# DR. ADRIAN M. PETER

*1235 Evans Rd., Melbourne, FL • (321) 837-7048*
adrian.peter@gmail.com • http://adrian.petervision.com

## Profile

My dissertation research was primarily focused on applying information geometric concepts to the study of shape analysis, a sub-field of computer vision. Information geometry is still an emerging applied math discipline—one that builds an overarching geometrical foundation unifying ideas from information theory, probabilistic analysis and differential geometry. With our approach, shapes are represented as probability density functions and all subsequent analysis takes place on the manifold of densities. We have successfully demonstrated this framework by developing novel methods for shape matching, deformable models, and shape indexing and retrieval. In a broader context, my research interests are in applying advanced analytics (e.g. machine learning, statistical modeling, optimization and visualization) to solve large-scale computing problems across a variety of domain areas (signal processing, geospatial, environmental, sensor fusion and enterprise intelligence).

My professional experience at Northrop Grumman, Harris and Intel corporations provides an overriding sensibility to my research endeavors, allowing me to balance the introduction of creative problem frameworks and novel algorithms along with the practicality of their implementation and experimental validation. Serving as a program manager in charge of project responsibilities and budgets has given me the necessary skills needed to set goals, define concrete deliverables and develop schedules to meet objectives in a timely and efficient manner.

*Mathematical Interests:* Differential geometry, information theory, wavelets, optimization, operator theory, complex variable and harmonic analysis.

**Citizenship:** United States of America

## Education

2008 UNIVERSITY OF FLORIDA
*Doctor of Philosophy in Electrical and Computer Engineering, August 2008*
*Information Geometry for Shape Analysis: Probabilistic Models for Shape Matching and Indexing*
*Chair: Anand Rangarajan*

2003 UNIVERSITY OF FLORIDA
*Master of Engineering in Electrical and Computer Engineering, May 2003*

1999 UNIVERSITY OF FLORIDA
*Bachelor of Science in Computer Engineering, August 1999*
*High Honors*

## Academic Experience

### Research

2004-2008 *Research Assistant* August - August Supervisor: Dr. Anand Rangarajan
Center for Vision, Graphics and Medical Imaging University of Florida

- Developed shape analysis algorithms using information geometry.

2002-2003 *Research Assistant* August - May Supervisor: James L. Kurtz
Electronics Communication Laboratory University of Florida

- Created simulations for advanced, multifunction radar waveforms.

**Teaching**

2007 *Teaching Assistant* August - December
Department of Electrical and Computer Engineering University of Florida
- Undergraduate Course: Circuits I.

2007 *Teaching Assistant* January - May
Department of Electrical and Computer Engineering University of Florida
- Undergraduate Course: Analytical Methods in Electrical Engineering.

2002 *Teaching Assistant* May - August
Department of Electrical and Computer Engineering University of Florida
- Graduate Course: Noise in Linear Systems.

2002 *Teaching Assistant* January - May
Department of Electrical and Computer Engineering University of Florida
- Undergraduate Course: Circuits II.

2001 *Teaching Assistant* August - December
Department of Electrical and Computer Engineering University of Florida
- Undergraduate Course: Circuits I.

1997-1998 *Programming Consultant* August - May
Department of Computer Information and Sciences University of Florida
- Undergraduate Course: Programming in C/C++.

**Professional Experience**

2009-Pres. *Chief Scientist (Advanced Analytics Group)*
Northrop Grumman Melbourne, FL
- Develop sensor agnostic data analysis algorithms for intelligent decision processing.
- Leading research and development of advanced analytics algorithms for cloud computing environments (Hadoop).
- Developing un/semi-supervised topic clustering methods for text mining in a stream-based computing environment (Complex Event Processing, IBM InfoSphere Streams)
- Served as lead system engineer for SOA-based multi-INT fusion architecture.
- Developed multi-model fusion algorithms for adaptive weather ensembling system.
- Secured excess of $610K in internal research and development funds for fiscal years 2009-2010.
- Co-authored several white papers and proposals in response to government announcements.

2003-2008 *Software Engineer*
Harris Corporation Melbourne, FL
- Designed real-time objection recognition algorithms for industrial robotics application.
- Developed image processing algorithms for feature extraction, 3D reconstruction, image formation, material classification and tracking on a wide array of remote sensing platforms including electro-optical, radar, hyperspectral and video.

- Assisted in developing PDE-based segmentation and interpolation algorithms which have helped Harris secure contracts in excess of $500K.
- Served as principal investigator of Video Internal Research and Development effort with $93K budget.
- Co-authored two BAA responses to government agencies.
- Co-invented eight patents, all of them have been submitted to U.S. patent office (see Patents section for more details).
- Served as liason to University of Florida, identifying and briefing engineers on impact technologies that will further advance Harris remote sensing capabilities.
- Assisted with recruiting new college graduates.

2000-2001 *Communications/Networking Initiative Manager*
Intel Corporation Chandler, AZ

- Managed technology life cycle and evangelism for short-range wireless standards including Bluetooth, Wi-Fi and HomeRF.
- Developed business case analysis for new cellular-based wireless product.

1999-2000 *Rotation Engineer*
Intel Corporation Chandler, AZ

- Completed three four-month assignments in software engineering, business development, and project management.
- Managed $100K budget to develop product demonstrations for Intel Developer Forum.

1998 *Co-op Software Engineer*
Intel Corporation Chandler, AZ

- Developed test simulations for real-time embedded OS on Intelligent I/O 960 platform.

## Publications

### Journals

2009 **Adrian Peter** and Anand Rangarajan, "Information Geometry for Landmark Shape Analysis: Unifying Shape Representation and Deformation," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, February 2009, pp. 337 - 350.

2008 **Adrian Peter** and Anand Rangarajan, "Maximum Likelihood Wavelet Density Estimation with Applications to Image and Shape Matching," *IEEE Transactions on Image Processing*, April 2008, pp. 458 - 468.

2001 **Adrian Peter** and Susan Michalak, "Making Wireless Networking Easier for Consumers," *Intel Developer Update Magazine*, March 2001. (NOTE: This was published under my former last name during my employment at Intel Corporation.)

### Conferences

2009 Jeffrey Ho, **Adrian Peter**, Anand Rangarajan, and Ming-Hsuan Yang, "An Algebraic Approach to Affine Registration of Point Sets," *IEEE International Conference on Computer Vision (ICCV)*, 2009.

2008 **Adrian Peter**, Anand Rangarajan and Jeffrey Ho, "Shape L'Âne Rouge: Sliding Wavelets for Indexing and Retrieval," *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2008. (Oral presentation.)

2006 **Adrian Peter** and Anand Rangarajan, "A New Closed-Form Information Metric for Shape Analysis," *Medical Image Computing and Computer-Assisted Intervention (MICCAI)*, 2006, pp. 249-256. (Also presented at Mathematical Foundations of Computational Anatomy (MFCA), a workshop at MICCAI.)

2006 Tariq Bakir, **Adrian Peter**, Ron Riley and Jay Hackett, "Non-Negative Maximum Likelihood ICA for Blind Source Separation of Images and Signals with Application to Hyperspectral Image Subpixel Demixing," *International Conference on Image Processing (ICIP)*, 2006, pp. 3237 - 3240.

2006 **Adrian Peter** and Anand Rangarajan, "Shape Matching Using the Fisher-Rao Riemannian Metric: Unifying Shape Representation and Deformation," *IEEE International Symposium on Biomedical Imaging (ISBI)*, 2006, pp. 1164-1167.

**Book Chapters**

2009 Our work on information geometry for deformable matching is covered in Chapter 4 of "Information Theory in Computer Vision and Pattern Recognition," Francisco Escolano, Pablo Suau and Boyán Bonev, Springer, July 2009.

## Invited Talks

2009 *Information Geometry for Shape Analysis: Probabilistic Models for Shape Matching*, given at Department of Statistics, Florida State University, September 2009.

2009 *Sliding Wavelets for Shape Matching*, given at Department of Computer Science, Florida Institute of Technology, March 2009.

2008 *Shape L'Âne Rouge: Sliding Wavelets for Indexing and Retrieval*, given at IEEE Conference on Computer Vision and Pattern Recognition (CVPR), June 2008.

2006 *Shape Matching Using Information Metrics: Unifying Shape Representation and Deformation*, given at International Workshop on Mathematical Foundations of Computational Anatomy (MFCA), October 2006.

2006 *Shape Matching Using the Fisher-Rao Riemannian Metric: Unifying Shape Representation and Deformation*, given at IEEE International Symposium on Biomedical Imaging (ISBI), April 2006.

## Honors and Awards

2007 *Golden Quill Award*
Harris Corporation — Melbourne, FL

2004 *Next Level Award*
Harris Corporation — Melbourne, FL

2001-2002 *Departmental Fellowship*
Department of Electrical and Computer Engineering — University of Florida

2000 *Outstanding Leadership Award*
Intel Corporation — Chandler, AZ

2000 *Intel Developer Conference Outstanding Track Owner Award*
Intel Corporation — Chandler, AZ

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| 1999 | *High Honors Undergraduate Education*<br>Department of Computer Information and Sciences | University of Florida |
| 1997-1999 | *Dean's List*<br>College of Engineering | University of Florida |

**Service**

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| 2007-Pres. | Reviewer for *Computer Vision and Image Understanding*. |
| 2007-Pres. | Reviewer for *Geoscience and Remote Sensing Letters*. |
| 2005-Pres. | Reviewer for *IEEE Transactions on Pattern Analysis and Machine Intelligence.* |
| 2007 | Reviewer for *International Conference on Computer Vision (ICCV) Conference*, Rio de Janeiro, Brazil. |
| 2005 | Reviewer for *Energy Minimization Methods in Computer Vision and Pattern Recognition (EMMCVPR) Conference*, St. Augustine, FL, USA. |

**Affiliations**

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| 2005-Pres. | Member of IEEE. |

**Pending Patents**

Co-inventor on following patents developed at Harris Corporation; all have been submitted to United States Patent and Trademark Office for approval.

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| 2007 | *Geospatial Modeling System and Related Method Using Multiple Sources of Geographic Information.* |
| 2006 | *Non-Negative Maximum Likelihood ICA for Blind Source Separation of Signals and Images.* |
| 2006 | *Topography-preserving, Non-linear Inpainting for Autonomous Digital Elevation Model Reconstruction.* |
| 2006 | *An Automated Method for Reconstruction of Obscured Cultural Features in a High Resolution Digital Elevation Model.* |
| 2006 | *Spatial/Spectral Calibration of Panchromatic/Multispectral Image Pairs.* |
| 2006 | *Panchromatic Modulation of Multispectral Imagery.* |
| 2006 | *Structured Smoothing for Super-resolution of Multispectral Imagery Based on Registered Panchromatic Image.* |
| 2006 | *Restoration of Notched Spectral Frequencies of SAR Data in the Spectral Domain Using Navier Stokes Turbulence Equations.* |