

Norbert Wiener Center for Harmonic Analysis and Applications

www.norbertwiener.umd.edu



Mission

Advance research in Mathematical Engineering in the 21st century analogous to Mathematical Physics of the 20th century

- Biomathematics
- Medical imaging and diagnostics
- Signal and image processing
- Waveform design
- Opportunistic sensing
- Non-uniform sampling
- Compressed sensing
- Machine learning
- Quantum detection
- RADAR and SONAR processing
- RF communications
- Dimension reduction
- Hyper-spectral and LIDAR data analysis
- Wavelet and time-frequency theory

Personnel

John J. Benedetto
Director

Matthew Begué
Associate Director

Michael Dellomo, Jeffrey Sieracki, Alfredo Nava-Tudela
Scientific Development Officers

Radu Balan , Wojciech Czaja, Kasso Okoudjou
Faculty Members

Xuemei Chen, Ben Manning
Postdoctoral Fellows



Advisory Boards

Academic

Margaret Cheney
Colorado State University

Ronald Coifman
Yale University

Ingrid Daubechies
Duke University

Guido Weiss
Washington University in St. Louis

Government and Industrial

Greg Coxson

Garry M. Jacyna

Jeffrey M. Sieracki

Michael R. Dellomo

Joseph Lawrence

Francis Sullivan

Glenn Easley

Harry A. Schmitt

University of Maryland

Patrick M. Fitzpatrick

Steven A. Tretter

Konstantina Trivisa

Scott Wolpert



Norbert Wiener Center Department of Mathematics

- State of the Art Research
- Leading Edge Education
- International Center



» State of the Art Research

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Research Center

- Theoretical and Applicable Harmonic Analysis
- Support technologies of 21st century

Research Center

- Build relationships with government and industry to provide a forum for interactive problem solving

AFOSR

NIH

ARO

NSF

Army ERDC

NGA

DARPA

ONR

DTRA

SBIR/STTR Contracts

LTS

Siemens

MITRE

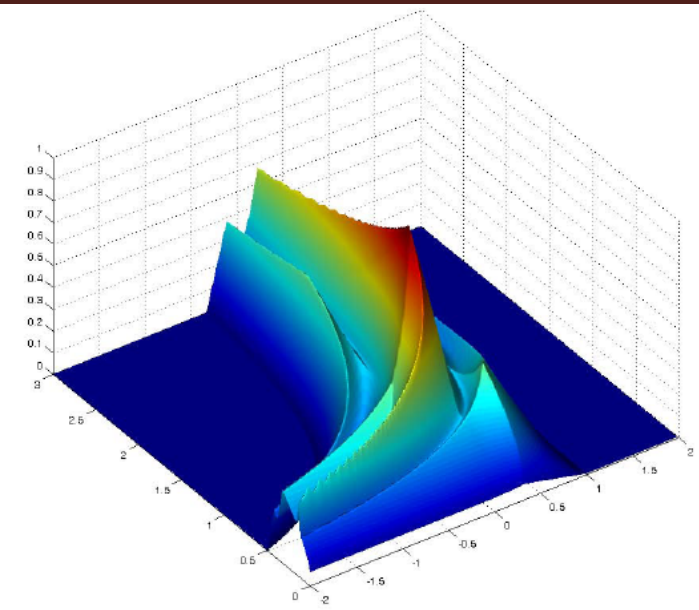
State Street Bank

- Targeted work groups and internships

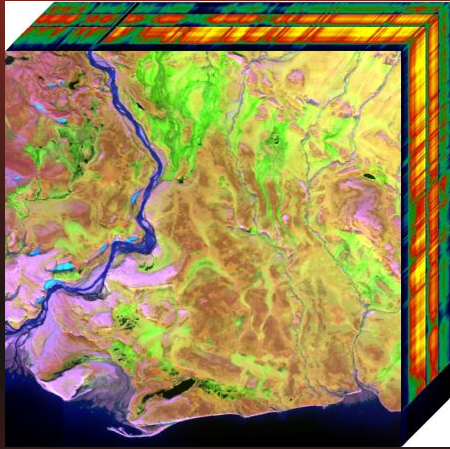


Waveform Design

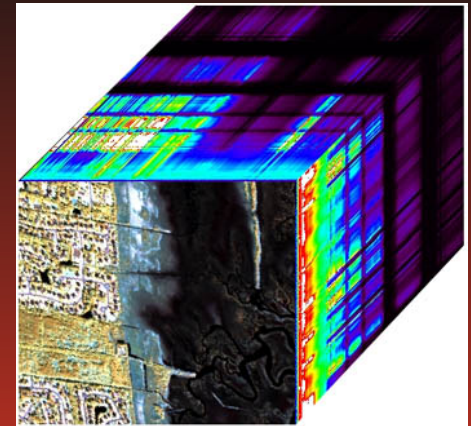
- Mathematics Involved
 - Number Theory
 - Euclidean Harmonic Analysis
 - Representations of Finite Groups
 - Theory of Frames
- Applications
 - RADAR & Communications
 - Number Theory



Dimension Reduction

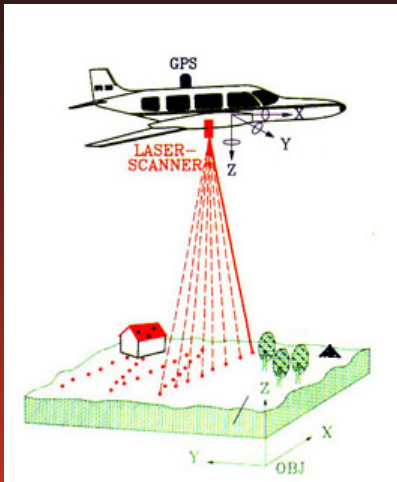
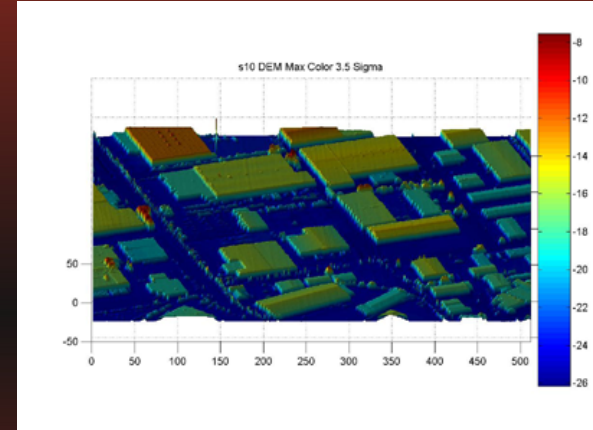


- Mathematics Involved
 - Theory of Frame Potential Energy
 - Harmonic Analysis
 - Geometry of Manifolds
 - Wavelet Packets
- Applications
 - Hyperspectral Imaging
 - Retinal Imaging at NIH
 - Classification Problems



Geospatial Terrain and Image Processing

- Mathematics Involved
 - Wavelet Theory
 - Scientific Computation
 - Multiresolution analysis



- Applications
 - LIDAR (Light Detection and Ranging)
 - Terrain Data Compression
 - Automatic Quality Assessment
 - Noise and Artifact Reduction

Blind Source Separation (Cocktail party problem)

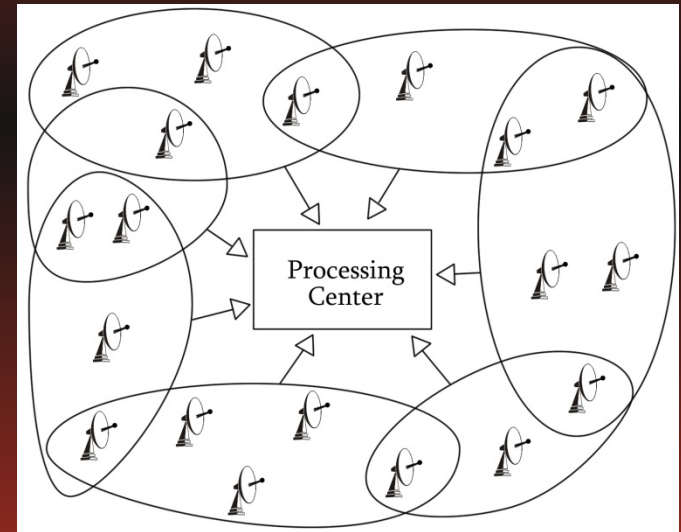


- Mathematics involved
 - Sparse signal representations
 - Harmonic Analysis
 - Statistical signal processing
- Applications
 - Security
 - Listening devices
 - Hearing Aids
 - Videoconferencing



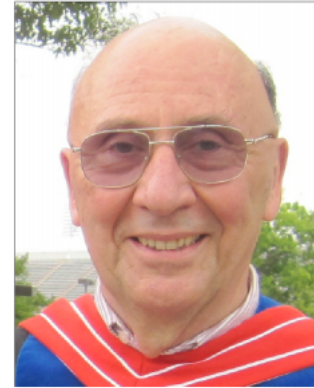
Data Fusion

- Mathematics Involved
 - Fusion frames
 - Kadison-Singer ~~conjecture~~ theorem in C^* -algebras
 - Frame potential
- Applications
 - Network communication
 - Parallel processing
 - Sensors and homeland security



Phase Retrieval Frames

- UMD Math PhD Herbert A. Hauptman was awarded the 1985 Nobel Prize in Chemistry
- Spectacular recent developments
- Balan, Candes, Strohmer among leading researchers.



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Student Opportunities

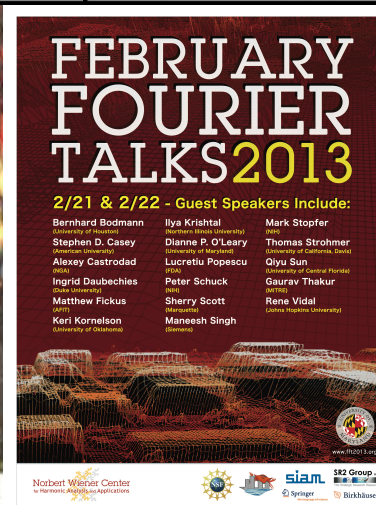
- Daniel Sweet undergraduate fellowship
- Research interaction teams
- Student conference participation
- Topics courses:
 - Compressed sensing
 - Frame theory
 - Dimension reduction & machine learning
 - Wavelet theory

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International Center

- Annual Conferences
 - February Fourier Talks (FFT)



International Center

- Annual Conferences
 - February Fourier Talks (FFT)
 - Biomedical Image Analysis Algorithms (BIAA)
- Collaborations
- CROWDS waveform repository
- News and Events Calendar
- Applied and Numerical Harmonic Analysis book series (Springer Birkhäuser)
- Journal Fourier Analysis & Applications
- Web site: www.norbertwiener.umd.edu



How do I get involved?

- Enroll in courses offered by Norbert Wiener Center faculty
- Attend weekly seminar (Tuesdays 2-3pm).
- Attend February Fourier Talks 2014 (February 20-21)
- Take a one-semester reading course with NWC faculty...
- Leading to potential RA or summer support...
- Leading to thesis topics...
- Leading to cutting-edge jobs advancing Mathematics and its applications.
- Check out the website www.norbertwiener.umd.edu for conferences, workshops, articles, and other opportunities.



