

Matthew Hirn

Curriculum Vitae

Contact Information

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Education

University of Maryland, College Park, Maryland.

Ph.D. in Mathematics (expected – August 2009).

- Dissertation: Enumeration of harmonic frames and frame based dimension reduction.
- Preliminary oral exam: Uncertainty principles in sparse representation and compressed sensing.
- Ph.D. written qualifying exams: algebra, analysis, topology.
- Coursework: real and complex analysis, harmonic analysis, frame theory, wavelet theory, advanced analytic methods, analysis on fractals, functional analysis, financial mathematics, abstract algebra, commutative algebra, representation theory, topology, algebraic topology.
- Advisors: John J. Benedetto, Kasso Okoudjou.

Cornell University, Ithaca, New York.

B.A. in Mathematics, cum laude (August 2000 – May 2004).

- Senior thesis: The refinability of step functions.
- Advisor: Robert S. Strichartz.

Research Interests

- Dimension reduction and its applications to hyperspectral imagery data.
- Harmonic frames.
- Compressed sensing and sparse representations.
- Whitney problems.

Research Positions

University of Maryland, College Park, Maryland.

Research Assistant (August 2007 – Present).

- Currently developing endmember finite unit norm tight frames to be used to give sparse representations of hyperspectral imagery data.
- Developed general framework that implements landmarking, kernel eigenmap methods, endmember selection algorithms, and frame theory for the purpose of classifying materials in large-scale hyperspectral imagery data sets.
- Coded Matlab programs for reading, writing, and manipulating hyperspectral imagery data, hyperspectral imagery data classifiers, kernel eigenmap dimension reducing methods, and computing sparse coefficients.

Awards and Grants

Fellowships:

- Ann G. Wylie Dissertation Fellowship (The Graduate School, University of Maryland, College Park), Spring 2009.
- VIGRE Dissertation Fellowship (Department of Mathematics, University of Maryland, College Park), Spring 2009, declined.

Travel Grants (awarded by host institution):

- Whitney Problems Workshop 2009, College of William and Mary, Williamsburg, VA, August 3-8, 2009.
- 20 Years of Wavelets, DePaul University, Chicago, IL, May 15-17, 2009.
- Recent Advances in Harmonic Analysis and Elliptic Partial Differential Equations, University of Virginia, Charlottesville, VA, May 8-10, 2009.
- Midwest Conference on Mathematical Methods for Images and Surfaces, Michigan State University, East Lansing, MI, April 18-19, 2009.

Publications, Preprints, and Works in Progress

- John Benedetto, Wojciech Czaja, Matthew Hirn, Ioannis Konstantinidis, David Widemann. Hyperspectral data dimension reduction, de-noising, and coding. In preparation.
- Matthew Hirn. The number of harmonic frames of prime order. Submitted.
- John Benedetto, Wojciech Czaja, Justin C. Flake, Matthew Hirn. Frame based kernel methods for automatic classification in hyperspectral data. Accepted to the *Proceedings of the IEEE 2009 International Geoscience and Remote Sensing Symposium*.
- Matthew Hirn. The refinability of step functions. *Proceedings of the American Mathematical Society*, 136(3):899-908, 2008.

Invited Talks and Lectures

- Frame potential classification algorithm for retinal data. Multispectral Retinal Imaging and Mapping of Naturally Occuring Fluorophore and Chromophore Distributions Research Interaction Team, University of Maryland, College Park, MD, May 11, 2009.
- Frame based kernel methods for hyperspectral imagery data.
 - Recent Advances in Harmonic Analysis and Elliptic Partial Differential Equations, University of Virginia, Charlottesville, VA, May 9, 2009.
 - Graduation Conference 2009, University of Maryland, College Park, MD, May 1, 2009.
- Introduction to compressed sensing. Guest lecture for MATH 648W, University of Maryland, College Park, MD, November 18, 2008.
- Uncertainty principles in sparse representation and compressed sensing. Norbert Wiener Center Seminar, University of Maryland, College Park, MD, November 8, 2007.
- Uncertainty principles for finite abelian groups. Norbert Wiener Center Seminar, University of Maryland, College Park, MD, September 20, 2007.
- Mock Fourier series for the standard Cantor measure. Math Association of America Mathfest, Burlington, VT, August 2, 2002.

Conferences and Workshops Attended

- Second Whitney Problems Workshop, College of William and Mary, Williamsburg, VA, August 3-8, 2009.
- 20 Years of Wavelets, DePaul University, Chicago, IL, May 15-17, 2009.
- Recent Advances in Harmonic Analysis and Elliptic Partial Differential Equations, University of Virginia, Charlottesville, VA, May 8-10, 2009.
- D.C. Math Graduate Student Meeting 2009, George Washington University, Washington, D.C., April 25, 2009.
- Midwest Conference on Mathematical Methods for Images and Surfaces, Michigan State University, East Lansing, MI, April 18-19, 2009.
- February Fourier Talks, University of Maryland, College Park, MD.
 - February 19-20, 2009.
 - February 21-22, 2008.
 - February 15-16, 2007.
- Advancing the Automation of Image Analysis III, University of California, Los Angeles, CA, December 3-4, 2008.
- Advancing the Automation of Image Analysis II, University of California, Los Angeles, CA, July 29-31, 2008.
- Diffusion Geometry Workshop: Methods for Processing and Analyzing High-Dimensional Data, MITRE Corporation, McLean, VA, January 15-17, 2008.

Teaching

University of Maryland, College Park, Maryland.

Teaching Assistant (August 2004 – August 2007).

- Instructor for the analysis Ph.D. qualifying exam review course (Summer 2007).
- Course Instructor:
 - Math 111: Introduction to Probability (Fall 2005, Spring 2006).
- Recitation Instructor:
 - Math 140: Calculus I (Spring 2007).
 - Math 141: Calculus II (Fall 2006).
 - Math 220: Elementary Calculus I (Fall 2004, Spring 2005).
- Grader:
 - Math 463: Complex variables for scientists and engineers (Summer 2007).

Other Activities

University of Maryland, College Park, Maryland.

Norbert Wiener Center seminar organizer (July 2007 – July 2008).

- Weekly harmonic analysis seminar series during the fall and spring semesters.
- Responsibilities:
 - Inviting and scheduling speakers for the seminar.
 - Managing the seminar budget.
 - Maintaining and managing the seminar listserv.

Texas A&M University, College Station, Texas.

Research Experience for Undergraduates (June 2003 – August 2003).

- Research: wavelets, step functions, refinable functions.
- Advisor: David R. Larson.

Cornell University, Ithaca, New York.

Research Experience for Undergraduates (June 2002 – August 2002).

- Research: Fourier series and fractals; “mock Fourier series” for the Cantor set.
- Computing: coded Matlab and C++ programs to obtain empirical data used for gaining insights into the general theory.
- Advisor: Robert S. Strichartz.

References

- John J. Benedetto.
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- Kasso Okoudjou.
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- Wojciech Czaja.
Associate Professor of Mathematics, University of Maryland, College Park.
Office phone: 301-405-5106.
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- William Schildknecht (teaching reference).
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