

ADITYA VISWANATHAN

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RESEARCH INTERESTS

Computational Harmonic Analysis, Mathematical Signal Processing, Phase Retrieval, Spectral and High-Order Methods for PDEs, Computational Electromagnetics

ACADEMIC EXPERIENCE

Sept. 2017 –	Assistant Professor (Tenure-track) Dept. of Mathematics and Statistics, University of Michigan – Dearborn
Aug. 2013 – Aug 2017	Visiting Assistant Professor Department of Mathematics, Michigan State University <i>Mentors:</i> Mark Iwen, Yang Wang (now at HKUST, Hong Kong) and Andrew Christlieb
Sep. 2010 – Aug. 2013	Postdoctoral Scholar Applied & Computational Mathematics, California Institute of Technology <i>Postdoctoral Supervisor:</i> Oscar Bruno
May 2007 – Aug. 2010	Graduate Research Associate School of Mathematical and Statistical Sciences, Arizona State University <i>Advisors:</i> Anne Gelb and Douglas Cochran

EDUCATION

Arizona State University, Tempe, AZ

- Ph.D., Electrical Engineering, August 2010
Dissertation Title: “Imaging from Fourier Spectral Data: Problems in Non-harmonic Fourier Reconstruction, Discontinuity Detection and Point-spread Function Estimation”
Co-Advisors: Anne Gelb (Dept. of Mathematics & Statistics) and Douglas Cochran
- M.S., Electrical Engineering, August 2008
Thesis Title: “Spectral Sampling and Discontinuity Detection Methods with Application To Magnetic Resonance Imaging”

R.V. College of Engineering, Bangalore, India

- B.E., Electronics and Communication Engineering, June 2005
Visvesvaraya Technological University

AWARDS AND FUNDING

Grants – Current Support

- **Institute for Mathematics and its Applications (IMA), Minneapolis, MN**, *Focused Research Initiative on Phase Retrieval Algorithms: Computational Efficiency, Deterministic Guarantees, and Auto-Calibration*, Co-PI, (\$20,000) IMA Special Workshop, Aug. 2017.

Grants (Submitted)

- **NSF Division of Mathematical Sciences – Computational and Data-Enabled Science and Engineering Program**, *Fast and Robust Phase Retrieval from Windowed Fourier Measurements with Applications to Ptychography*, Co-PI, Nov. 2016.

Awards

- Visvesvaraya Technological University (B.E.) Rank List/Honor Roll, 2004–2005
Ranked 9 out of about 6750 Electronics and Communication Engineering majors state-wide.
- **Travel Awards:** International Conference on Advances in Scientific Computing (2009), SIAM Conference on Imaging Science – IS10 (2010), International Conference on Computational Harmonic Analysis – ICCHAV (2014).

PUBLICATIONS AND PREPRINTS

Journal Articles

1. Mark Iwen, A. Viswanathan and Yang Wang. *Fast Phase Retrieval from Local Correlation Measurements*. SIAM J. on Imaging Sciences, Vol. 9, Issue 4, pp. 1655–1688, Oct. 2016.
2. Mark Iwen, A. Viswanathan and Yang Wang. *Robust Sparse Phase Retrieval Made Easy*. Applied and Computational Harmonic Analysis, Vol. 42, Issue 1, pp. 135–142, Jan. 2017.
3. A. Viswanathan, Anne Gelb and Douglas Cochran. *Iterative Design of Concentration Factors for Jump Detection*. J. of Scientific Computing, Vol. 51, Issue 3, pp. 631–649, June 2012.
4. Wolfgang Stefan, A. Viswanathan, Anne Gelb and Rosemary Renaut. *Sparsity Enforcing Edge Detection Method for Blurred and Noisy Fourier data*. J. of Scientific Computing, Vol. 50, Issue 3, pp. 536–556, Mar. 2012.
5. A. Viswanathan, Anne Gelb, Douglas Cochran and Rosemary Renaut. *On Reconstruction from Non-uniform Spectral Data*. J. of Scientific Computing, Vol. 45, Issue 1–3, pp. 487–513, Oct. 2010.

Preprints

1. Mark Iwen, Brian Preskitt, Rayan Saab and A. Viswanathan. *Phase Retrieval from Local Measurements: Improved Robustness via Eigenvector-Based Angular Synchronization*, submitted, Dec. 2016.
2. Anne Gelb, Guohui Song, A. Viswanathan and Yang Wang. *Detection of Edges from Two-Dimensional Fourier Data using Gaussian Mollifiers*, preprint, Sept. 2016.

In Preparation

1. Andrew Christlieb and A. Viswanathan. *High-Order Non-Reflecting Boundary Conditions for Method of Lines Transpose Wave Propagators*, in preparation.

Refereed Conference Proceedings

1. Mark Iwen, Brian Preskitt, Rayan Saab and A. Viswanathan. *Two Dimensional Phase Retrieval from Local Measurements*, accepted to the SPIE Optical Engineering + Applications conference on Wavelets and Sparsity XVII, Aug. 2017.
2. Jade Larriva-Latt*, Angela Morrison*, Alison Radgowski*, Joseph Tobin*, Mark Iwen and A. Viswanathan. *Edge-Augmented Fourier Partial Sums with Applications to Magnetic Resonance Imaging*

(MRI), accepted to the SPIE Optical Engineering + Applications conference on Wavelets and Sparsity XVII, Aug. 2017. ***Undergraduate students.**

3. Sami Merhi, A. Viswanathan and Mark Iwen. *Recovery of Compactly Supported Functions from Spectrogram Measurements via Lifting*, accepted to the 12th International Conference on Sampling Theory and Applications (SampTA), Tallinn, Estonia, July 2017.
4. A. Viswanathan and Mark Iwen. *Fast Compressive Phase Retrieval*. Proc. 49th Asilomar Conference on Signals, Systems and Computers, pp. 1686–1690, IEEE, Nov. 2015.
5. A. Viswanathan and Mark Iwen. *Fast Angular Synchronization for Phase Retrieval via Incomplete Information*. Proc. SPIE 9597, Wavelets and Sparsity XVI, 959718, Aug. 2015.
6. A. Viswanathan, Douglas Cochran, Anne Gelb and Dennis Cates. *Detection of Signal Discontinuities from Noisy Fourier Data*. 42nd Asilomar Conference on Signals, Systems and Computers, pp. 1705–1708, IEEE, Oct. 2008.

Technical Reports and Unpublished Notes

1. Jade Larriva-Latt, Angela Morrison, Alison Radgowski, Joseph Tobin, Mark Iwen and A. Viswanathan. *Technical Report: Improved Fourier Reconstruction using Jump Information with Applications to MRI*. 2016. (arXiv:1610.03764)
2. Mark Iwen, Felix Krahmer and A. Viswanathan. *Technical Note: A Minor Correction of Theorem 1.3 from [1]*. 2015.

TEACHING AND MENTORING

Teaching Experience

Michigan State University, East Lansing, MI

- Functions and Calculus for Elementary/Middle School Teachers (MTH 305, Section 001) – Spring 2017
Functions and calculus needed for understanding connections between topics of calculus and the mathematics taught in middle school.
- Matrix Algebra I (MTH 314, Section 001) – Fall 2016
Problem-solving and applications in matrix algebra for scientists and engineers. Vectors, matrices, linear transformations, inner products, dimension, eigenvalues and eigenvectors. Applications to systems of equations and to geometry.
- Transition to Formal Mathematics (MTH 299, flipped classroom format)
Introduction to mathematical reasoning, basic logic, set theory, integers, natural numbers and induction, basic number theory, real numbers, limits, sequences, series.
 - Fall 2016 – Section 001
 - Spring 2015 – Section 002 and Section 004
- Survey of Calculus I (MTH 124, Sections 015 and 036) – Spring 2014
Study of limits, continuous functions, derivatives, integrals and their applications.

Guest Lecturing (at Michigan State University)

- Compressive Sensing and Big Data (MTH 995, Graduate course)
- Introduction to Signal Processing (ECE 366, Electrical Engineering course)

Thesis Committee Member

- Alexander Reynolds
External Examiner, Undergraduate Honors Thesis Committee, Barrett – The Honors College, Arizona State University, Apr. 2016
Thesis title: Edge Detection from Spectral Phase Data
Thesis Advisor: Anne Gelb, Mathematical & Statistical Sciences, Arizona State University
- Shane Lubold
External Examiner, Undergraduate Honors Thesis Committee, Barrett – The Honors College, Arizona State University, Oct. 2015
Thesis title: A Statistical Framework for Detecting Edges from Noisy Fourier Data using Multiple Concentration Factors
Thesis Advisor: Anne Gelb, Mathematical & Statistical Sciences, Arizona State University
- Alexander Gutierrez (*currently a graduate student at the University of Minnesota, Minneapolis*)
External Examiner, Undergraduate Honors Thesis Committee, Barrett – The Honors College, Arizona State University, Aug. 2012
Thesis title: Edge Informed Fourier Reconstruction from Non-Uniform Spectral Data
Thesis Advisor: Anne Gelb, Mathematical & Statistical Sciences, Arizona State University

Student Advising and Mentoring

- Lead Mentor, Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM), May – July 2016.
Lyman Briggs College, Michigan State University, East Lansing, MI, USA
Mentored a group of four students on a project investigating improved accuracy of Fourier reconstructions (by incorporating edge information) with applications to Magnetic Resonance Imaging (MRI).
- Invited Lecturer, Notional Research Experience for Undergraduates Program (NREUP) – part of the MAA **Strengthening Underrepresented Minority Mathematics Achievement** (SUMMA) program, May 2014.
Department of Mathematics, Michigan State University, East Lansing, MI, USA
Conducted lecture and computer lab sessions on numerical methods for ODEs for a group of five students working on projects involving modeling cancer and modeling competing car companies using deterministic and stochastic differential equations.
- Mentor, Summer Undergraduate Research Fellowship (SURF), June – August 2012, 2013
Computing & Mathematical Sciences, California Institute of Technology, Pasadena, CA, USA
Mentored a student each summer on projects developing fast and accurate numerical methods for solving computational electromagnetics problems.
- Student Mentor, Computational Science Training for Undergraduates in the Mathematical Sciences (CSUMS), May – July 2009
School of Mathematical & Statistical Sciences, Arizona State University, Tempe, AZ, USA

Students Supervised

- Mathialakan Thavappiragasam (*graduate student, Electrical and Computer Engineering*)
Michigan State University, Summer 2015 – present (with Andrew Christlieb)
Topic: Fast, Efficient and High-Order Method of Lines Transpose Wave Propagators for Electromagnetic Scattering Problems
- Simon Schulz (*currently a graduate student at Oxford University*)
Mentor, Summer Undergraduate Research Fellowship (SURF) Program
California Institute of Technology, June – August 2013 (with Oscar Bruno)
Topic: Multimesh Spectral Implicit-Explicit Solvers for Maxwell's Equations

- Emmanuel Garza Gonzales (*currently a graduate student at California Institute of Technology*)
Co-Mentor, Summer Undergraduate Research Fellowship (SURF) Program
California Institute of Technology, June – August 2012 (with Oscar Bruno)
Topic: High-Order Fourier Continuation Solvers for Maxwell’s Equations with Discontinuous Permittivity;
Applications to Photonics

PRESENTATIONS AND POSTERS

Seleted Presentations at Conferences and Workshops

1. *Fast Robust Phase Retrieval from Local Correlation Measurements.*
 - AMS Special Session on Mathematics of Signal Processing and Information, Joint Mathematics Meeting (JMM 2017), Atlanta, GA, Jan 2017.
 - SIAM Conference on Imaging Science (SIAM IS16), Albuquerque, NM, May 2016.
 - SIAM Great Lakes Spring Meeting, University of Michigan – Dearborn, MI, April 2016.
2. *Fast Angular Synchronization for Phase Retrieval via Incomplete Information.* SPIE Optics+Photonics, Wavelets and Sparsity XVI, San Diego, CA, August 2015.
3. *Robust and Efficient Computational Methods for Phase Retrieval.* **Invited speaker**, ICERM Research Cluster: Computational Challenges in Sparse and Redundant Representations, The Institute for Computational and Experimental Research in Mathematics, Brown University, Providence, RI, November 2014.
4. *Direct Methods for Reconstruction of Functions and their Edges from Non-Uniform Fourier Data.* **Invited speaker**, ICERM Research Cluster: Computational Challenges in Sparse and Redundant Representations, The Institute for Computational and Experimental Research in Mathematics, Brown University, Providence, RI, November 2014.
5. *Fast and Robust Phase Retrieval.* International Conference on Spectral and High Order Methods (ICOSAHOM 14), Salt Lake City, UT, June 2014.
6. *Constructing Approximation Kernels for Non-Harmonic Fourier Data.* SIAM Annual Meeting, San Diego, CA, July 2013.
7. *Incorporating Edge Information in Image Reconstruction.* **Invited speaker**, Mathematical Challenges in Biomolecular/Biomedical Imaging and Visualization, Mathematical Biosciences Institute, Ohio State University, Columbus, OH, February 2013.
8. *Reconstruction from Non-uniform Spectral Data.* SIAM Conference on Imaging Science (IS10), Chicago, IL, April 2010.
9. *On Fourier Reconstruction from Non-uniform Spectral Data.* International Conference on Spectral and High Order Methods (ICOSAHOM 09), Trondheim, Norway, June 2009.

Selected Invited Colloquia and Seminar Talks

1. *Block-Circulant Constructions for Robust and Efficient Phase Retrieval.*
 - Computational/Applied Mathematics Seminar, School of Mathematical and Statistical Sciences, Arizona State University, Tempe, AZ, May 2015.
 - Department of Mathematics and Statistics, University of Michigan – Dearborn, MI, April 2015.
2. *Fast and Robust Phase Retrieval.* Center for Computational and Applied Mathematics (CCAM) Lunch Seminar, Department of Mathematics, Purdue University, West Lafayette, IN, April 2014.
3. *Edge Detection from Spectral Data.* Special Seminar, Department of Applied & Computational Mathematics, California Institute of Technology, Pasadena, CA, October 2009.

4. *Reconstruction from Non-uniform Spectral Data*. Computational & Applied Mathematics Proseminar, School of Mathematical & Statistical Sciences, Arizona State University, Tempe, AZ, October 2009.

Selected Posters at Conferences and Workshops

1. A. Viswanathan and Mark Iwen. *Fast Compressive Phase Retrieval*. 49th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, November 2015.
2. Yang Wang, Mark Iwen and A. Viswanathan. *Fast and Robust Phase Retrieval*. Fifth International Conference on Computational Harmonic Analysis (ICCHA V), Vanderbilt University, Nashville, TN, May 2014.
3. A. Viswanathan, Anne Gelb, Douglas Cochran and Rosemary Renaut. *Reconstruction from Non-uniform Spectral Data*. February Fourier Talks, The Norbert Wiener Center for Harmonic Analysis and Applications, University of Maryland, College Park, College Park, MD, February 2010.
4. A. Viswanathan, Wolfgang Stefan, Anne Gelb, Douglas Cochran and Rosemary Renaut. *Edge Detection from Fourier Data and its Application to PSF Estimation in Blurring Problems*. International Conference on Advances in Scientific Computing, Brown University, Providence, RI, December 2009.
5. A. Viswanathan, Douglas Cochran, Anne Gelb and Dennis Cates. *Detection of Signal Discontinuities from Noisy Fourier Data*. Sensor, Signal and Information Processing (SenSIP) Workshop, Sedona, AZ, May 2008.

PROFESSIONAL SERVICE AND DEVELOPMENT

Sessions Organized at Conferences and Meetings

- Co-Organizer, Special Workshop on Phaseless Imaging in Theory and Practice: Realistic Models, Fast Algorithms, and Recovery Guarantees, Institute for Mathematics and its Applications (IMA), University of Minnesota, Minneapolis, August 14 – 18, 2017.
- Co-Organizer, AMS Special Session on Approximation Theory in Signal Processing and Computer Science, AMS Central Spring Sectional Meeting, Michigan State University, March 14–15, 2015.

Conference Sessions Chaired

- Special Session on Approximation Theory in Signal Processing and Computer Science, IV, AMS Central Spring Sectional Meeting, Michigan State University, East Lansing, MI, 2015.
- Contributed Talks (Session CT1), International Conference on Spectral and High Order Methods (ICOSAHOM), Salt Lake City, UT, 2014.

Journal and Conference Reviewing

- Applied and Computational Harmonic Analysis, Journal of Scientific Computing, SIAM Journal of Scientific Computing, Journal of Computational and Applied Mathematics, Numerical Functional Analysis and Optimization, Journal of Fluids Engineering, IEEE Signal Processing Letters, IEEE Transactions on Signal Processing
- Sampling Theory and Applications (SampTA 2015), IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)

Departmental and University Service

- IEEE Student Branch Secretary, 2004–2005, R.V. College of Engineering, Bangalore, India

Other Educational Outreach

- *Group Testing: How to Find What's Important in Life*
Assisted in the organization of a hands-on activity session and presentation as part of the 2017 Middle School Girls Math & Science Day, Michigan State University, March 4, 2017

Workshops Attended

- HKUST – ICERM International Program on Phase Retrieval: Theory, Application and Algorithms, June 2017 [**Funded Participant**]
The Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, Rhode Island.
- Research Cluster: Computational Challenges in Sparse and Redundant Representations, November 2014 [**Funded Participant**]
The Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, Rhode Island.
- Mathematical Challenges in Biomolecular/Biomedical Imaging and Visualization, February 2013 [**Funded Participant**]
Mathematical Biosciences Institute, Ohio State University, Columbus, Ohio.
- Summer School: Mathematics in Brain Imaging, July 2008
Institute for Pure & Applied Mathematics, University of California, Los Angeles, CA.
- WinterSchools in Speech and Audio Processing (WiSSAP-06) – Automatic Speech Recognition & Understanding, January 2006
Indian Institute of Science, Bangalore, India

Professional Memberships

- SIAM – Society for Industrial and Applied Mathematics
- AMS – American Mathematical Society
- IEEE – The Institute for Electrical and Electronics Engineers, IEEE Signal Processing Society

Citizenship and Visa Status

Citizen of India

Currently hold university sponsored H-1B visa