

## Mark A. Iwen

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### CONTACT INFORMATION

Department of Mathematics  
Michigan State University, 619 Red Cedar Rd.  
East Lansing, MI 48824  
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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

- Single Investigator: NSF DMS Computational Math, 7/1/2019 – 6/30/2022.  
*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 – 6/30/2020 (3 years + 1 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

- 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*. Submitted, 2019.
- 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*. Submitted, 2019.
- Michael Perlmutter, Sami Merhi, Aditya Viswanathan, and Mark Iwen. *Inverting Spectrogram Measurements via Aliased Wigner Distribution Deconvolution and Angular Synchronization*. Submitted, 2019.
- Choi, Bosu, Mark A. Iwen, and Felix Krahmer. *Sparse Harmonic Transforms: A New Class of Sublinear-time Algorithms for Learning Functions of Many Variables*. Submitted, 2018.
- Iwen, M.A., Felix Krahmer, Sara Krause-Solberg, and Johannes Maly. *On Recovery Guarantees for One-Bit Compressed Sensing on Manifolds*. Submitted, 2018.

### JOURNAL ARTICLES

- 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*, to appear.
- 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 Kraher. *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

- 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*. 50<sup>th</sup> 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*. 49<sup>th</sup> 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*. 45<sup>th</sup> 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*. 43<sup>rd</sup> Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, 2009.
- Iwen, M.A., *Simple Deterministically Constructible RIP Matrices with Sublinear Fourier Sampling Requirements*. 43<sup>rd</sup> Annual Conference on Information Sciences and Systems (CISS), Baltimore, MD, 2009.
- Iwen, M.A., *Empirical Evaluation of Two Deterministic Sparse Fourier Transforms*. 43<sup>rd</sup> 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*. 42<sup>nd</sup> 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*. 42<sup>nd</sup> 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 Campbell, 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 3,100 code downloads from this site as of 4/15/2017.

## TEACHING AND MENTORING

#### TEACHING EXPERIENCE

- **Michigan State University**, East Lansing, MI
  - Undergraduate Courses
    1. Linear Algebra (MTH 314), Fall 2013
    2. Honors Multivariable Calculus (MTH 254H), Fall 2014
    3. Introduction to Signal Processing (ECE 366), Spring 2015

4. Abstract Algebra I & Number Theory (MTH 310), Fall 2015
  5. Special Topics & Capstone Course: Intro. to Fourier Analysis (MTH 490), Spring 2016
  6. Calculus II for Engineers (Developed a Special Section of MTH 133)  
Fall 2016, 2017, & 2018, and Spring 2017, 2018, & 2019
- Graduate Courses
1. Intro. to Compressive Sensing and the Analysis of Big Data (MTH 995),  
Spring 2014 & Spring 2015
  2. Numerical Linear Algebra (CMSE 823, Qualifier Course), Fall 2016
  3. Foundations of Mathematical Reasoning (CMSE 890.003, Introduction to proofs for data  
scientists through applied analysis), Fall 2018

- **Duke University**, Durham, NC

Multivariable Calculus, Advanced Vector Calculus (I have also coordinated this course), Linear Algebra & Applications, Mathematical Numerical Analysis, Introduction to Mathematical Logic

- **University of Michigan**, Ann Arbor, MI

Algebra, Calculus I, II, and III, Introduction to Differential Equations

GRADUATE  
STUDENTS AND  
POSTDOCS ADVISED

- Postdocs Supervised:

1. Michael Perlmutter Co-Supervisor: Matt Hirn, Math & CMSE, MSU  
CMSE, Sept. 2017 – Present.
2. 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.
3. Wei-Hsuan Yu Co-Supervisor: Prof. Yang Wang, Mathematics, HKUST  
Mathematics, Sept. 2014 – Aug. 2017. Took a 2<sup>nd</sup> 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. 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.
4. Sami Eid Merhi (MTH)  
Math Ph.D. received in Summer 2019. Went to Open Data Group Inc. as a Data Scientist.
5. 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.
6. Mark Roach (MTH)
7. Ali Zare (CMSE)
8. Ruochuan Zhang (MTH, jointly advised) Co-Advisor: Prof. Christlieb, CMSE & Math  
Math Ph.D. received in Summer 2017. Went to Delphi Automotive as an Algorithm Eng..

- Graduate Thesis Committee Memberships:

1. Esraa Alsharoha Thesis Advisor: Prof. Selin Aviyente, ECE, MSU
2. Xavier Brumwell Thesis Advisor: Matt Hirn, CMSE & Math, MSU
3. Anton Efremov Thesis Advisor: Prof. Lalita Udpa, ECE, MSU
4. Jieqian He Thesis Advisor: Matt Hirn, CMSE & Math, MSU
5. Leo Li Thesis Advisor: Ming Yan, CMSE & Math, MSU
6. Ashwini Maurya Thesis Advisor: Prof. Hira Koul, Statistics & Probability, MSU

- 7. Luis Polanco Thesis Advisor: Jose Perea, CMSE & Math, MSU
- 8. Seyyid Emre Sofuoglu Thesis Advisor: Prof. Selin Aviyente, ECE, MSU
- 9. Xun Wang Thesis Advisor: Prof. Yang Wang, Mathematics, HKUST
- Master of Science in Industrial Mathematics (MSIM) Committee Memberships:
  - 1. Jason McKelvey Spring Semester, 2018

UNDERGRADUATE  
RESEARCH  
MENTORED IN THE  
LAST 5 YEARS

- *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 2015 & 2018, Fall 2013 & 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.
  - Zhen Gao and Brian Pinsky (Spring 2015): Studied computationally efficient nearly-isometric embeddings of genome sequences with edit distance into Euclidean space with Euclidean distance.
- *MTH 490 Independent Study Course Instructor*, Michigan State Spring 2017  
Mentored, together with my graduate student Sami Merhi, an MSU Advanced Track Student, Nicholas Frederick, on a project related to deterministic phase retrieval algorithms with provable recovery guarantees. Nick gave a presentation about his work at the 2017 SIAM Annual Meeting (AN17) in Pittsburgh.
- *Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM) Mentor*, Michigan State University Summer 2016  
Mentored a group of four students on the mathematics of MRI together with co-mentors Aditya Viswanathan (postdoc, MSU) and Tsvetanka Sendova (instructor, MSU). This project aimed to improve classical Fourier-based reconstruction of piecewise smooth functions with jump discontinuities by utilizing additional edge detection and jump estimation methods. The results were published in a conference proceedings (see below – SPIE 2017). The four student participants were: Jade Larriva-Latt (Wellesley College), Angela Morrison (Albion College), Alison Radgowski (Goucher College), and Joseph Tobin (University of Virginia). Angela and Joe also gave a poster about the project at the 2017 Joint Mathematics Meetings (JMM) in Atlanta.

### INVITED TALKS AND FUNDED VISITS IN THE LAST 5 YEARS

INVITED & FUNDED  
WORKSHOP  
PARTICIPATION

- Phase Retrieval: Theory, Applications and Algorithms. ICERM at Brown University, Providence, Rhode Island, June 12 – 18, 2017.
- Mathematics of Signal Processing Trimester Program. Hausdorff Research Institute for Mathematics (HIM), Bonn, Germany, January 4 – 19, 2016.

SELECTED  
COLLOQUIA &  
INVITED TALKS

- *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 (NCSU), 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 20<sup>th</sup>, 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. 7<sup>th</sup> International Conference on Computational Harmonic Analysis (ICCHA7), Vanderbilt University, Nashville, TN, May 17<sup>th</sup>, 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.
  - *Recovery of Compactly Supported Functions from Spectrogram Measurements via Lifting.* ICERM at Brown University, Providence, Rhode Island, June 14, 2017.
  - *Group Testing: From Syphilis to Sparse Fourier Transforms.*
    1. Math Dept. Colloquium, University of Minnesota Duluth (UMD), August 9, 2018.
    2. Anniversary Celebration of Math Graduate Program, UW Milwaukee, October 22, 2016.
    3. Math/CS Colloquium, Albion College, October 20, 2016.
  - *Fast Phase Retrieval from Local Correlation Measurements.*
    1. ICERM at Brown University, Providence, Rhode Island, June 12, 2017.
    2. Applied and Interdisciplinary Math (AIM) Seminar, University of Michigan, March 10, 2017.
    3. Information Theory and Applications (ITA) Workshop, San Diego CA, February 13, 2017.
    4. App. Math Sem., Hong Kong University of Sci. and Tech. (HKUST), August 2, 2016.
    5. Opt. and Data Analysis Sem., Technische Universität München (TUM), May 17, 2016.
    6. Hausdorff Research Institute for Mathematics (HIM), Bonn, Germany, Jan. 7<sup>th</sup>, 2016.
  - *Sparse Fourier Transforms: A General Framework with Extensions.*
    1. Mathematics Days in Sofia, Sofia, Bulgaria, July 14, 2017.
    2. Optimization and Data Science Seminar, UC San Diego, February 15, 2017.
    3. Math Department Colloquium, Technische Universität München (TUM), May 11, 2016.
    4. Keynote Speaker at SIAM Great Lakes Annual Meeting, UM-Dearborn, April 30, 2016.
    5. PIMS/CSC Research Seminar, Simon Fraser University (SFU), March 11, 2016.
    6. Math of Inf. and App. Seminar, University of British Columbia (UBC), March 10, 2016.
  - *An Introduction to Distance Preserving Projections of Smooth Manifolds.*
    1. Applied Math Seminar, Johns Hopkins University, November 3, 2016.

2. CRC Colloquium, Technische Universität München (TUM), May 24, 2016.

- *Fast Phase Retrieval for High-Dimensions.*
  1. ICIAM 2015 minisymposium, Beijing, China, August 10, 2015.
  2. Center for Computational Mathematics Seminar, UC San Diego, May 12, 2015.
  3. Applied Math Seminar, Duke University, Jan. 12, 2015.

## DEPARTMENTAL SERVICE

DEPARTMENT OF  
MATHEMATICS

- *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.
- *Teaching Mentor for MTH Graduate Students.*
  - Mentored Cheuk “Eric” Wai in teaching during the Fall of 2017 for CIM.
  - Mentored Chuangtian “Armstrong” Guan in teaching during the Spring of 2017 for CIM.
- *Gave Alumni Distinguished Scholarship (ADS) Recruitment Talks, February 3, 2017.* Gave several 15 minute presentations to help recruit ADS winners into the undergraduate MTH major.
- *Hosted Fireside Chats for the Honors College.*
  - Hosted a dinner for 5 undergraduate honors students with Bruce Sagan attending as a “guest speaker” on October 29<sup>th</sup>, 2017.
  - Hosted a dinner for 9 undergraduate honors students and lead an informal conversation about REUs and mathematics programs at MSU on September 17<sup>th</sup>, 2016. Had a followup dinner with the students at Shaw Dining Hall on November 14<sup>th</sup>, 2016.
- *Organized Phillips Lecture Series, October 25-28, 2015.* Professor Emmanuel Candes delivered three lectures during his visit.
- *Member of committee for organizing AMS spring sectional meeting at Michigan State, March 14-15, 2015.* This turned out to be the largest sectional AMS meeting up to that date (no hyperbole). I personally convinced at least seven non-MSU faculty to help organize special sessions. I also organized two myself (see WORKSHOPS AND CONFERENCES ORGANIZED below).
- Graduate Student Panels and Recruitment Activities
  1. *Panelist on Responsible Professional Conduct Panel.* January 28, 2016.
  2. *Graduate Student Recruitment “Visiting Day” Participant and Speaker.* March 21, 2015.

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

- *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.
- *Served on Organizational Committee for the first CMSE Workshop on Frontiers in Computing and Data Science, Spring Semester and Summer of 2015.*  
Recruited, scheduled, and troubleshoot speakers for the first CMSE Workshop on Frontiers in Computing and Data Science, Michigan State University, September 16-17, 2015.
- *Hiring Subcommittee Member for CMSE-Math Joint Hires (3 positions), Fall 2014 and Spring 2015 Semesters.* This subcommittee accomplished hiring Jose Perea (out of Duke), Matt Hirn (out of Ecole normale superieure, Paris), and Ming Yan (out of UCLA). I played a leading role in all three searches and am proud of the results.

## PROFESSIONAL SERVICE AND DEVELOPMENT

WORKSHOPS,  
CONFERENCES,  
SPECIAL SESSIONS,  
AND MINISYMPOSIA  
ORGANIZED

- 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. 24<sup>th</sup> – March 1<sup>st</sup>, 2019.
- Phaseless Imaging in Theory and Practice: Realistic Models, Fast Algorithms, and Recovery Guarantees, IMA, Aug. 14<sup>th</sup> – Aug. 18<sup>th</sup>, 2017.
- Special Session on Mathematics of Signal Processing and Information (#41), Joint Mathematics Meeting (JMM) in Atlanta, GA, Sat. Jan. 7<sup>th</sup>, 2017.
- Special Session on Approximation Theory in Signal Processing and Computer Science, AMS spring sectional meeting at Michigan State, March 14-15, 2015.
- Special Session on Phase Retrieval in Theory and Practice, AMS spring sectional meeting at Michigan State, March 14-15, 2015.

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, 7<sup>th</sup> International Conf. on Comp. Harmonic Analysis, Vanderbilt University, Nashville, TN, May 14 – May 18, 2018.
- “Topics in Theoretical Computer Science”, Feb. 13 afternoon session, Information Theory and Applications (ITA) Workshop, San Diego, CA, Feb. 13 – 17, 2017.
- Jan 26 afternoon session, 60<sup>th</sup> Birthday Conference for Eric Allender and Mike Saks, DIMACS, Rutgers University, Jan. 26 – 27, 2017.

EDUCATIONAL  
OUTREACH

- *Group Testing: How to find out what’s important in life.* Lectured 4 groups of middle school students as part of “Girls Math and Science Day” at Michigan State University. March 4, 2017.
- Delivered a TOPical Seminar for Undergraduate Mathematicians (TOP-SUM) talk at MSU, *Group Testing: From Syphilis to Sparse Fourier Transforms*, on Friday, February 27, 2015.

GRANT PANELS

- National Science Foundation CDS&E-MSS Panelist, March 23 – March 25, 2015.

REVIEWER

- ACM Transactions on Computational Theory
- ACM Transactions on Algorithms
- Advances in Computational Mathematics
- Algorithmica
- Annals of Operations Research
- Applied and Computational Harmonic Analysis (ACHA)

- Digital Signal Processing
- IEEE Information Theory Workshop (IEEE ITW)
- IEEE International Symposium on Information Theory (IEEE ISIT)
- IEEE Signal Processing Letters
- IEEE Transactions on Information Theory
- IEEE Transactions on Signal Processing
- Information and Inference: A Journal of the IMA
- Ingeniera y Ciencia
- International Conference on Sampling Theory and Applications (SampTA)
- Journal of Fourier Analysis and Applications
- Journal of Selected Topics in Signal Processing
- Linear Algebra and its Applications (LAA)
- Mathematical Reviews
- Numerical Algorithms
- Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA)
- Sampling Theory and Applications (SAMPPTA)
- SIAM Journal on Imaging Sciences
- SIAM Journal on Matrix Analysis and Applications (SIMAX)
- Signal Processing with Adaptive Sparse Structured Representations (SPARS)
- Transactions of the American Mathematical Society