

Mark A. Iwen

CONTACT INFORMATION

Department of Mathematics
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RESEARCH INTERESTS

Computational Harmonic Analysis, Mathematical Data Science, Signal Processing, Algorithms for the Analysis of Large and High Dimensional Data Sets.

EMPLOYMENT

Michigan State University, Associate Professor

- Associate Professor, Department of Mathematics & Department of CMSE, March 2019 – Present
- Assistant Professor, Dept. of Mathematics & Department of CMSE, August 2017 – March 2019
- Assistant Professor, Dept. of Mathematics & Department of ECE, August 2013 – August 2017

Duke University, Visiting Assistant Professor

Department of Mathematics, September 2010 – August 2013

University of Minnesota, Postdoctoral Fellow

Institute for Mathematics and its Applications (IMA), September 2008 – August 2010

EDUCATION

University of Michigan, Ann Arbor

Ph.D., Applied and Interdisciplinary Mathematics, August, 2008

University of Wisconsin, Milwaukee

B.S., Computer Science and Mathematics, May, 2002

RESEARCH GRANTS AND AWARDS

- Principal Investigator (Lead): NSF DMS Applied Math, 9/1/2021 – 8/31/2024.
Collaborative Research: Fast, Low-Memory Embeddings for Tensor Data with Applications, (MSU budget: 151K). Collaboration w/ UCLA (PI: Deanna Needell) and Princeton (PI: Liza Rebrova).
- Single Investigator: NSF DMS Comp. Math, 7/1/2019 – 6/30/2023 (3 years + 1 year NCE).
Fast and Robust Algorithms for Signal Recovery from Underdetermined Measurements: Generalized Sparse Fourier Transforms, Inverse Problems, and Density Estimation, (200K)
- Co-PI: NSF CCF CIF, 7/1/2016 – 6/30/2021 (3 years + 2 year NCE).
CIF: Small: Low-Dimensional Structure Learning for Tensor Data with Applications to Neuroimaging, (500K)
PI: Prof. Selin Aviyente, ECE, MSU (award split between two PIs: 50%-50%)
- Single Investigator: NSF DMS CDS&E-MSS, 8/1/2014 – 7/31/2018 (3 years + 1 year NCE).
Better Fast Algorithms for Large and High-Dimensional Datasets: Sparse Fourier Transforms and Fast Density Estimators, (264K)
- Google Cloud Platform (GCP) research credits program, 7/1/2018 – 12/28/2018, (5K)
- Principal Investigator: Inst. for Mathematics and its Apps. (IMA), 8/14/2017 – 8/18/2017.
Focused Research Initiative on Phase Retrieval Algorithms: Computational Efficiency, Deterministic Guarantees, and Auto-Calibration, (20K)
- August-Wilhelm Scheer Visiting Professor, Technische Universität München, 5/8/16 – 5/26/16.
- Single Investigator: NSA Young Investigators Grant, 7/1/2013 – 6/30/2015.
Multiscale Geometric Density Estimation for High-Dimensional Data, (40K)
- AMS-Simons Travel Grant, 2011 – 2012, (4K)

OTHER GRANTS
AND AWARDS

- J.S. Frame Excellence in Teaching Award, 2019. Given annually by MSU Math Department.
- Co-PI: NSA REU, 5/1/2019 – 4/30/2020.
Summer Undergraduate Research Institute in Experimental Mathematics, (95K)
PI: Prof. Bob Bell, Lyman Briggs College and MTH, MSU
- Co-PI: MathWorks Curriculum Development Grant, 8/16/2018 – 8/15/2020.
Enhancement of calculus instruction through LiveScript Laboratories: design, deployment, and assessment, (41K)
PI: Prof. Willie Wai-Yeung Wong, Math, MSU
- Co-PI: NSA REU, 5/1/2018 – 4/30/2019.
Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM), (102K)
PI: Prof. Bob Bell, Lyman Briggs College and MTH, MSU
- Principal Investigator: MAA National REU Program (NREUP), 5/12/2014 – 6/20/2014.
Noisy Competing Dynamics and Its Applications, (27K)

PUBLICATIONS

SUBMITTED
JOURNAL ARTICLES

- Gross, Craig and Mark A. Iwen. *Sparse Spectral Methods for Solving High-Dimensional and Multiscale Elliptic PDEs*. Submitted, 2023.
- Zare, Ali, Roland Wirth, Cullen Haselby, Heiko Hergert, M. A. Iwen. *Modewise Johnson-Lindenstrauss Embeddings for Nuclear Many-Body Theory*. Submitted, 2022.
- Iwen, M.A. and Mark Roach. *On Outer Bi-Lipschitz Extensions of Linear Johnson-Lindenstrauss Embeddings of Low-Dimensional Submanifolds of \mathbb{R}^N* . Submitted, 2022.
- Iwen, M.A., Benjamin Schmidt, Arman Tavakoli. *Characterizing Unit Spheres in Euclidean Spaces via Reach and Volume*. Submitted, 2022.
- Iwen, M.A., Deanna Needell, Michael Perlmutter, Elizaveta Rebrova. *Modewise Operators, the Tensor Restricted Isometry Property, and Low-Rank Tensor Recovery*. Submitted, 2021.
- Iwen, M.A., Benjamin Schmidt, and Arman Tavakoli. *Lower Bounds on the Low-Distortion Embedding Dimension of Submanifolds of \mathbb{R}^n* . Submitted, 2021.

JOURNAL ARTICLES

- Iwen, M.A., Benjamin Schmidt, Arman Tavakoli. *On Fast Johnson-Lindenstrauss Embeddings of Compact Submanifolds of \mathbb{R}^N with Boundary*. *Discrete & Computational Geometry*, to appear.
- Iwen, M.A., Michael Perlmutter, Mark Roach. *Toward Fast and Provably Accurate Near-field Ptychographic Phase Retrieval*. *Sampling Theory, Signal Processing, and Data Analysis*, Vol. 21, Issue 1, article 6, 2023.
- Iwen, M.A., Michael Perlmutter, Nada Sissouno, and Aditya Viswanathan. *Phase Retrieval for $L^2([-\pi, \pi])$ via the Provably Accurate and Noise Robust Numerical Inversion of Spectrogram Measurements*. *Journal of Fourier Analysis and Applications*, Vol. 29, Issue 1, Article 8, 2023.
- Gross, Craig, Mark A. Iwen, Lutz Kämmerer, and Toni Volkmer. *Sparse Fourier Transforms on Rank-1 Lattices for the Rapid and Low-Memory Approximation of Functions of Many Variables*.

Sampling Theory, Signal Processing, and Data Analysis, Vol. 20, Issue 1, Article 1, 2022.

- Gross, Craig, Mark A. Iwen, Lutz Kämmerer, and Toni Volkmer. *A Deterministic Algorithm for Constructing Multiple Rank-1 Lattices of Near-Optimal Size*. Advances in Computational Mathematics, Vol. 47, Issue 6, Article 86, 2021.
- Michael Perlmutter, Sami Merhi, Aditya Viswanathan, and Mark Iwen. *Inverting Spectrogram Measurements via Aliased Wigner Distribution Deconvolution and Angular Synchronization*. Information and Inference: A Journal of the IMA, Vol. 10, Issue 4, pages 1491 – 1531, 2021.
- Choi, Bosu, Mark A. Iwen, and Toni Volkmer. *Sparse Harmonic Transforms II: Best s -Term Approximation Guarantees for Bounded Orthonormal Product Bases in Sublinear-Time*. Numerische Mathematik, Vol. 148, Issue 2, pages 293 – 362, 2021.
- Faust*, Theodore, Mark A. Iwen, Rayan Saab, and Rongrong Wang. *On the ℓ^∞ -norms of the Singular Vectors of Arbitrary Powers of a Difference Matrix with Applications to Sigma-Delta Quantization*. Linear Algebra and its Applications, Vol. 626, pages 79 – 151, 2021. ***Undergraduate Student**.
- Iwen, M.A., Felix Kraemer, Sara Krause-Solberg, and Johannes Maly. *On Recovery Guarantees for One-Bit Compressed Sensing on Manifolds*. Discrete & Computational Geometry, Vol. 65, Issue 4, pages 953 – 998, 2021.
- Choi, Bosu, Mark A. Iwen, and Felix Kraemer. *Sparse Harmonic Transforms: A New Class of Sublinear-time Algorithms for Learning Functions of Many Variables*. Foundations of Computational Mathematics, Vol. 21, Issue 2, pages 275 – 329, 2021.
- Iwen, M.A., Deanna Needell, Elizaveta Rebrova, and Ali Zare. *Lower Memory Oblivious (Tensor) Subspace Embeddings with Fewer Random Bits: Modewise Methods for Least Squares*. SIAM Journal on Matrix Analysis and Applications, Vol. 42, Issue 1, pages 376 – 416, 2021.
- Sissouno, Nada, Florian Bossmann, Frank Filbir, Mark Iwen, Maik Kahnt, Rayan Saab, Christian Schroer, and Wolfgang zu Castell. *A Direct Solver for the Phase Retrieval Problem in Ptychographic Imaging*. Mathematics and Computers in Simulation, Vol. 176, pages 292–300, 2020.
- Iwen, M.A., Brian Preskitt, Rayan Saab, and Aditya Viswanathan. *Phase Retrieval from Local Measurements: Improved Robustness via Eigenvector-Based Angular Synchronization*. Applied and Computational Harmonic Analysis, Vol. 48, Issue 1, pages 415–444, 2020.
- Iwen, M.A., Sami Merhi, and Michael Perlmutter. *Lower Lipschitz Bounds for Phase Retrieval from Locally Supported Measurements*. Applied and Computational Harmonic Analysis, Vol. 47, Issue 2, pages 526 – 538, 2019.
- Merhi, Sami, Ruochuan Zhang, Mark A. Iwen, and Andrew Christlieb. *A New Class of Fully Discrete Sparse Fourier Transforms: Faster Stable Implementations with Guarantees*. Journal of Fourier Analysis and Applications, Vol. 25, Issue 3, pages 751 – 784, 2019.
- Bittens, Sina, Ruochuan Zhang, and Mark A. Iwen. *A Deterministic Sparse FFT for Functions with Structured Fourier Sparsity*. Advances in Computational Mathematics, Vol. 45, Issue 2, pages 519 – 561, 2019.
- Zare, Ali, Alp Özdemir, Mark A. Iwen, and Selin Aviyente. *Extension of PCA to Higher Order Data Structures: An Introduction to Tensors, Tensor Decompositions, and Tensor PCA*. Proceedings of the IEEE, Vol. 106, Number 8, pages 1341–1358, 2018.

- Hu, Xianfeng, M.A. Iwen, and Hyejin Kim. *Rapidly Computing Sparse Legendre Expansions via Sparse Fourier Transforms*. Numerical Algorithms, Vol. 74, Issue 4, pages 1029 – 1059, 2017.
- Iwen, M.A., Aditya Viswanathan, and Yang Wang. *Robust Sparse Phase Retrieval Made Easy*. Applied and Computational Harmonic Analysis, Vol. 42, Issue 1, pages 135 – 142, 2017.
- Iwen, M.A., Aditya Viswanathan, and Yang Wang. *Fast Phase Retrieval from Local Correlation Measurements*. SIAM Journal on Imaging Sciences, Vol. 9, Number 4, pages 1655 – 1688, 2016.
- Iwen, M.A. and Benjamin Ong. *A Distributed and Incremental SVD Algorithm for Agglomerative Data Analysis on Large Networks*. SIAM Journal on Matrix Analysis and Applications, Vol. 37, Issue 4, pages 1699 – 1718, 2016.
- Iwen, M.A. and Felix Krahmer. *Fast Subspace Approximation via Greedy Least-Squares*. Constructive Approximation, Vol. 42, Issue 2, pages 281 – 301, 2015.
- Gilbert, A.C., Piotr Indyk, Mark Iwen, and Ludwig Schmidt. *Recent Developments in the Sparse Fourier Transform*. IEEE Signal Processing Magazine, Vol. 31, Issue 5, pages 91 – 100, 2014.
- Iwen, M.A. *Compressed Sensing with Sparse Binary Matrices: Instance Optimal Error Guarantees in Near-Optimal Time*. Journal of Complexity, Vol. 30, Issue 1, pages 1 – 15, 2014.
- Iwen, M.A. and Rayan Saab. *Near-Optimal Encoding for Sigma-Delta Quantization of Finite Frame Expansions*. Journal of Fourier Analysis and Applications, Vol. 19, Issue 6, pages 1255 – 1273, 2013.
- Iwen, M.A. and Mauro Maggioni. *Approximation of Points on Low-Dimensional Manifolds via Random Linear Projections*. Information and Inference: A Journal of the IMA, Vol. 2, Issue 1, pages 1 – 31, 2013.
- Segal*, B. and M.A. Iwen. *Improved Sparse Fourier Approximation Results: Faster Implementations and Stronger Guarantees*. Numerical Algorithms, Vol. 63, Issue 2, pages 239 – 263, 2013. ***Undergraduate Student.**
- Iwen, M.A., Fadil Santosa, and Rachel Ward. *A Symbol-Based Algorithm for Decoding Bar Codes*. SIAM Journal on Imaging Sciences, Vol. 6, Issue 1, pages 56 – 77, 2013.
- Iwen, M.A. *Improved Approximation Guarantees for Sublinear-Time Fourier Algorithms*. Applied and Computational Harmonic Analysis, Vol. 34, Issue 1, pages 57 – 82, 2013.
- Iwen, M.A., and A. H. Tewfik. *Adaptive Strategies for Target Detection and Localization in Noisy Environments*. IEEE Transactions on Signal Processing, Vol. 60, Issue 5, pages 2344 – 2353, 2012.
- Bailey*, J., M. A. Iwen, C. V. Spencer. *On the Design of Deterministic Matrices for Fast Recovery of Fourier Compressible Functions*. SIAM J. Matrix Anal. Appl., Vol. 33, No. 1, pages 263 – 289, 2012. ***Undergraduate Student.**
- Iwen, M.A. *Combinatorial Sublinear-Time Fourier Algorithms*. Foundations of Computational Mathematics, Vol. 10, Issue 3, pages 303 – 338, 2010.
- Iwen, M.A., and C. V. Spencer. *A Note on Compressed Sensing and the Complexity of Matrix Multiplication*. Information Processing Letters, Vol. 109, Issue 10, April, 2009.

- Farrell, B., Yi Huang, Mark Iwen, Ting Wang, Lisa Zhang, and Jintong Zheng. *Wavelength Assignment in Optical Network Design*. Mathematics-in-Industry Case Studies (MICS), Vol. 1, 2008.
- Iwen, M.A., A. Gilbert, and M. Strauss. *Empirical Evaluation of a Sub-Linear Time Sparse DFT Algorithm*. Communications in Mathematical Sciences, Vol. 5, No. 4, December, 2007.

PATENTS

- Fadil Santosa, Mark A. Iwen, and Rachel Ward. *Symbol-Based Decoding of Optical Codes*, Patent Number US 8,967,481 B2. March 3, 2015.

REFEREED CONFERENCE PROCEEDINGS

- Perlmutter, Michael, Jieqian He, Mark A. Iwen, and Matthew Hirn. *A Hybrid Scattering Transform for Signals with Isolated Singularities*. Asilomar Conf. on Signals, Systems, and Computers (ACSSC), 2021.
- Perlmutter, Michael, Nada Sissouno, Aditya Viswanathan, and Mark A. Iwen. *A Provably Accurate Algorithm for Recovering Compactly Supported Smooth Functions from Spectrogram Measurements*. European Signal Processing Conference (EUSIPCO), 2020. [Invited Paper]
- Iwen, M.A., Eric Lybrand, Aaron A. Nelson, and Rayan Saab. *New Algorithms and Improved Guarantees for One-Bit Compressed Sensing on Manifolds*. Sampling Theory and Applications (SampTA), 2019. [Invited Paper]
- Dirksen, Sjoerd, Mark A. Iwen, Sara Krause-Solberg, and Johannes Maly. *Robust One-bit Compressed Sensing with Manifold Data*. Sampling Theory and Applications (SampTA), 2019. [Invited Paper]
- Özdemir, Alp, Ali Zare, Mark A. Iwen, and Selin Aviyente. *Multiscale Analysis for Higher-order Tensors*. Proc. of SPIE Optical Engineering + Applications, San Diego, CA, 2019. [Invited Paper]
- Merhi, Sami, Aditya Viswanathan, and Mark A. Iwen. *Recovery of Compactly Supported Functions from Spectrogram Measurements via Lifting*. Sampling Theory and Applications (SampTA), 2017.
- Iwen, M.A., Brian Preskitt, Rayan Saab, and Aditya Viswanathan. *Phase Retrieval from Local Measurements in Two Dimensions*. Proceedings of SPIE Optical Engineering + Applications, San Diego, CA, 2017. [Invited Paper]
- Larriva-Latt*, Jade, Angela Morrison*, Alison Radgowski*, Joseph Tobin*, Mark Iwen, and Aditya Viswanathan. *Edge-Augmented Fourier Partial Sums with Applications to Magnetic Resonance Imaging (MRI)*. Proceedings of SPIE Optical Engineering + Applications, San Diego, CA, 2017. [Invited Paper] ***Undergraduate Student**.
- Özdemir, Alp, Marisel Villafañe-Delgado, David C. Zhu, Mark A. Iwen, and Selin Aviyente. *Multi-Scale Higher Order Singular Value Decomposition (MS-HOSVD) for Resting-State fMRI Compression and Analysis*. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2017. [ICASSP'17 acceptance rate: ~48.5%]
- Özdemir, Alp, Mark A. Iwen, and Selin Aviyente. *Multiscale Tensor Decomposition*. 50th Asilomar Conf. on Sig., Sys., and Comp., Pacific Grove, CA, 2016.
- Özdemir, Alp, Mark A. Iwen, and Selin Aviyente. *A Multiscale Approach for Tensor Denoising*. IEEE Statistical Signal Processing Workshop (SSP), 2016.

- Özdemir, Alp, Mark A. Iwen, and Selin Aviyente. *Locally Linear Low-rank Tensor Approximation*. GlobalSIP, 2015. [GlobalSIP'15 acceptance rate: $\sim 45\%$]
- Viswanathan, Aditya, and Mark A. Iwen. *Fast Compressive Phase Retrieval*. 49th Asilomar Conf. on Sig., Sys., and Comp., Pacific Grove, CA, 2015.
- Viswanathan, Aditya, and Mark A. Iwen. *Fast Angular Synchronization for Phase Retrieval via Incomplete Information*. Proceedings of SPIE Optics + Photonics, San Diego, CA, 2015. [Invited Paper]
- Iwen, M.A., and Rayan Saab. *Random encoding of quantized finite frame expansions*. Proceedings of SPIE Wavelets XV, San Diego, CA, 2013. [Invited Paper]
- Chen, Guangliang, Mark Iwen, Sang Chin, and Mauro Maggioni. *A Fast Multiscale Framework for Data in High-Dimensions: Measure Estimation, Anomaly Detection, and Compressive Measurements*. Visual Comm. and Image Proc. (VCIP), 2012. [VCIP'12 acceptance rate: 49.6%]
- Iwen, M.A., and A. H. Tewfik. *Adaptive Compressed Sensing for Sparse Signals in Noise*. 45th Asilomar Conf. on Sig., Sys., and Comp., Pacific Grove, CA, 2011. [Invited Paper]
- Segal*, I.B. and M.A. Iwen. *Signal Approximation via the Gopher Fast Fourier Transform*. AIP Conf. Proc., Vol. 1301, pp. 494 – 504, June, 2010. ***Undergraduate Student**.
- Iwen, M.A., *Group Testing Strategies for Recovery of Sparse Signals in Noise*. 43rd Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, 2009.
- Iwen, M.A., *Simple Deterministically Constructible RIP Matrices with Sublinear Fourier Sampling Requirements*. 43rd Annual Conference on Information Sciences and Systems (CISS), Baltimore, MD, 2009.
- Iwen, M.A., *Empirical Evaluation of Two Deterministic Sparse Fourier Transforms*. 43rd Annual Conference on Information Sciences and Systems (CISS), Baltimore, MD, 2009.
- Gilbert, Anna C., Mark A. Iwen, and Martin J. Strauss. *Group Testing and Sparse Signal Recovery*. 42nd Asilomar Conference on Signals, Systems, and Computers, Monterey, CA, 2008.
- Iwen, M.A., and C.V. Spencer. *Improved Bounds for a Deterministic SubLinear-Time Sparse Fourier Algorithm*. 42nd Annual Conference on Information Sciences and Systems (CISS), Princeton, NJ, 2008.
- Iwen, M.A., W. Lang, J. Patel. *Scalable Rule-Based Gene Expression Data Classification*. IEEE International Conference on Data Engineering (ICDE), 2008. [ICDE'08 full paper acceptance rate: 12.1%]
- Iwen, M.A. *A Deterministic Sub-linear Time Sparse Fourier Algorithm via Non-adaptive Compressed Sensing Methods*. ACM-SIAM Symposium on Discrete Algorithms (SODA), 2008. [SODA '08 acceptance rate: 29.7%]
- Iwen, M.A., G.S. Mandair, M.D. Morris, M. Strauss. *Fast Line-Based Imaging of Small Sample Features*. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2007. [ICASSP'07 acceptance rate: 46.2%]
- Laska, J., S. Kirolos, Y. Massoud, R. Baraniuk, A. Gilbert, M. Iwen, and M. Strauss. *Random*

Sampling for Analog-to-Information Conversion of Wideband Signals. IEEE Dallas Circuits and Systems Workshop (DCAS), 2006.

- Iwen, M., and A.D. Mali. *Distributed Graphplan*. IEEE International Conference on Tools with Artificial Intelligence (ICTAI), 2002. [ICTAI'02 regular paper acceptance rate: 30%]
- Iwen, M., and A.D. Mali. *Dsatz: A Directional SAT Solver for Planning*. IEEE International Conference on Tools with Artificial Intelligence (ICTAI), 2002. [ICTAI'02 regular paper acceptance rate: 30%]
- Iwen, M., and A.D. Mali. *Interaction Graphs for Planning Problem Decomposition*. International Conference on Autonomous Agents & Multi Agent Systems (AAMAS), 2002. [AAMAS'02 acceptance rate: 27%]
- Iwen, M., and A.D. Mali. *Automatic Problem Decomposition for Distributed Planning*. International Conference on Artificial Intelligence (ICAI'02), 2002. [ICAI'02 acceptance rate: 30%]

TECHNICAL REPORTS

- Larriva-Latt, Jade, Angela Morrison, Alison Radgowski, Joseph Tobin, Aditya Viswanathan, and Mark Iwen. *Technical Report: Improved Fourier Reconstruction using Jump Information with Applications to MRI*. Unpublished Report, October 12, 2016.
- Iwen, Mark, Felix Kraemer, and Aditya Viswanathan. *Technical Note: A Minor Correction of Theorem 1.3 from [1]*. Unpublished Note, April 23, 2015.
- Chen, Shengyuan, Emilie Danna, Kory Hedman, Mark Iwen, Wei Kang, John Marriott, Anders Nottrott, George Yin, and Qing Zhang. *Battery Storage Control for Steadying Renewable Power Generation*. IMA Preprint Series #2373, July, 2011.
- Ian Besse, Patrick Campbelly, Julianne Chungz, Malena I. Espanolx, Mark Iwen, Edward Keyes, and Qingshuo Song. *Integrated Circuit Layout Reconstruction*. IMA Mathematical Modeling in Industry Workshop, 2005.

PUBLICLY AVAILABLE CODE PACKAGES

- Phase Retrieval Code. Matlab code for solving both standard phase retrieval problems (**BlockPR**), and sparse phase retrieval problems (**SparsePR**). Implemented with Aditya Viswanathan. Available at <https://bitbucket.org/charms/blockpr>, and <https://bitbucket.org/charms/sparsepr>, respectively.
- Michigan State University's Sparse FFT Repository. C++ implementations of several Sparse Fourier Transform (SFT) Algorithms, including the one developed in "Improved Time Bounds for Near-Optimal Sparse Fourier Representations" (2003) by Gilbert et al. Available at <http://sourceforge.net/projects/aafftannarborfa>. There have been over 3,700 code downloads from this site as of 3/14/2022.

TEACHING AND MENTORING

GRADUATE STUDENTS AND POSTDOCS ADVISED

- Postdocs Supervised:
 1. Santhosh Karnik
CMSE, Sept. 2021 – Present. Co-Supervisor: Rongrong Wang, Math & CMSE, MSU
 2. Michael Perlmutter
CMSE, Sept. 2017 – August 2020. Co-Supervisor: Matt Hirn, Math & CMSE, MSU
Took a 2nd postdoc in UCLA's Math Department.

3. Aditya Viswanathan Co-Supervisors: Prof. Yang Wang, Mathematics, HKUST
Mathematics, Sept. 2013 – Aug. 2017. Andrew Christlieb, Math & CMSE, MSU
Took a tenure track assistant professor position at UM-Dearborn beginning Fall of 2017.
 4. Wei-Hsuan Yu Co-Supervisor: Prof. Yang Wang, Mathematics, HKUST
Mathematics, Sept. 2014 – Aug. 2017. Took a 2nd postdoc @ ICERM, Brown University.
- Graduate Students Advised:
 1. Bosu Choi (MTH, jointly advised) Co-Advisor: Prof. Christlieb, CMSE & Math, MSU
Math Ph.D. received in Summer 2018. Took postdoc @ ICES, University of Texas – Austin.
 2. Craig Gross (MTH)
 3. Cullen Haselby (MTH)
 4. Xianfeng Hu (MTH, jointly advised) Co-Advisor: Prof. Yang Wang, Math, HKUST
Math Ph.D. received in Fall 2015. Went to a postdoc position w/ the Univ. of MN's IMA.
 5. Sami Eid Merhi (MTH)
Math Ph.D. received in Summer 2019. Went to Open Data Group Inc. as a Data Scientist.
 6. Alp Özdemir (ECE, jointly advised) Co-Advisor: Prof. Selin Aviyente, ECE, MSU
ECE Ph.D. received in Fall 2017. Went to General Motors (GM) as a Data Engineer.
 7. Mark Roach (MTH)
 8. Arman Tavakoli (MTH, jointly advised) Co-Advisor: Prof. Ben Schmidt, Math, MSU
Math Ph.D. received in Fall 2021. Went to Amazon as a Software Deveopment Engineer.
 9. Ali Zare (CMSE)
CMSE Ph.D. received in Spring 2022. Took a postdoc at the University of Michigan in the
Department of Computational Medicine and Bioinformatics.
 10. Ruochuan Zhang (MTH, jointly advised) Co-Advisor: Prof. Christlieb, CMSE & Math
Math Ph.D. received in Summer 2017. Went to Google as a Software Engineer.
 - Graduate Thesis Committee Memberships in Last 5 Years:
 1. Esraa Alsharoa Thesis Advisor: Prof. Selin Aviyente, ECE, MSU
 2. Gokul Bhusal Thesis Advisor: Ekaterina Rabinchuk, Math & CMSE, MSU
 3. Xavier Brumwell Thesis Advisor: Matt Hirn, CMSE & Math, MSU
 4. Anton Efremov Thesis Advisor: Prof. Lalita Udpa, ECE, MSU
 5. Jieqian He Thesis Advisor: Matt Hirn, CMSE & Math, MSU
 6. Yao Li Thesis Advisor: Ming Yan, CMSE & Math, MSU
 7. He Lyu Thesis Advisor: Rongrong Wang, CMSE & Math, MSU
 8. Luis Polanco Contreras Thesis Advisor: Jose Perea, CMSE & Math, MSU
 9. Luis Suarez Salas Thesis Advisor: Jose Perea, CMSE & Math, MSU
 10. Seyyid Emre Sofuoglu Thesis Advisor: Prof. Selin Aviyente, ECE, MSU
 11. Timothy Szocinski Thesis Advisor: Prof. Guowei Wei, Math, MSU
 12. Boyao Zhu Thesis Advisor: Heiko Hergert, NSCL/FRIB, MSU
 - Master of Science in Industrial Mathematics (MSIM) Committee Memberships in Last 5 Years:
 1. Jim Lewis Spring Semester, 2022
 2. Jason McKelvey Spring Semester, 2018

CLASSES TAUGHT IN
THE LAST 5 YEARS

- Undergraduate Courses
 1. Calculus II for Engineers (Developed a Special Section of MTH 133) Fall 2016, 2017, & 2018, and Spring 2017, 2018, & 2019
 2. Capstone Course: Intro. to Fourier Analysis (MTH 490-001), Spring 2023
- Graduate Courses
 1. Foundations of Mathematical Reasoning (CMSE 890.003, Introduction to proofs for data scientists through applied analysis), Fall 2018
 2. Compressive Sensing and Applied Probability (MTH 994-005), Fall 2020
 3. Error Correcting Codes (MTH 810-001), Spring 2021
 4. High-Dimensional Probability with Applications (MTH 994-001), Fall 2022
 5. Fast and Memory Efficient Algorithms for Big Data (CMSE 890-002) Fall 2020 and Spring 2023

UNDERGRADUATE
RESEARCH
MENTORED IN THE
LAST 5 YEARS

- *MSU Honors College P.A. Program*, Michigan State University Fall 2022 – Spring 2023
Mentored Areebah Mahdia and Erik Brodsky together with co-mentor Craig Gross (graduate student, MSU). The students learned about PCA and Factor Analysis, and then applied them to study equity issues in transit data.
- *Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM) Mentor*, Michigan State University Summer 2021
Mentored a group of three students on the mathematics of phase retrieval with co-mentor Mark Roach (graduate student, MSU). This project focused on understanding and implementing recent algorithms for image reconstruction from Short-Time Fourier Transform (STFT) magnitude measurements. The three student participants were: Jason Curtachio (Syracuse University), Grace Wilcox (Grand Valley State University), and Brandon Hutchinson (UM-Dearborn).
- *Undergraduate Thesis/Research Adviser*, Michigan State University Fall 2019 & Spring 2020
Advised and collaborated with Theo Faust on an undergraduate research/thesis project dedicated to bounding the ℓ_∞ -norms of the ℓ_2 -normalized singular vectors of a special class of difference matrices used in engineering applications. Theo was admitted to graduate school in mathematics at UCLA in the fall of 2020.
- *Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM) Mentor*, Michigan State University Summer 2018
Mentored a group of three students on the mathematics of compressive sensing with co-mentors Mike Perlmutter (postdoc, MSU) and Bosu Choi (graduate student, MSU). This project focused on improving a numerical method for very rapidly and concisely approximating functions of many variables. The three student participants were: Jaya Blanchard (Bowdoin College), Simon Miller (Oakland University), and Josh Patana (Arizona State University).
- *Discovering America Student Mentoring*, Michigan State Spring 2018 & Fall 2017
 - Chenhao Wang, Theo Faust, and Zhenru Wang (Spring 2018): Continued to study and improve numerical methods for very rapidly and concisely approximating functions of many variables.
 - Nui Jianwei, Theo Faust, and Zhenru Wang (Fall 2017): Studied and implemented a numerical method for very rapidly and concisely approximating functions of many variables.

INVITED TALKS AND FUNDED VISITS IN THE LAST 5 YEARS

INVITED & FUNDED
WORKSHOP
PARTICIPATION

- Funded Participant at the 2022 Pacific Rim Mathematical Association (PRIMA) Congress, Vancouver, Canada, December 4 - 9, 2022.
- Funded Participant at the Institute for Pure and Applied Mathematics (IPAM) for its Fall 2022 workshop on “Multi-Modal Imaging with Deep Learning and Modeling”. IPAM, Los Angeles, CA, November 28 - December 2, 2022.

- Funded Participant at Texas A&M “Conference on Advances in Data Science Theory, Methods and Computation”, College Station, Texas, October 21 - 22, 2022.
- Funded Participant at the Fields Institute for Research in Mathematical Sciences for its Spring 2022 “Focus Program on Data Science, Approximation Theory, and Harmonic Analysis”. Fields Institute, Toronto, Canada, May 9 – 13, 2022.
- Fellow and Core Participant at the Institute for Pure and Applied Mathematics (IPAM) for its Spring 2021 program on “Tensor Methods and Emerging Applications to the Physical and Data Sciences”. IPAM, Los Angeles, CA, March 8 - June 11, 2021.

HONORARY
PLENARIES AND
LECTURE SERIES

- Delivered an honorary mini-course at Le Centre de Recherches Mathématiques (CRM) on “Sublinear-Time Algorithms for Approximating Functions of Many Variables”. CRM, Montreal, Canada, May 16 – 18, 2022.

SELECTED
COLLOQUIA &
INVITED TALKS

- *Low-Distortion Embeddings of Submanifolds of \mathbb{R}^n : Lower Bounds, Faster than FFT-time Realizations, and Applications.*
 1. SFU Applied and Computational Math Seminar, Simon Fraser University (SFU), Vancouver, Canada. In person, December 7, 2022.
 2. UBC Mathematics of Information, Learning and Data (MILD) Seminar, University of British Columbia (UBC), Vancouver, Canada. In person, December 5, 2022.
 3. Conference on Advances in Data Science Theory, Methods and Computation, College Station, Texas. In person, October 22, 2022.
 4. Center for Approximation and Mathematical Data Analytics (CAMDA) Seminar, Texas A & M University, College Station, Texas. In person, October 19, 2022.
 5. ASU joint Computational and Applied Mathematics (CAM) and Data-oriented Mathematical and Statistical Sciences (DoMSS) seminar, Arizona State University (ASU). By Zoom, September 19, 2022.
 6. Mathematics Colloquium, Katholische Universität Eichstätt – Ingolstadt, Eichstätt, Germany. By Zoom, June 15, 2022.
 7. Workshop on Computational Harmonic Analysis and Linear Algebra, Fields Institute, Toronto, Canada. In person, May 10, 2022.
 8. UCSD Math Department Colloquium, University of California San Diego (UCSD). By Zoom, April 14, 2022.
 9. UCLA Applied Math Colloquium, University of California Los Angeles (UCLA). Hybrid in Person and by Zoom, September 29, 2021.
- *Provably Accurate Recovery of Compactly Supported Smooth Functions from Spectrogram Measurements.*
 1. Institute for Pure and Applied Mathematics (IPAM) workshop on “Multi-Modal Imaging with Deep Learning and Modeling”. IPAM, Los Angeles, CA. In person, December 1, 2022.
 2. Electrical and Computer Engineering (ECE) Seminar Series, Michigan State University ECE Department. By Zoom, April 7, 2022.
- *Generalized Sparse Fourier Transforms for Approximating Functions of Many Variables with Applications to Multiscale PDE.* Faculty of Mathematics and Informatics (FMI) Colloquium, St. Kliment Ohridski University of Sofia, Sofia, Bulgaria. In Person, July 7, 2022.
- *Sparse Fourier Transforms on Rank-1 Lattices for the Rapid and Low-Memory Approximation of Functions of Many Variables.* Laboratory of High-Dimensional Approximation and Applications of the Lomonosov Moscow State University, Chemnitz Technical University, and Moscow Center

for Fundamental and Applied Mathematics. Virtually via Zoom, May 5, 2021.

- *On Sublinear-Time Approximation of Functions of Many Variables: Best s -term Approximation Guarantees.*
 1. Joint SIAM/CAIMS Annual Meeting (AN20) Minisymposium “The Mathematics of Sparse Recovery and Machine Learning - Part I of II”, Virtually via Zoom, July 16, 2020.
 2. AMS Special Session on Mathematical Analysis in Data Science, I (Associated with AMS Colloquium Lectures of Ingrid Daubechies), JMM, Denver CO, January 16, 2020.

- *Sparse Fourier Transforms, Generalizations, and Extensions.*
 1. Math-FLDS Seminar, University of Southern California (USC), October 25, 2019.
 2. Math Dept. Colloquium, University of California, Los Angeles (UCLA), October 3, 2019.
 3. Math Dept. Colloquium, Technische Universität Chemnitz, Germany, July 4, 2019.
 4. SIAM CSE Minisymposium MS354, Spokane WA, March 1, 2019.
 5. Math Dept. Colloquium, University of Delaware (UD), January 28, 2019.
 6. Math Dept. Colloquium, University of Illinois at Chicago (UIC), January 14, 2019.
 7. Math Dept. Colloquium, North Carolina State University (NCSSU), January 11, 2019.
 8. Math Dept. Colloquium, University of California San Diego (UCSD), December 11, 2018.

- *Phase Retrieval from Windowed Fourier Measurements via Wigner Deconvolution and Angular Synchronization with Associated Lower Bounds.*
 1. Randomness and Determinism in Compressive Data Acquisition, Texas A&M University, College Station, TX, July 22, 2019.
 2. Ptycho Developer Workshop, Lawrence Berkeley Lab, Berkeley, CA, June 5, 2019.
 3. Approximation Theory 16 (AT16), Vanderbilt University, Nashville, TN, May 20th, 2019.

- *Sparse Harmonic Transforms: A New Class of Sublinear-Time Algorithms for Approximating Functions of Many Variables.*
 1. AMS Spring Central and Western Joint Sectional Meeting, Special Session on Sparsity, Randomness, and Optimization II, University of Hawaii, March 22, 2019.
 2. Michigan State Symposium on Mathematical Statistics and Applications, Michigan State University (MSU), September 15, 2018.
 3. PIMS Summer School and Workshop on the Mathematical Foundations of Data Science, University of British Columbia (UBC), August 2, 2018.
 4. 2018 SIAM Annual Meeting, Minisymposia MS146, Portland, OR, July 13, 2018.
 5. 7th International Conference on Computational Harmonic Analysis (ICCHA7), Vanderbilt University, Nashville, TN, May 17th, 2018.

- *Fast Phase Retrieval from Localized Time-Frequency Measurements.*
 1. SIAM Conf. on Imaging Science, Special Session MS21-1, Univ. of Bologna, June 6, 2018.
 2. Coherent X-ray Scattering Group Seminar, Paul Scherrer Institute (PSI), May 28, 2018.
 3. Opt. and Data Analysis Sem., Technische Universität München (TUM), May 25, 2018.
 4. Applied and Computational Mathematics (ACM) seminar, Georgia Tech, March 26, 2018.

- *Group Testing: From Syphilis to Sparse Fourier Transforms.*
 1. Math Dept. Colloquium, University of Minnesota Duluth (UMD), August 9, 2018.

DEPARTMENTAL SERVICE IN THE LAST 5 YEARS

DEPARTMENT OF
MATHEMATICS

- *Member of Hiring Committee for Two Tenure Track Positions (Elected, Fall 2022 – Spring 2023).*
- *Organizer for Applied-Math Seminar (Fall 2022 – now)*
- *Manager for Applied-Math/Math-Physics Seminar Speaker Travel Funds (Spring 2022 – now)*
- *Member of Fixed Term Instructor Hiring Committee (Fall 2021 – Spring 2022).*
- *Member of the Advisory Committee to the Chair (AdCom, Elected, Fall 2020 – Spring 2022).*
- *Committee Member of the Core Research Group for the Math Department Strategic Planning Process (Spring 2019).*
- *Development of MTH 133 Calculus Sections for EGR students (Fall 2016 – Spring 2019).*
 - taught 6 semesters of special math 133 sections aimed at including modeling and computational applications of calculus into the curriculum,
 - developed computational labs for recitations which demonstrate the role of each week’s calculus content in an engineering application,
 - participated in new 133 WebWork problem development and reform, and
 - met with representatives from every department in EGR in order to get their feedback and suggests concerning course modifications.
- *MTH 133 Supervisor.* I supervised Calculus II during the Spring 2018 semester.
- *Gave Alumni Distinguished Scholarship (ADS) Recruitment Talks.* Gave several 15 minute presentations to help recruit ADS winners into the undergraduate MTH major.
 - Recruitment talk on February 7, 2020.

DEPT. OF COMP.
MATH, SCI. AND
ENG. (CMSE)

- *Diversity, Equity, and Inclusion (DEI) Committee (Fall 2022 – Spring 2023).*
- *Undergraduate Studies Committee (Fall 2022 – Spring 2023).*
- *CMSE hiring committee (joint MTH position, Jan 6 2022 – Spring 2022).*
- *Reappointment, Promotion, and Tenure Committee (RPT, Fall 2021 – Spring 2022).*
- *Reappointment, Promotion, and Tenure Committee (RPT, Fall 2020 – Spring 2021).*
- *CMSE Evaluation Team for ASTRO Big Data candidate, Spring 2018 Semester.*
Served on team for evaluating CMSE (30)-Phy (70)-ASTRO Big Data joint hire for CMSE.

PROFESSIONAL SERVICE AND DEVELOPMENT IN THE LAST 5 YEARS

EDITORIAL
POSITIONS HELD

- Lead Guest Editor of the “Special Topical Issue on Data Science, approximation, and harmonic analysis” in the Springer journal *Sampling Theory, Signal Processing, and Data Analysis*.

PRINCIPAL
ORGANIZER OF THE
1W-MINDS
SEMINAR

- In April of 2020 several colleagues and I founded the global online One World Mathematics of Information, Data, and Signals (1W-MINDS) Seminar in response to the COVID-19 pandemic. The seminar has been running every week via zoom since April 23rd 2020. Speaker lists and videos of past talks are available on the seminar website at <https://sites.google.com/view/minds-seminar/home>. I served as the principal organizer and moderator from April 2020 – June 2021, and then as an organizer from July 2021 – Present.

WORKSHOPS,
CONFERENCES,
SPECIAL SESSIONS,
AND MINISYMPOSIA
ORGANIZED

- Mathematics of Information, 2022 Pacific Rim Mathematical Association Congress (PRIMA 2022). Hosted by the Pacific Institute for the Mathematical Sciences (PIMS) in Vancouver, CA., December 4 – 9, 2022.
- Sparse Approximation, Fast Algorithms, and Applications, SIAM Conference on Mathematics of Data Science (MDS20). [Two minisymposia held virtually on June 19th 2020 due to COVID-19.]
- Fast Algorithms, Sparsity and Approximation, 2019 SIAM SEAS Meeting at The University of Tennessee, Knoxville, September 20 – 22, 2019.
- Next Generation FFT Algorithms in Theory and Practice: Parallel Implementations, Sparse FFTs, and Applications (MS354 & MS386), 2019 SIAM CSE, Feb. 24th – March 1st, 2019.

OTHER
CONFERENCE
SESSIONS CHAIRED

- July 23 afternoon session, Randomness and Determinism in Compressive Data Acquisition, Texas A&M University, College Station, TX, July 22 – 26, 2019.
- May 15 afternoon session, 7th International Conf. on Comp. Harmonic Analysis, Vanderbilt University, Nashville, TN, May 14 – May 18, 2018.

EDUCATIONAL
OUTREACH

- Delivered a TOPical Seminar for Undergraduate Mathematicians (TOP-SUM) talk via zoom, *Group Testing: From COVID-19 to Sparse Fourier Transforms in 50 Minutes Flat*, on Friday, Oct. 16, 2020.
- Delivered a TOPical Seminar for Undergraduate Mathematicians (TOP-SUM) talk at MSU, *An Introduction to Distance Preserving Projections of Smooth Manifolds*, on Friday, Feb. 21, 2020.

GRANT PANELS &
EXTERNAL
REVIEWING

- External Reviewer for Oleh Melnyk's thesis (Technische Universität München) – October, 2022. [Done Remotely]
- National Science Foundation (NSF) Panelist for DMS – March, 2022.
- National Science Foundation (NSF) Panelist for DMS – Feb., 2021.
- External Reviewer for Nat. Sci. and Eng. Research Council of Canada (NSERC) – Dec., 2020.
- External Reviewer for an Israel Science Foundation (ISF) research proposal – May, 2020.
- External Reviewer for Yi Sui's thesis (Simon Fraser University) – April, 2020. [Done Remotely]
- External Reviewer for Nat. Sci. and Eng. Research Council of Canada (NSERC) – Dec., 2019.

REVIEWER

- ACM Transactions on Computational Theory
- ACM Transactions on Algorithms
- Advances in Computational Mathematics
- Algorithmica
- AMS Notices
- Annals of Operations Research
- Applied and Computational Harmonic Analysis (ACHA)
- Constructive Approximation
- Frontiers in Applied Mathematics and Statistics
- IEEE Transactions on Information Theory
- IEEE Transactions on Signal Processing
- Information and Inference: A Journal of the IMA
- International Conference on Sampling Theory and Applications (SampTA)
- Journal of the American Mathematical Society (JAMS)
- Journal of Fourier Analysis and Applications

- Journal of Scientific Computing
- Linear Algebra and its Applications (LAA)
- Numerical Algorithms
- Numerical Linear Algebra with Applications
- Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)
- Sampling Theory and Applications (SAMPTA)
- SIAM Journal on Imaging Sciences
- SIAM Journal on Matrix Analysis and Applications (SIMAX)
- Symposium on Computational Geometry (SoCG 2023)
- Transactions of the American Mathematical Society