Conference on Acoustics, Speech, and Signal Processing (ICASSP), May 2011.

54) L. Balzano, W. Bajwa, and R. Nowak, "**Column Subset Selection with Missing Data**," In the NIPS workshop on Low-Rank Methods for Large-Scale Machine Learning, December 2010.

55) L. Balzano, B. Recht, and R. Nowak, "**Online and Adaptive Tracking of Subspaces from Highly Incomplete Information**," In the NIPS workshop on Low-Rank Methods for Large-Scale Machine Learning, December 2010.

56) L. Balzano, R. Nowak, and B. Recht, "**Online and Adaptive Tracking of Subspaces from Highly Incomplete Information**," Proceedings of the Allerton Conference on Communications, Control, and Computing, September 2010.

57) L. Balzano, B. Recht, and R. Nowak, "**High-Dimensional Matched Subspace Detection when Data are Missing**," Proceedings of the International Symposium on Information Theory (ISIT), June 2010.

58) L. Balzano and R. Nowak, "**Blind Calibration in Sensor Networks**," Proceedings of the Conference on Information Processing in Sensor Networks (IPSN, oral presentation 15% acceptance), April 2007.

59) N. Ramanathan, L. Balzano, D. Estrin, T. Harmon, M. Hansen, J. Jay, B. Kaiser, and G. Sukhatme. "**Designing Wireless Sensor Networks as a Shared Resource for Sustainable Development**," Proceedings of the 1st International Conference on Information and Communication Technologies and Development, April 2006.

ABSTRACTS, BOOK CHAPTERS, AND OTHER PUBLICATIONS	1) Y. Wang, T. Thong, V. Saligrama, J. Colacino, L. Balzano, and C. Scott. "**A Gene Filter for Comparative Analysis of Single-Cell RNA-Sequencing Trajectory Datasets**." (2019) Technical Report available at https://www.biorxiv.org/content/10.1101/637488v1.

2) D. Zhang and L. Balzano, "**Convergence of a Grassmannian Gradient Descent Algorithm for Subspace Estimation from Undersampled Data**." (2018) University of Michigan Technical Report available at https://hdl.handle.net/2027.42/171760.

3) G.S. Ledva, Z. Du, L. Balzano, and J. Mathieu, "**Disaggregating Load by Type from Distribution System Measurements in Real-Time**." Energy Markets and Responsive Grids: Modeling, Control, and Optimization, Sean Meyn, Tariq Samad, Sonja Glavaski, Ian Hiskens, and Jakob Stoustrup, editors. pp. 413-437. Springer, New York, NY, 2018.

4) D. Zhang, Y. Sun, B. Eriksson, and L. Balzano, "**Deep Unsupervised Clustering Using a Mixture of Autoencoders**." 2017. University of Michigan Technical Report at http://hdl.handle.net/2027.42/145190.

5) D. Zhang and L. Balzano, "**Convergence results of GROUSE**," Presented at Signal Processing with Adaptive Sparse Structured Representations (SPARS), June 2017.

6) J. Lipor and L. Balzano, "**Leveraging Union of Subspace Structure to Improve Constrained Clustering**," Presented at Signal Processing with Adaptive Sparse Structured Representations (SPARS), June 2017.

7) A. Eftekhari, L. Balzano, D. Yang, M. Wakin, "**SNIPE for Memory-Limited PCA From Incomplete Data: From Failure to Success**," Presented at Signal Processing with

Adaptive Sparse Structured Representations (SPARS), June 2017.

8) D. Hong, L. Balzano, and J. Fessler, "**Theoretical Analysis of PCA with Heteroscedastic Data**,'' Presented at Signal Processing with Adaptive Sparse Structured Representations (SPARS), June 2017.

9) N. Farouk, M. Zhang, and L. Balzano, "**Ordinal Embedding with a Latent Factor Model**," University of Michigan Tech Report CSPL-420, March 2017.

10) B. Wong, B. Kerkez, J. Lipor, L. Balzano, and D. Scavia, "**Measuring the water quality of lakes using an internet-enabled robot**,'' Presented at the International Conference on Hydroinformatics, August 2016.

11) R. Kennedy, C.J. Taylor, and L. Balzano, "**Online Completion of Ill-Conditioned Low-Rank Matrices**,'' Signal Processing with Adaptive Sparse Structured Representations (SPARS), June 2015.

12) J. Lipor and L. Balzano, "**Quantile Search**," Signal Processing with Adaptive Sparse Structured Representations (SPARS), June 2015.

13) A. Russell-Graham, P. Xiao, S. Brown, and L. Balzano, "**Determination of Trends in Ozone in the Mid-Atlantic Using Non-Negative Matrix Factorization**," American Geophysical Union (AGU) Fall meeting, December 2014.

14) J. He, L. Balzano, and A. Szlam, "**Online Robust Background Modeling via Alternating Grassmannian Optimization**.'' Background Modeling and Foreground Detection for Video Surveillance, Thierry Bouwmans, editor. Chapman and Hall. July 2014.

15) L. Balzano, "**Handling Missing Data in High-Dimensional Subspace Modeling**," Ph.D. Thesis under the supervision of Professors Rob Nowak, Ben Recht, Barry Van Veen, Stark Draper, and Jordan Ellenberg. University of Wisconsin, Madison, May 2012.

16) L. Balzano, R. Nowak, A. Szlam and B. Recht, "**K-Subspaces with Missing Data**," University of Wisconsin Tech Report ECE-11-02, February 2011.

17) He, L. Balzano, A. Szlam, and J. C.S. Lui, "**Online Robust Subspace Tracking from Partial Information,**'' Tech report; Arxiv version available at http://arxiv.org/abs/1109.3827

18) L. Balzano and J. Ellenberg, "**Understanding Persistent Homology and Plex using a Networking Dataset**," University of Wisconsin Tech Report, October 2010.

19) L. Balzano and R. Nowak, "**Blind Calibration of Networks of Sensors: Theory and Applications**," Networked sensing information and control, Venkatesh Saligrama, editor. Springer 2008.

20) L. Balzano, "**Addressing Fault and Calibration in Sensor Networks**," Masters Thesis under the guidance of Professors Mani Srivastava, Mark Hansen, Greg Pottie and Steven Margulis. University of California, Los Angeles, March 2007.

21) N. Ramanathan, L. Balzano, M. Burt, D. Estrin, E. Kohler, T. Harmon, C. Harvey, J. Jay, S. Rothenberg, and M. Srivastava, "**Rapid Deployment with Confidence: Calibration and Fault Detection in Environmental Sensor Networks**," Center for Embedded Networked Sensing (CENS) Technical Report #62, April 2006.

TEACHING AND ADVISING EXPERIENCE

Courses Taught

Term	Course number		Enrollment	Q1	Q2	Q4	Q217/216*	Q230
WN 2013	EECS/IOE 600	Functional Analysis for Optimization	16	4.33	4.75	4.75	4.92*	4.67
FA 2013	EECS 451	Digital Signal Processing and Analysis	74	4.37	4.73	4.33	4.93	4.73

Term	Course	Title	Enroll	Q1	Q2	Q4	Q216/Q217	Q230
WN 2014	EECS 564	Estimation, Filtering, and Detection	40	4.25	4.50	4.50	4.75*	4.64
FA 2014	EECS 451	Digital Signal Processing and Analysis	91	4.11	4.24	4.17	4.82	4.34
FA 2014	EECS/IOE 600	Functional Analysis for Optimization	17	4.50	4.50	4.50	4.80*	4.30
FA 2015	EECS 351	Digital Signal Processing and Analysis	40	4.44	4.72	4.46	4.90	4.83
WN 2016	EECS 564	Estimation, Filtering, and Detection	37	4.64	4.83	4.59	4.83*	4.88
FA 2016	EECS 351	Digital Signal Processing and Analysis	49	4.74	4.92	4.39	4.95	4.90
FA 2016	EECS/IOE 600	Functional Analysis for Optimization	24	4.17	4.40	4.58	4.81	4.40
FA 2018	EECS/IOE 600	Functional Analysis for Optimization	21	4.80	4.70	4.60	5.00	4.80
WN 2019	EECS 351	Digital Signal Processing and Analysis	59	4.50	4.70	4.10	4.90	4.90
FA 2020	EECS 351	Digital Signal Processing and Analysis	45	4.20	4.70	4.40	4.90	4.80
WN 2021	EECS 600	Functional Analysis for Optimization	20	4.70	4.70	4.30	5.00	4.80
FA 2021	EECS598-005	Randomized Numerical Linear Algebra for Machine Learning	28	4.70	4.80	4.00	5.00	4.80
WN 2022	EECS 351	Digital Signal Processing and Analysis	71	4.40	4.70	4.30	4.80	4.70
FA 2022	EECS 553	Machine Learning	86	4.40	4.60	4.60	4.90	4.80

Scores out of 5:
Q1: Overall, this is an excellent course.
Q2: Overall, Laura Balzano is an excellent teacher.
Q4: I had a strong desire to take this course.
Q216: The instructor acknowledged all questions insofar as possible.
Q217: Laura Balzano treated students with respect.
Q230: Laura Balzano seemed well prepared for class meetings.

Advisees

Alex Ritchie, co-advised by Clayton Scott, joined September 2018.
Rachel Newton, co-advised by Peter Seiler, joined September 2020.
Javier Salazar Cavazos, co-advised by Jeff Fessler, joined September 2021.
Can Yaras, co-advised by Qing Qu, joined September 2021.
Soo Min Kwon, co-advised by Qing Qu, joined September 2022.

Kyle Gilman, joined September 2018, proposal May 2021, Ph.D. defense October 2022.
"Scalable Algorithms Using Optimization on Orthogonal Matrix Manifolds"
Next position: Applied AI/ML Senior Associate at Chase Bank

Zhe Du, co-advised by Necmiye Ozay, joined July 2016, proposal December 2021, Ph.D. defense November 2022. "Learning, Control, and Reduction for Markov Jump Systems"
Next position: Postdoctoral scholar at UC Riverside

Amanda Bower, AIM student co-advised by Martin Strauss joined January 2017, proposal December 2017, Ph.D. defense October 2020. "Dealing with Intransitivity, Non-Convexity, and Algorithmic Bias in Preference Modeling"
Next position: Twitter Machine Learning Ethics, Transparency, and Accountability (META) group

Dejiao Zhang, joined September 2013, proposal January 2018, Ph.D. defense May 2019. "Extracting Compact Knowledge from Massive Data"
Next position: Applied research scientist at Amazon Web Services, New York

David Hong, co-advised by Jeffrey Fessler joined January 2015, proposal March 2017, Ph.D. defense March 2019.
"Learning Low-Dimensional Models for Heterogeneous Data"
Next position: Postdoctoral scholar at Penn – Wharton Statistics Department

John Lipor, joined September 2013, proposal November 2016, Ph.D. defense September 2017.
"*Sensing Structured Signals with Active and Ensemble Methods*"
Next position: Assistant Professor, Portland State University Electrical and Computer Engineering

Postdoctoral Researchers

Peng Wang joined December 2021.

Davoud Ataee Tarzanagh September 2020 – August 2022.
Following position: Postdoctoral Researcher at UPenn.
Haroon Raja August 2019 – February 2021.
Following position: AI Scientist at Eli Lilly.
Ali Soltani-Tehrani, co-advised by Jason Corso May 2018 – May 2019.
Following position: Associate Principal Data Scientist at AstraZeneca.
Gregory Ongie, co-advised by Jeffrey Fessler September 2016 – July 2018.
Following position: Assistant Professor, Marquette University Math.

Ph.D. Committees

I have been a member of 33 Ph.D. committees in addition to chairing the above committees: 25 in EECS, 1 in Statistics, 3 in Industrial and Operations Engineering, 1 in Civil and Environmental Engineering, 1 in Chemistry, 1 in Mathematics, 1 in Climate and Space Sciences.

Outreach and extra-curricular

Faculty Advisor for Michigan IEEE student branch (2015-present) and MIDAS MSAIL artificial intelligence reading group (2017-present).
Supporting students in finding useful resources and helping maintain continuity across student officers.

Michigan Institute for Data Science (MIDAS) certificate student program, September 2016 – December 2018
Monthly meetings with the data science certificate students, working to build a community and culture of data science leadership at Michigan.

University of Michigan Pipeline Initiative and Wolverine Pathways, March 2015 - present
Working with school districts and community stakeholders to recruit successive cohorts of 100 seventh and 100 tenth graders from both the Southfield school district and the Ypsilanti school district on an annual basis to participate in a research-based learning experience. The program offers these students a portfolio of programs and supports them through college admission. Program content is aligned with the Michigan Department of Education learning objectives. The first program will in spring 2016 involved programming and understanding media, including my lectures on Machine Learning.

Michigan MSTEM Academies, June 2013
Visit with students in the MSTEM program as the transition from high school to STEM fields at the University of Michigan.

Undergraduate Research Opportunity Program, June 2014 – May 2016
Mentor undergraduate students on research activities.

Delta Certificate Program for Research, Teaching and Learning in STEM fields, University of Wisconsin, June 2010 – June 2012.
Studied research for teaching in the college classroom, for teaching international and diverse communities, and for motivating high school students' interest in STEM careers. Taught units of the college classroom course and taught to high school students at Madison La Follette HS

TALKS AND SEMINARS

Keynote or Plenary Seminars

- Environmental Protection Agency (EPA) Air Sensors Meeting, March 2013.

Invited Seminars

- Arizona State University LIONS Seminar, March 2022.
- Johns Hopkins MINDS & CIS Seminar, October 2021.
- Rutgers University Signal and Information Processing Seminar, March 2021.
- UT Austin Oden Institute lecture (virtual), November 2020.
- Priberam Machine Learning seminar at Instituto Superior Técnico (virtual), June 2020.
- Institute for Advanced Study Special Year Seminar, February 2020.
- Princeton Colloquium Series for the Program in Applied and Computational Mathematics, February 2020.

- Princeton Colloquium of the Operations Research and Financial Engineering, December 2019.
- Berkeley Laboratory for Information Systems and Sciences (BLISS) Seminar, November 2018.
- Toyota Technical Institute of Chicago Seminar, March 2017.
- Institute for Mathematics and its Applications (IMA) summer school on Mathematical Optimization, August 2016.
- Air Force Research Lab seminar, June 2016.
- Johns Hopkins Center for Imaging Science, May 2015.
- Annual Workshop on Data Science, Tennessee State University, April 2015.
- University of Chicago Computation Seminar, April 2015.
- University of Wisconsin Advanced Signal Processing Class, March 2015.
- Claremont McKenna Math department, February 2015.
- Colorado School of Mines Center for Automation, Robotics, and Distributed Intelligence (CARDI) and the EECS department, August 2014.
- University of Pennsylvania (interview), March 2012.
- The Ohio State University (interview), March 2012.
- Duke University, February 2012.
- Notre Dame University (interview), February 2012.
- University of Michigan (interview), February 2012.
- University of Wisconsin, Madison SILO (Systems Information Learning and Optimization) seminar.
- Rice University invited seminar, November 2011.
- University of Minnesota invited seminar, April 2011.
- University of Illinois, Urbana-Champaign, invited seminar, April 2011.

Selected Invited Workshop Presentations	

- INFORMS track for Dynamic Data Driven Applications Systems, October 2021.
- University of Toronto Fields Institute Symposium on Low-Rank Models and Applications, June 2021.
- Institute for Advanced Study, Workshop on Missing Data Challenges in Statistics, Computation, and Applications (virtual), September 2020.
- Institute for Advanced Study, Workshop on New Directions in Reinforcement Learning and Control, Lightning talk, November 2019.
- Simons Workshop on Robust High-Dimensional Statistics, November 2018.
- Simons Workshop on Randomized Numerical Linear Algebra and Applications, September 2018.
- SIAM Optimization Minisymposium on Non-Convex Optimization, May 2017
- Simons Interactive Learning Workshop, February 2017.
- Workshop for Geometry in Machine Learning at the International Conference on Machine Learning (ICML), June 2016.
- The Institute for Mathematics and its Applications (IMA) Workshop on Resource Tradeoffs: Computation, Communication, and Information, May 2016.
- IMA Workshop on Optimization and Parsimonious Modeling, January 2016
- Workshop for Sparse Representations, Numerical Linear Algebra, and Optimization at the Banff International Research Station (BIRS), October 2014.
- INFORMS Optimization society meeting, March 2014.
- Adaptive Data Analysis and Sparsity workshop at the Institute for Pure and Applied Mathematics (IPAM), January 2013.
- Society for Industrial and Applied Mathematics (SIAM) Imaging, May 2012.

PROFESSIONAL ACTIVITIES AND SERVICE

Organizer

- SIAM Optimization – Minisymposium on "Tractable Non-Convex Problems in Low-Dimensional Learning" 2023.
- Institute for Advanced Study Workshop on Missing Data Challenges in Statistics, Computation, and Applications, September 2020.
- IEEE Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP) - Special session on The Intersection of Optimization Theory and Information Processing, December 2019.
- Sampling Theory and Applications (SampTA) – conference session on Missing Data Imputation, July 2019.
- Midwest Machine Learning Workshop – Organizing committee 2019; Advisory Board 2018-present; Organizing committee 2017
- Michigan Statistical Machine Learning Reading Group (SMLRG) Workshop - Organizer 2014-2018
- Asilomar - Special Session Chair for the session on Structured Matrix and Covariance Recovery within the track on Signal Processing and Adaptive Systems 2017
- Pulsar Information Processing Workshop – Lead organizer (concurrent with SPARS) 2017
- SIAM Optimization - Minisymposium on Non-convex Methods Organizer 2017
- Neural Information Processing Systems (NIPS) – Technical program committee 2016
- IEEE Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP) - Special session on Optimization and Adaptivity in Big Data Organizer 2015

- IEEE Conference on Global Signal and Information Processing (Global SIP) - Symposium on Information Processing and Big Data Organizer 2014; Technical program committee 2013
- Institute for Pure and Applied Mathematics – Workshop on Adaptive Data Sparsity and Analysis Organizer 2013

Editorial Roles
- IEEE Open Journal of Signal Processing 2020-present
- SIAM Journal on the Mathematics of Data Science 2021-present

Faculty Advisor
- MSAIL Michigan Undergraduate Artificial Intelligence Reading Group Advisor September 2017-present.
- University of Michigan IEEE Student Group September 2015-present.
- Girls in EECS (GEECS) Student Group September 2013-September 2015.

Departmental and University Service
- Committee for an Inclusive Department, September 2020-August 2022. Lead author of the department's code of conduct, adopted April 2023.
- Dean's advisory committee of female faculty, September 2021-present.
- Signal and Image Processing and Machine Learning area chair, September 2022-present.
- Signal and Image Processing and Machine Learning graduate advisor, September 2022-present.
- PhD Admissions Committee
- Computer Engineering Undergraduate Program Advisor January 2016-December 2020.

Contributor / Panelist
- Midwest Machine Learning workshop panel, 2017-2018.
- Information Theory Summer School at the University of Toronto, June 2014.
- Girls in EECS (GEECS) panel for high school workshop for Girls Who Code, Nov 2013.
- Matrix Computations (Golub and Van Loan) version 4. Contributed problem 6.4.8. 2012.
- Volunteer for the UW Oral History project series on Women in Science and Engineering. 2008-2012.
- Institute for Pure and Applied Mathematics (IPAM) 2011 Newsletter.
- NPR All Tech Considered, *The path from syphilis to faster MRIs* by Art Silverman. Contributed audio demo, see details at http://sunbeam.ece.wisc.edu/csaudio. 2010

Program Committee Roles
- AI Stats - Senior program committee 2019-present.
- Neural Information Processing Systems (NeurIPS) – Senior program committee 2019.
- International Conference on Machine Learning (ICML) – Senior program committee 2019.
- SPARS - Technical Program Committee 2015, 2017, 2019.
- IEEE Workshop on Statistical Signal Processing (SSP) – Technical program committee 2018.

Senior Member, IEEE, Signal Processing Society
Member, SIAM, Optimization Society