

## CURRICULUM VITAE

### GUILLERMO SAPIRO

#### PERSONAL

**Date and place of birth:** 4.3.1966, Uruguay (US Citizen).

**Family status:** Married, two children.

**Address:** Department of Electrical and Computer Engineering, Duke University, Durham, NC 27707

**e-mail:** guillermo.sapiro@duke.edu

#### EDUCATION

**1991 - 1993:** D. Sc. in Electrical Engineering - Technion, Israel

Advisor: Allen Tannenbaum

Thesis: Topics in Shape Evolution

**1989 - 1991:** M. Sc. in Electrical Engineering - Technion, Israel

Advisor: David Malah

Thesis: Image Coding via Morphological Techniques

**1985 - 1989:** B. Sc. in Computer Engineering - Technion, Israel (summa cum laude).

#### RESEARCH INTERESTS

- Image processing
- Computer vision
- Computational vision
- Functional and diffusion MRI
- Biomedical imaging
- Brain imaging
- Translational neuroscience

- Cryo-tomography of viruses
- Protein and RNA research
- Differential geometry and differential equations
- Scientific computation
- Computer graphics
- Machine learning
- Applied mathematics

## **POSITIONS HELD**

**2013-present** Edward T. Pratt, Jr Distinguished Professor.

**2012-present** Professor, Department of Electrical and Computer Engineering, Department of Computer Sciences, and Department of Biomedical Engineering, Duke University.

**2012-present** Faculty Member, Duke Institute for Brain Sciences.

**2008 - 2012:** Vincentine Hermes-Luh Chair in Electrical and Computer Engineering

**2004 - 2012:** Distinguished McKnight University Professor, University of Minnesota

**2002 - 2012:** Professor, University of Minnesota

**2002 - 2012:** Graduate Faculty, Scientific Computation

**2002 - 2012:** Graduate Faculty, Computer Engineering

**2000 - 2002:** Associate Professor, University of Minnesota

**1999-2012:** Core Faculty, Cognitive Neuroscience and Brain Imaging Program, University of Minnesota

**1999-2012:** Faculty Affiliate Member, Center for Cognitive Sciences, University of Minnesota

**1998-present:** Honorary Professor, Universidad de La Republica, Uruguay.

**1997 - 2000:** Assistant Professor, University of Minnesota

**1995 - 1997:** Hewlett-Packard Delegate on ISO. Member of HP Labs team that developed the new standard for lossless/near-lossless image compression (part of JPEG).

**1994 - 1995:** Visiting Staff Scientist, Lawrence Berkeley Lab., University of California.

**1994 - 1997:** Member of Technical Staff, Hewlett-Packard Labs.

**1993 - 1994:** Post-doctoral Associate, M.I.T.

**Summer 1993:** Consultant at *Optibase Ltd.*, Israel (video processing).

**1989 - 1993:**

- Teaching Assistant at the Electrical Engineering Department at the Technion, I. I. T., *Signals and Systems* course.
- Undergraduate students project supervisor at the Signal Processing Laboratory, EE Department. Projects included topics as image compression, robotics, image enhancement, mathematical morphology, character recognition, pattern detection. Some of the projects were performed for companies as IBM-Israel, Motorola Communications, Elbit, Galai.

**1986 - 1989:** Assistant at the Signal Processing Lab. at the Faculty of Electrical Engineering at the Technion, I. I. T.

### **CONSULTING EXPERIENCE**

Hewlett-Packard, Optibase Ltd., Motorola Research Labs, Summus Ltd, Freestyle Technologies, Adobe (Litigation), Level Sets Systems, Vital Images, Milbank (Litigation), Telairity, 3M, CyberOptics.

### **SHORT TERM VISITS**

- ENS Cachan, Paris
- INRIA, Sophia-Antipolis, France.
- UCLA, IPAM Fellow.
- Institute Henri Poincare, Paris, France.
- CEREMADE, University Paris-Dauphine, France.

- Department of Computer Sciences, University of Balears, Palma de Mallorca, Spain.
- Isaac Newton Institute for Mathematical Sciences, University of Cambridge, England (Computer Vision Program).

## HONORS AND AWARDS

- 1986:** Electrical Engineering Dean Award for distinguished undergraduate students.
- 1987:** Electrical Engineering Dean Award for distinguished undergraduate students.
- 1988:** Technion President Award for distinguished undergraduate students.
- 1989:** Special Honors (summa cum laude) in the culmination of the B. Sc. at the Electrical Engineering Department, Technion, I. I. T.
- 1991:** Gutwirth Scholarship Award for Special Excellence in Graduate Studies.
- 1992:** Ollendorff Fellowship for Excellence in Vision and Image Understanding Work.
- 1993:** Rothschild Fellowship for Post-Doctoral Studies.
- 1997:** Plenary Speaker, *1997 IEEE/EURASIP Workshop on Nonlinear Signal and Image Processing*, Mackinac Island, Michigan, September 1997.
- 1998:** Office of Naval Research Young Investigator Award.
- 1998:** Presidential Early Career Awards for Scientists and Engineers (PECASE)
- 1999:** National Science Foundation Faculty Early Career Development (CAREER) Program Award
- 1999:** Plenary Speaker, *Foundations of Computational Mathematics*, Oxford, July 1999.
- 2001:** Best student paper award with graduate student M. Bertalmio, *First IEEE Workshop on Variational and Level Set Methods in Computer Vision*, Vancouver, July 2001.

- 2003-2005:** Vice-President/President of the SIAM (Society of Industrial and Applied Mathematics) Imaging Sciences Activity Group.
- 2004:** Distinguished McKnight University Professor.
- 2006:** George Taylor Research Award, University of Minnesota.
- 2006:** Plenary Speaker, *Curves and Surfaces*, Norway, June 2006.
- 2007:** Founding Editor-in-Chief, *SIAM Journal on Imaging Sciences* (currently ranked second impact factor in Applied Mathematics).
- 2008:** Vincentine Hermes-Luh Chair in Electrical and Computer Engineering.
- 2008:** Success story from the *National Geospatial-Intelligence Agency* Basic Research Program (NURI).
- 2009:** Abel Science Lecture, Oslo, Norway, May 2009.
- 2009:** Plenary Speaker, *EMMCVPR*, Bonn, August 2009.
- 2009:** Success story from the *National Geospatial-Intelligence Agency* Basic Research Program (NURI).
- 2010:** Plenary Speaker, *The Learning Workshop*, Snowbird, April 2010.
- 2010:** Plenary Speaker, *SIAM Image Science Conference*, Chicago, April 2010.
- 2010:** National Security Science and Engineering Faculty Fellowship.
- 2011:** Success story from the *National Geospatial-Intelligence Agency* Basic Research Program (NURI).
- 2011:** Helmholtz Test-of-Time Award, *International Conference Computer Vision*, “Geodesic Active Contours” ICCV ’95 paper.
- 2012:** Best Poster Award, P. Sprechmann, A. Bronstein, and G. Sapiro, “Real-time online singing voice separation from monaural recordings using robust low-rank modeling,” *International Society for Music Information Retrieval Conference*, Porto, October 2012.
- 2013** SIAM Fellow.

**2013** Best Paper Award, P. Llull, X. Liao, X. Yuan, J. Yang, D. Kittle, L. Carin, G. Sapiro, and D. J. Brady, “Compressive sensing for video using a passive coding element,” *Imaging and Applied Optics Congress*, Arlington, VA, June 2013.

**2013** International Society in Magnetic Resonance in Medicine Recognition, Top 5 cited articles in *Magnetic Resonance in Medicine* 10, Aganj, C. Lenglet, G. Sapiro, E. Yacoub, K. Ugurbil, and N. Harel, “Reconstruction of the orientation distribution function in single and multiple shell q-ball imaging within constant solid angle” *Magnetic Resonance in Medicine* **64:2**, pp. 554-566, 2010.

**2013** IEEE Fellow.

**2013** Science Advisory Board, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University.

## **GRADUATE STUDENTS AWARDS**

**2000-2001:** University of Minnesota Graduate School Fellowship. Awarded to PhD student Marcelo Bertalmio.

**2002:** Femlab Prize 2002 for research done as a student in scientific fields related to Prof. Stan Osher research. Awarded to PhD student Marcelo Bertalmio.

**2007:** Best Numerical Paper-Project Award, G. Sundaramoorthi (graduate student, GATECH), A. Yezzi, G. Sapiro, and A. Menzies, “New possibilities with sobolev active contours,” *Scale Scale and Variational Methods in Computer Vision*, Ischia, Italy, May-June 2007.

**2008** Best Student Paper Award, P. Passalacqua, T. Do Trung, E. Foufoula-Georgiou, G. Sapiro, and W. E. Dietrich, “River network extraction from LIDAR using backwards-in-time diffusion,” *Hydrology Section of the American Geophysical Union Meeting*, San Francisco, December 2008.

## **PUBLICATIONS**

### **Books**

1. G. Sapiro, *Geometric Partial Differential Equations and Image Processing*, Cambridge University Press, January 2001.

### **Journals and Book Chapters**

2. G. Prasad, J. Joshi, N. Jahanshad, J. Villalon, I. Aganj, C. Lenglet, G. Sapiro, K. McMahon, G. de Zubicaray, N. Martin, M. Wright, A. Toga, and P. Thompson, "Automatic clustering and population analysis of white matter tracts using maximum density paths," *NeuroImage*, 2014, to appear.
3. J. Yang, X. Yuan, X. Liao, P. Llull, D.J. Brady, G. Sapiro, and L. Carin, "Video compressive sensing using Gaussian Mixture Models," *IEEE Trans. Image Processing*, 2014, to appear.
4. J. Kim, C. Lenglet, Y. Duchin, G. Sapiro, and N. Harel, "Semi-automatic segmentation of brain subcortical structures from high-field MRI," *IEEE Transactions on Information Technology in Biomedicine*, 2014, to appear.
5. J. M. Duarte-Carvajalino, C. Lenglet, K. Ugurbil, S. Moeller, L. Carin, and G. Sapiro, "Estimation of the CSA-ODF using Bayesian compressed sensing of multishell HARDI," *Magnetic Resonance in Medicine*, 2014, to appear.
6. S. Jbabdi, J. Xu, J. L. Andersson, S. Moeller, E. J. Auerbach, M. F. Glasser, M. Hernandez, G. Sapiro, M. Jenkinson, D. A. Feinberg, E. Yacoub, C. Lenglet, D. C. Van Essen, K. Ugurbil, and T. E. Behrens, "Advances in diffusion MRI acquisition and processing in the Human Connectome Project," *NeuroImage*, 2013, to appear.
7. E. Caruyer, C. Lenglet, G. Sapiro, and R. Deriche, "Design of multi-shell sampling schemes with uniform coverage in diffusion MRI," *Magnetic Resonance in Medicine*, to appear, 2013.
8. L. Zhan, N. Jahanshad, Y. Jin, C. Lenglet, B. A. Mueller, G. Sapiro, K. Ugurbil, N. Harel, A. W. Toga, K. O. Lim, and P. M. Thompson, "Field strength effects on diffusion measures and brain connectivity networks," *Brain Connectivity*, to appear, 2013.
9. B. D. Harrison, J. Hashemi, M. Wellington, G. Sapiro, and J. Berman, "A tetraploid intermediate precedes aneuploid formation in yeasts exposed to fluconazole," *PLoS Biology*, March 2014.
10. M. Tong, Y. Kim, L. Zhan, G. Sapiro, C. Lenglet, B. A. Mueller, P. M. Thompson, and L. A. Vese, "A vectorial total variation model for

- denoising high angular resolution diffusion images corrupted by Rician noise,” *Methods and Applications of Analysis* **21**, pp. 139-164, 2014.
11. B. Chen, G. Polatkan, G. Sapiro, D. Blei, D. B. Dunson, and L. Carin, “Deep learning with hierarchical convolution factor analysis,” *IEEE Trans. Pattern Analysis Machine Intelligence* **35**, pp. 1887-1901, 2013.
  12. P. Llull, X. Liao, X. Yuan, J. Yang, D. Kittle, L. Carin, G. Sapiro, and D. J. Brady, “Coded aperture compressive temporal imaging,” *Optics Express* **2**, pp. 1052610545, 2013.
  13. J. Pokrass, A. Bronstein, M. Bronstein, P. Sprechmann, and G. Sapiro, “Sparse modeling of intrinsic correspondences,” *Eurographics Computer Graphics Forum* **32**, pp. 459-468, May 2013.
  14. A. K. Harris, J. R. Meyerson, Y. Matsuoka, O. Kuybeda, A. Moran, D. Bliss, S. R. Das, J. Yewdell, G. Sapiro, K. Subbarao, and S. Subramaniam, “Structure and accessibility of HA trimers on intact 2009 H1N1 pandemic influenza virus to stem region-specific neutralizing antibodies,” *Proceedings of the National Academy of Sciences*, March 2013.
  15. J. Duarte, G. Sapiro, N. Harel, and C. Lenglet, “A framework for linear and non-linear registration of diffusion-weighted MRIs using angular interpolation,” *Frontiers in Brain Imaging Methods*, March 2013.
  16. J. Duarte Carvajalino, G. Yu, L. Carin, and G. Sapiro, “Task-driven adaptive statistical compressive sensing of Gaussian mixture models,” *IEEE Trans. Signal Processing* **61**, pp. 585-600, February 2013.
  17. E. Caruyer, I. Aganj, C. Lenglet, G. Sapiro, and R. Deriche, “Motion detection in diffusion MRI via online ODF estimation,” *International Journal of Biomedical Imaging* **2013:849363**, 2013.
  18. O. Kuybeda, G. A. Frank, A. Bartesaghi, M. Borgnia, S. Subramaniam, and G. Sapiro, “A collaborative framework for 3D alignment and classification of heterogeneous subvolumes in cryo-electron tomography,” *Journal of Structural Biology* **181**, pp. 116127, 2013.
  19. T. Michaeli, Y. Eldar, and G. Sapiro, “Semi-supervised single- and multi-domain regression with multi-domain training,” *Information and Inference: A Journal of the IMA* **1:1**, pp. 68-97, December 2012.



20. L. Yatziv, M. Chartouni, S. Datta, and G. Sapiro, "Towards multiple catheters detection in fluoroscopic image guided interventions," *IEEE Transactions on Information Technology in Biomedicine* **16**, pp. 770-781, 2012.
21. E. Esser, M. Moller, S. Osher, G. Sapiro, and J. Xin, "A convex model for non-negative matrix factorization and dimensionality reduction on physical space," *IEEE Trans. Image Processing* **21**, pp. 3239-3252, 2012.
22. S. Su, T. White, M. Schmidt, C.-Y. Kao, and G. Sapiro, "Geometric computation of human gyrification indexes from magnetic resonance images," *Human Brain Mapping*, 2012.
23. I. Ramirez and G. Sapiro, "Universal regularizers for robust sparse coding and modeling," *IEEE Trans. Image Processing* **21**, pp. 3850-3864, 2012.
24. A. Bartesaghi, F. Lecumberry, G. Sapiro, and S. Subramaniam, "Constrained single particle tomography: A hybrid approach for 3D structure determination at sub nanometer resolution," *Structure* **20**, pp. 2003-2013, 2012.
25. A. Castrodad and G. Sapiro, "Sparse modeling of human actions from motion imagery," *International Journal of Computer Vision* **100**, pp. 1-15, October 2012.
26. E. E. H. Tran, M. J. Borgnia, O. Kuybeda, D. M. Shauder, A. Bartesaghi, G. A. Frank, G. Sapiro, J. L. S. Milne, S. Subramaniam, "Structural mechanism of trimeric HIV-1 envelope glycoprotein activation," *PLoS Pathogens* **8**, 2012.
27. G. A. Frank, A. Bartesaghi, O. Kuybeda, M. J. Borgnia, T. A. White, G. Sapiro, and S. Subramaniam, "Computational separation of conformational heterogeneity using cryo-electron tomography and 3D sub-volume averaging," *Journal of Structural Biology* **178**, pp. 165-176, 2012.
28. I. Ramirez and G. Sapiro, "An MDL framework for sparse coding and dictionary learning," *IEEE Trans. Signal Processing* **60**, pp. 2913-2927, 2012.

29. Y. Duchin, A. Abosch, E. Yacoob, G. Sapiro, and N. Harel, "Feasibility of using ultra-high field (7T) MRI for clinical surgical targeting," *PLoS One*, 2012.
30. M. Mahmoudi and G. Sapiro, "Sparse representations for range data restoration," *IEEE Trans. Image Processing* **21**, pp. 2909-2915, 2012.
31. G. Yu, G. Sapiro, and S. Mallat, "Solving inverse problems with piecewise linear estimators: From Gaussian mixture models to structured sparsity," *IEEE Trans. Image Processing* **21**, pp. 2481-2499, 2012.
32. M. Zhou, H. Chen, J. Paisley, L. Ren, L. Li, Z. Xing, D. Dunson, G. Sapiro, and L. Carin, "Nonparametric Bayesian dictionary learning for analysis of noisy and incomplete images," *IEEE Trans. Image Processing* **21**, pp. 130-144, 2012.
33. Z. Xing, M. Zhou, A. Castrodad, G. Sapiro, and L. Carin, "Dictionary learning for noisy and incomplete hyperspectral images," *SIAM Journal on Imaging Sciences* **5:1**, pp. 33-56, 2012.
34. C. Lenglet, A. Abosch, E. Yacoub, G. Sapiro, and N. Harel, "Comprehensive in vivo mapping of the human basal ganglia and thalamic connectome in individuals using 7T MRI," *PLoS One* **7:1**, 2012.
35. J. M. Duarte-Carvajalino, N. Jahanshad, C. Lenglet, K. L. McMahon, C. de Zubicaray, N. Martin, M. Wright, P. M. Thompson, and G. Sapiro, "Hierarchical topological network analysis of anatomical human brain connectivity and differences related to sex and kinship," *NeuroImage* **59**, pp. 3784-3804, 2012.
36. L. Yatziv, J. Ibarz, N. Stobel, S. Datta, and G. Sapiro, "Esophagus silhouette extraction and reconstruction from fluoroscopic views for cardiac ablation procedure guidance," *IEEE Transactions on Information Technology in Biomedicine* **15**, pp. 703-708, 2011.
37. G. Yu and G. Sapiro, "Statistical compressed sensing of Gaussian mixture models," *IEEE Trans. Signal Processing* **59**, pp. 5842-5858, December 2011.
38. A. Castrodad, Z. Xing, J. Greer, E. Bosch, L. Carin, and G. Sapiro, "Learning discriminative sparse representations for modeling, source separation, and mapping of hyperspectral imagery," *IEEE Trans. on Geoscience and Remote Sensing* **49**, pp. 4263-4281, November 2011.

39. G. Sapiro, "Comparing shapes, understanding evolution," *Proceedings of the National Academy of Sciences (Commentary)*, October 31st, 2011.
40. I. Aganj, C. Lenglet, N. Jahanshad, E. Yacoub, N. Harel, P. M. Thompson, and G. Sapiro, "A Hough transform global probabilistic approach to multiple-subject diffusion MRI tractography," *Medical Image Analysis* **15**, pp. 414-425, 2011.
41. G. Yu and G. Sapiro, "DCT image denoising: A simple and effective image denoising algorithm," *Image Processing Online (ipol.im)*, September 2011.
42. P. Sprechmann, I. Ramirez, Y. Eldar, and G. Sapiro, "C-HiLasso: A collaborative hierarchical sparse modeling framework," *IEEE Trans. Signal Processing* **59**, pp. 4183-4198, 2011.
43. I. Aganj, C. Lenglet, E. Yacoub, G. Sapiro, and N. Harel, "A 3D wavelet fusion approach for the reconstruction of isotropic-resolution MR images from orthogonal anisotropic-resolution scans," *Magnetic Resonance in Medicine*, July 2011.
44. P. Arias, G. Facciolo, V. Caselles, and G. Sapiro, "A variational framework for exemplar-based image inpainting," *International Journal of Computer Vision* **93:3**, March 2011.
45. B. Wirth, L. Bar, M. Rumpf, and G. Sapiro, "A continuum mechanical approach to geodesics in shape space," *International Journal of Computer Vision* **93:3**, March 2011.
46. G. Sapiro, "Partial differential equations and image processing," in *Foundations of Computational Mathematics, Handbook of Numerical Analysis*, F. Cucker, Editor, North-Holland, to be published.
47. L. Carin, R. G. Baraniuk, V. Cevher, D. Dunson, M. I. Jordan, G. Sapiro, and M.B. Wakin, "Learning low-dimensional signal models," *Proceedings of the IEEE* **2**, pp. 39-51, 2011.
48. J. Wright, Y. Ma, J. Mairal, G. Sapiro, T. Huang, and S. Yan, "Sparse representation for computer vision and pattern recognition," *Proceedings of the IEEE* **6**, pp. 1031 - 1044, 2010.

49. A. Bugeau, M. Bertalmio, V. Caselles, and G. Sapiro, "A comprehensive framework for image inpainting," *IEEE Trans. Image Processing* **19:10**, pp. 2634-2645, 2010.
50. I. Aganj, C. Lenglet, G. Sapiro, E. Yacoub, K. Ugurbil, and N. Harel, "Reconstruction of the orientation distribution function in single and multiple shell q-ball imaging within constant solid angle," *Magnetic Resonance in Medicine* **64**, pp. 554-566, 2010.
51. F. Lecumberry, A. Pardo, and G. Sapiro, "Simultaneous object classification and segmentation with high-order multiple shape models," *IEEE Trans. Image Processing* **19**, pp. 625-635, 2010.
52. J. Mairal, F. Bach, J. Ponce, and G. Sapiro, "Online learning for matrix factorization and sparse coding," *Journal of Machine Learning Research* **11**, pp. 19-60, 2010.
53. P. Passalacqua, T. D. Trung, E. Foufoula-Georgiou, G. Sapiro, and W. E. Dietrich, "A geometric framework for channel network extraction from LiDAR: Nonlinear diffusion and geodesic paths," *Journal of Geophysical Research - Earth Surface* **115**, 2010.
54. T. White, S. Su, M. Schmidt, C. Y. Kao, and G. Sapiro, "The development of gyrification in children and adolescents," *Brain & Cognition* **71**, pp. 35-45, 2010.
55. I. Aganj, G. Sapiro, N. Parikshak, S. K. Madsen, and P. M. Thompson, "Measurement of cortical thickness from MRI by minimum line integrals on soft-classified tissue," *Human Brain Mapping* **30**, pp. 3188-3199, 2009.
56. A. M. Bronstein, M. M. Bronstein, M. Mahmoudi, R. Kimmel, and G. Sapiro, "A Gromov-Hausdorff framework with diffusion geometry for topologically-robust non-rigid shape matching," *International Journal Computer Vision*, October 2009.
57. X. Bai, J. Wang, G. Sapiro, and D. Simons, "Video SnapCut: Robust video object cutout using localized classifiers," *SIGGRAPH, ACM Transactions on Graphics*, August 2009.
58. J. M. Duarte-Carvajalino and G. Sapiro, "Learning to sense sparse signals: Simultaneous sensing matrix and sparsifying dictionary optimization," *IEEE Trans. Image Processing* **18**, pp. 1395-1408, 2009.

59. L. Bar and G. Sapiro, "Generalized Newton-type methods for energy formulations in image processing," *SIAM Journal on Imaging Sciences* **2:2**, pp. 508-531, 2009.
60. X. Bai and G. Sapiro, "Geodesic matting: A framework for fast interactive image and video segmentation and matting," *International Journal Computer Vision* **82**, pp. 113-132, 2009.
61. C. Lenglet, J.S.W. Campbell, M. Descoteaux, G. Haro, P. Savadjiev, D. Wassermann, A. Anwender, R. Deriche, G.B. Pike, G. Sapiro, K. Siddiqi, and P. Thompson, "Mathematical methods for diffusion MRI processing," *NeuroImage* 2009.
62. M. Mahmoudi and G. Sapiro, "Three-dimensional point cloud recognition via distributions of geometric distances," *Graphical Models* **71**, pp. 22-31, 2009.
63. T. Ivry, S. Michal, A. Avihoo, G. Sapiro, and D. Barash "An image processing approach to computing distances between RNA secondary structures dot plots," *Algorithms for Molecular Biology* **4:4**, 2009.
64. F. E. Pollick, U. Maoz, A. A. Handzel, P. J. Giblin, G. Sapiro, and T. Flash, "Three-dimensional arm movements at constant equi-affine speed," *Cortex* **45:3**, pp. 325-339, 2009.
65. R. Narasimha, I. Aganj, A. Bennett, M. J. Borgnia, D. Zabransky, G. Sapiro, S. W. McLaughlin, J. L. S. Milne, and S. Subramaniam, "Evaluation of denoising algorithms for biological electron tomography," *Journal of Structural Biology* **164**, pp. 7-17, 2008.
66. A. Bartesaghi, P. Sprechmann, J. Liu, G. Randall, G. Sapiro, and S. Subramaniam, "Classification and 3D averaging with missing wedge correction in biological electron tomography," *Journal of Structural Biology* **162**, pp. 436-450, 2008.
67. G. Haro, G. Randall, and G. Sapiro, "Translated Poisson mixture model for stratification learning," *International Journal Computer Vision* **80:3**, pp. 358-374, December 2008.
68. G. Haro, V. Caselles, G. Sapiro, and J. Verdera, "On geometric variational models for inpainting surface holes," *Computer Vision Image Understanding* **11**, pp. 351-373, September 2008.

69. J. M. Duarte-Carvajalino, G. Sapiro, M. Velez-Reyes, and P. Castillo, "Multiscale representation and segmentation of hyperspectral imagery using geometric partial differential equations and algebraic multigrid methods," *IEEE Trans. on Geoscience and Remote Sensing* **46**, pp. 2418-2434, August 2008.
70. J. Liu, A. Bartesaghi, M. J. Borgnia, G. Sapiro, and S. Subramaniam, "Molecular architecture of native HIV-1 gp120 trimers," *Nature* **07159**, July 30, 2008.
71. G. Sundaramoorthi, A. Yezzi, A. Mennucci, and G. Sapiro, "New possibilities with Sobolev active contours," *Int. Journal Computer Vision*, July 2008.
72. G. Singh, F. Memoli, T. Ishkhanov, G. Carlsson, G. Sapiro, and D. Ringach, "Topological structure of population activity in primary visual cortex," *Journal of Vision* **8:8**, pp. 1-18, 2008.
73. J. Mairal, M. Elad, and G. Sapiro, "Learning multiscale sparse representations for image and video restoration," *SIAM Multiscale Modeling and Simulation* **7**, pp. 214-241, 2008.
74. D. Rother, G. Sapiro, and V. J. Pande, "Statistical characterization of protein ensembles," *IEEE/ACM Trans. Computational Biology and Bioinformatics* **5**, pp. 42-55, 2008.
75. K. Patwardhan, G. Sapiro, and V. Morellas, "Robust foreground detection in video using pixel layers," *IEEE Trans. Pattern Analysis Machine Intelligence* **30**, pp. 746-751, 2008.
76. J. Mairal, M. Elad, and G. Sapiro, "Sparse representation for color image restoration," *IEEE Trans. Image Processing* **17**, pp. 53-69, 2008.
77. C. Moenning, F. Memoli, G. Sapiro, N. Dyn, and N. A. Dodgson, "Meshless geometric subdivision," *Graphical Models* **69**, pp. 160-179, 2007.
78. A. Mohan, G. Sapiro, and E. Bosch, "Spatially-coherent non-linear dimensionality reduction and segmentation of hyper-spectral images," *IEEE Geoscience and Remote Sensing Letters* **4**, pp. 206-210, 2007.

79. Y. Kao, M. Hofer, G. Sapiro, J. Stern, K. Rehm, and D. A. Rottenberg, "A geometric method for automatic extraction of sulcal fundi," *IEEE Trans. Medical Imaging* **26**, pp. 530-540, 2007.
80. A. Protiere and G. Sapiro, "Interactive image segmentation via adaptive weighted distances," *IEEE Trans. Image Processing* **16**, pp. 1046-1057, 2007.
81. K. Patwardhan, G. Sapiro, and M. Bertalmio, "Video inpainting under camera motion," *IEEE Trans. Image Processing* **16**, pp. 545-553, 2007.
82. M. Lee, P. Lloyd, X. Zhang, J. M. Schallhorn, K. Sugimoto, A. G. Leach, G. Sapiro, and K. N. Houk, "Shapes of antibody binding sites: Qualitative and quantitative analysis based on a geomorphic classification scheme," *J. Org. Chem.* **71**, pp. 5082-5092, 2006.
83. L. Yatziv and G. Sapiro, "Image and video colorization," in *Color Image Processing: Methods and Applications*, R. Lukac and K. N. Plataniotis, Editors, CRC Press, 2006.
84. M. Hofer, G. Sapiro, and H. Wallner, "Fair polyline networks for constrained smoothing of digital terrain elevation data," *IEEE Trans. on Geoscience and Remote Sensing* **44**, pp. 2983-2990, 2006.
85. J. Greer, A. Bertozzi, and G. Sapiro, "Fourth order partial differential equations on general geometries," *Journal of Computational Physics* **216**, pp. 216-246, 2006.
86. L. Yatziv and G. Sapiro, "Fast image and video colorization using chrominance blending," *IEEE Trans. Image Processing* **15**, pp. 1120-1129, 2006.
87. M. Bertalmio, V. Caselles, G. Haro, and G. Sapiro, "PDE-based image and surface inpainting," in *Handbook of Mathematical Models in Computer Vision*, N. Paragios, Y. Chen, and O. Faugeras, Editors, Springer, New York, pp. 33-61, 2006.
88. E. Hershkovitz, G. Sapiro, A. Tannenbaum, and L. D. Williams, "Statistical Analysis of RNA Backbone," *IEEE/ACM Trans. Computational Biology and Bioinformatics* **3**, pp. 33-46, 2006.

89. A. Mohan, A. Bartesaghi, and G. Sapiro, "Constrained regularization of digital terrain elevation data," *IEEE Geoscience and Remote Sensing Letters* **3**, pp. 59-62, 2006.
90. L. Yatziv, A. Bartesaghi, and G. Sapiro, "O(N) implementation of the fast marching algorithm," *Journal of Computational Physics* **212**, pp. 393-399, March 2006.
91. M. Mahmoudi and G. Sapiro, "Fast image and video denoising via non-local means of similar neighborhoods," *IEEE Signal Processing Letters* **2**, pp. 839-842, December 2005.
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## **CURRENT RESEARCH GRANTS**

1. *HARDI Mapping of Disease Effects on the Brain*, National Institutes of Health, 9/2009-8/2013, \$1,200,000.
2. *Geometric High Dimensional Information Analysis and Integration*, Office of Naval Research, 3/2008-9/2011, \$240,000.

3. *Geometry, PDEs, and Sparsity in Target Detection/Recognition and Image Signatures*, National Geospatial-Intelligence Agency, 9/2008-8/2012, \$600,000.
4. *Learning Sparse Representations for Restoration and Classification: Theory, Computations, and Applications in Image, Video, and Multi-modal Analysis*, National Science Foundation 9/2008-8/2012, \$305,000.
5. *Image Understanding Program*, Office of Naval Research, 1/2009-12/2011, \$400,000
6. *Informed Signal Models: Theory and Applications in Image Sciences*, Office of Naval Research, 6/2011-9/2014, \$734,000.
7. *Computational Modeling of High Field MR Images*, National Institutes of Health, 8/2007-4/2012, \$263,740.
8. *CDI-Type I: Geometric Image analysis for Computational Knowledge Discovery in Geosciences*, National Science Foundation, 9/2008-8/2012, \$467,000.
9. *Correlation of Functional and Structural Units in Cerebral Cortex*, National Institutes of Health, 9/2007-9/2012, \$21,000 a year.
10. *National Security Science and Engineering Faculty Fellowship*, AFOSR, 5/2010-4/2015, \$2,500,000.
11. *CDI-Type II: Computational Tools for Behavioral Analysis, Diagnosis, and Intervention of at Risk Children*, National Science Foundation, 9/2010-8/2013, \$1,500,000
12. *MRI: Development of a Video-Based Robotic Instrument for Behavioral Analysis and Diagnosis of At-Risk Children*, National Science Foundation, 9/2010-8/2014, \$1,500,000.
13. *Human Connectome*, National Institutes of Health, 09/15/2010-08/31/2015.
14. *Structured and Collaborative Sparse Models; Theory and Applications in Image, Video, and Audio Analysis*, Army Research Office, 3/2011-2/2015, \$361,000.
15. *Pathway targeted deep brain stimulation for Parkinson's disease*, National Institutes of Health, 09/01/2013-08/31/2018, \$3,410,000 (PI: N. Harel).

## SELECTED INVITED ORAL PRESENTATIONS

1. Plenary Speaker, *MATHEON Workshop on Compressed Sensing and its Applications*, Berlin, 2013.
2. Plenary Speaker, *Workshop on Learning Data Representation: Hierarchies and Invariance*, MIT, November 2013.
3. Plenary Speaker, *Methodological Aspects of Hyperspectral Imaging*, Nice, October 2013.
4. *February Fourier Talks (FFT) at the Norbert Wiener Center*, University of Maryland, February 2012.
5. *Foundations of Computational Mathematics*, Budapest, July 2011.
6. Plenary Speaker, *1st Technion Computer Engineering (TCE) Conference*, June 2011.
7. Plenary Speaker, *The Learning Workshop*, Snowbird, April 2010.
8. Plenary Speaker, *SIAM Image Science Conference*, Chicago, April 2010.
9. Plenary Speaker, *EMMCVPR*, Bonn, August 2009.
10. *Abel Science Lecture*, Oslo, Norway, May 2009.
11. Invited Speaker, *Compressive-Sensing Workshop*, Duke University, February 2009.
12. Invited Speaker, *UCLA Summer School on Brain Imaging*, July 2008.
13. Invited Speaker, *SIAM Imaging Conference*, San Diego, July 2008.
14. Plenary Speaker, *CVPR Workshop on Non-Rigid Shape Analysis and Deformable Image Alignment*, Anchorage, June 2008.
15. Invited Speaker, *Hausdorff Institute Workshop – Geometry and Statistics of Shapes*, June 2008.
16. Plenary Speaker, *International Workshop on Nonlinear Signal Processing*, Bucharest, Romania, 2007.

17. *Geometry and Statistics of Shape Spaces*, SAMSI, North Carolina, July 2007.
18. *American Association for the Advancement of Science Annual Meeting*, San Francisco, February 2007.
19. *CSC Distinguished Speaker Series*, Simon Fraser University, October 2006.
20. *Curves and Surfaces*, Avignon, France, 2006.
21. *Abel Symposium*, Norway, May 2006.
22. *ALGORITMY 2005, Conference on Scientific Computing*, Slovakia, March 2005.
23. *IPAM-NSF Meeting on Geometric Multiscale Analysis (2 lectures)*, September-December 2004.
24. *Representation of Reality by Brain and Machines*, Uruguay, November 2004.
25. *IPAM-NSF Summer School on Brain Imaging*, July 2004.
26. *5th International Congress on Industrial and Applied Mathematics*, Sydney, Australia, July 2003.
27. *International Conference on Scientific Computing and Partial Differential Equations*, Hong Kong Baptist University, Hong Kong, December 2002.
28. *Image Analysis and Understanding Data From Scientific Experiments*, Los Alamos National Lab, November 2002.
29. *Workshop on Protein Folding and Design*, DARPA, Washington D.C., October 2002.
30. *Mathematics and Image Analysis 2002*, Paris, September 10-13, 2002
31. *ALGORITMY 2002, Conference on Scientific Computing*, Slovakia, September 2002.
32. *Workshop in honor of Prof. S. Osher*, UCLA, Los Angeles, April 2002.

33. *American Mathematical Society (AMS) Annual Meeting*, San Diego, January 2002.
34. *SIAM Sessions at the Joint Mathematics Meetings*, San Diego, January 2002.
35. *First SIAM Conference on Imaging Science*, Boston, September 2001.
36. *Workshop in honor of Prof. S. Smale*, Hong Kong, July 2000.
37. Plenary Speaker, *Foundations of Computational Mathematics*, Oxford, July 1999.
38. "Partial Differential Equations, Theory and Numerical Solutions," Prague, August 10-15, 1998.
39. "Mathematical Theory of Networks and Systems," Padova, Italy, July 6-10, 1998.
40. Plenary Speaker, *1997 IEEE/EURASIP Workshop on Nonlinear Signal and Image Processing*, Mackinac Island, Michigan, September 1997.
41. *Society for Industrial and Applied Mathematics Annual Meeting*, Stanford, California, July 1997.
42. *Foundations of Computational Mathematics*, IMPA, Rio de Janeiro, January 1997.
43. *IEEE International Conference on Image Proc.*, Special Session: PDE's in Image Processing, Lausanne, September 16-19, 1996.
44. *UCLA Workshop on Computational and Applied Mathematics*, Lake Arrowhead, California, February 1996.
45. *New Connections between Mathematics and Computer Science Workshop*, Isaac Newton Institute for Mathematical Sciences, University of Cambridge, England, November 1995.
46. *Second European Conference on Mathematical Image Modeling*, Palma de Mallorca, Spain, September 1995.
47. *Society for Industrial and Applied Mathematics Annual Meeting*, San Diego, July 1994.



48. *SPIE Annual Meeting*, San Diego, July 1994.
49. *Third Workshop on Geometry Driven Diffusion in Computer Vision*, Stockholm, May 1994.
50. *First European Conference on Mathematical Image Modeling*, Las Palmas, Spain, March 1994.
51. *Second Workshop on Geometry Driven Diffusion in Computer Vision*, Cambridge, UK, December 1993.
52. Invited talks and colloquium at numerous universities and research centers, including UCLA, UC Berkeley, Stanford University, Caltech, MIT, Xerox PARC, IBM Almaden, Courant Institute-NYU, Bell Labs, Hebrew University, Technion-Haifa.

#### **SELECTED INVITED COURSES**

1. ICVSS 2011 - International Computer Vision Summer School 2011, Sicily, Italy, July 2011.
2. IEEE Computer Vision Pattern Recognition, San Francisco, June 2010
3. International Conference Computer Vision, Kyoto, 2009
4. SIGGRAPH 2004, August 2004, Los Angeles.
5. UPC, Barcelona, June 2004.
6. 2004 IEEE International Symposium on Biomedical Imaging: From Nano to Macro, April 2004, Washington D.C.
7. SIGGRAPH, July 2002, San Antonio.
8. London Mathematical Society, Cambridge, UK, March 2002.
9. IEEE Conference Computer Vision Pattern Recognition, December 2001.
10. Institute for Pure and Applied Mathematics, UCLA, May 2001.
11. National University of Singapore, February 1999.
12. Universidad de la Republica, Montevideo, Uruguay, May 1997, June 1998, June 1999, 2000, 2002, 2004, 2007, 2009.

## **COURSES TAUGHT**

1. System design (undergraduate)
2. Signals and systems (undergraduate, course coordinator)
3. Image processing (graduate)
4. Partial differential equations in image processing (graduate, new course developed)
5. Visual tracking (graduate, new course developed)
6. Brain imaging (graduate, new course developed)
7. Applied geometry for digital technology and engineering (graduate, new course developed)
8. Image classification (graduate, new course developed)
9. Dictionary learning and sparse coding (graduate, new course developed)
10. The mathematics of information and high dimensional data (graduate, new course developed)

## **SELECTED CONFERENCE ORGANIZATIONS & JOURNAL ACTIVITIES**

1. Program Committee, *Symmetries of Differential Equations: Frames, Invariants and Applications*, May 2012.
2. Program Committee, *Advances in Scientific Computing, Imaging Science and Optimization*, IPAM, UCLA, April 2012.
3. Program Committee, *International Conference on Scale Space and Variational Methods in Computer Vision*, 2011.
4. Program Committee, *SIAM Imaging Sciences Conference*, 2008.
5. Conference co-Chair, *International Conference on Scale Space and Variational Methods in Computer Vision*, Ischia, Italy, May 2007.
6. Organizing Committee, *Image Processing for Random Shapes*, IPAM-UCLA, May 2007.

7. Editor in Chief, *SIAM Journal on Imaging Sciences* (currently ranked second impact factor in Applied Mathematics).
8. Editorial Board, *Applied Mathematics Research eXpress*.
9. Editorial Board, *SIAM Multiscale Modeling and Simulation*.
10. Associate Editor, *IEEE Trans. Pattern Analysis Machine Intelligence*.
11. Area Chair, *Computer Vision Pattern Recognition*, 2004.
12. Program Committee, *European Conference Computer Vision*, 2004.
13. Program Committee, *SIAM Imaging Sciences Conference*, 2004.
14. Area Chair, *Computer Vision Pattern Recognition*, 2003.
15. Organizing Committee, *Data Analysis and Imaging in Nanosciences*, NSF Institute for Pure and Applied Mathematics (UCLA), 2002.
16. Organizing Committee, *Foundations of Computational Mathematics*, 2002.
17. Program Committee, *European Conference Computer Vision*, 2002.
18. Program Committee, *First SIAM Conference on Imaging Science*, 2001.
19. Program Committee, *Computer Vision Pattern Recognition*, 2001.
20. Program Committee, *International Conference Computer Vision*, 2001.
21. Organizing Committee, *Imaging in Medicine and Neurosciences*, NSF Institute for Pure and Applied Mathematics (UCLA), 2001.
22. Co-organizer, *Brain Imaging Workshop*, IMA, University of Minnesota, October 2000.
23. Guest Co-Editor, *Journal of Visual Communication and Image Representation*, Special Issue on “Partial Differential Equations in Image Analysis,” to appear, 2001.
24. Guest Co-Editor, *Journal of Visual Communication and Image Representation*, Special Issue on “Selected Papers of Scale-Space '99,” 2000.

25. Co-Organizer of Scale-Space '99, Corfu, Greece, September, 1999.
26. Editorial Board, *Journal of Visual Communication and Image Representation*.
27. Guest Co-Editor, *IEEE Transactions on Image Processing*, Special Issue on "Partial Differential Equations and Geometry Driven Diffusion," March 1998.
28. Co-Organizer and Co-Chairman of the special session on "Partial Differential Equations (PDE's) and Geometry-Driven Diffusion in Image Processing and Analysis," *Fourth IEEE-International Conference on Image Processing*, Santa Barbara, California, October 1997.
29. Member of the Program Committee, *Scale-Space '97*, Utrecht, July 2-4, 1997.
30. Organizer of the *Workshop on Geometry Driven Diffusion in Image Processing and Computer Vision*, Hewlett-Packard Laboratories, Palo Alto, June 13-14, 1996.
31. Organizer and Chairman of the special session on "Non-linear dynamics in image processing," *Second IEEE-International Conference on Image Processing*, Washington DC, October 22-25, 1995.
32. Member of the Organizing Committee, *Workshop on Mathematical Methods in Computer Vision*, The Geometry Center, University of Minnesota, September 11-15, 1995.
33. Member of Program Committee, *IEEE Workshop on Physics-Based Modeling in Computer Vision*, MIT-Cambridge, June 18-19, 1995.
34. Organizer and Chairman of the special session on "Non-linear dynamics in image processing," *First IEEE-International Conference on Image Processing*, Austin-Texas, November 1994.

## **SAMPLE OF PROFESSIONAL REVIEWING**

1. *SIAM Publications (Books)*
2. *Cambridge University Press (Books)*
3. *National Science Foundation*

4. *Office of Naval Research*
5. *Army Research Office*
6. *National Institute of Health*
7. *IEEE Trans. Signal Processing*
8. *IEEE Trans. Image Processing*
9. *IEEE Trans. Pattern Analysis and Machine Intelligence*
10. *IEEE Trans. Signal Processing*
11. *IEEE Trans. Medical Imaging*
12. *IEEE Signal Processing Letters*
13. *International Journal Computer Vision*
14. *Computer Vision and Image Understanding*
15. *Graphical Models and Image Processing*
16. *Journal of Mathematical Imaging and Vision*
17. *Journal of Visual Communication and Image Representation*
18. *SIAM J. Applied Math*
19. *Journal of Computational Physics*
20. *IEEE International Conference Computer Vision*
21. *Computer Vision and Pattern Recognition Conference*
22. *European Conference Computer Vision*
23. *IEEE International Conference Image Processing*
24. *NIPS*
25. *International Conference Machine Learning*

## **GRADUATE STUDENTS**

### **Graduated**

1. M. Bertalmio, MSc June 1998 (joint with Prof. G. Randall, continued to the PhD Program)
2. H. S. Neoh, MSc April '99 (currently at Altera).
3. B. Tang, MSc July '99 (currently at Motorola Research Labs).
4. D. H. Chung, PhD, '00 (currently at Summus Ltd.).
5. A. Bartesaghi, MSc, '01 (joint with Prof. G. Randall, continued to the PhD Program)
6. G. Gorla, MSc, '01 (joint with Prof. V. Interrante, currently at Nvidia).
7. M. Bertalmio, PhD, '01 (currently Professor at Universidad Pompeu Fabra, Barcelona, Spain)
8. U. Ramamurthy, MSc, '01
9. F. Memoli, MSc, '01 (continued to the PhD Program)
10. S. Rane, MSc, '01 (currently at Mitsubishi Research Labs)
11. R. Joshi, MSc, '03 (currently in industry, India)
12. K. Patwardhan, MSc, '03 (continued to the PhD Program)
13. A. Bartesaghi, PhD, '05 (currently at NIH)
14. L. Yatziv, MSc, '05 (currently at Google)
15. P. Lloyd, MSc, '05 (currently at IBM)
16. F. Memoli, PhD, '05 (currently Professor at Ohio State University)
17. A. Mohan, MSc, '06 (currently at Microsoft)
18. M. Mahmoudi, MSc, '06 (continued to the PhD Program)
19. P. Sprechmann, MSc, '07 (currently in the PhD Program)
20. K. Patwardhan, PhD, '07 (currently at GE Research)
21. P. Arias, MSc '07 (joint with Prof. G. Randall, currently in the PhD Program)

22. I. Aganj, MSc, '08 (continued to the PhD Program)
23. A. Chandran, MSc, '08 (currently in industry)
24. D. Rother, PhD, '08 (currently at Google)
25. X. Bai, PhD, '10 (currently at Adobe)
26. M. Mahmoudi, PhD, '10
27. I. Aganj, PhD, '10 (joint with Prof. C. Lenglet, currently at MIT/MGH)
28. M. Fiori, MSc '11 (joint with Prof. P. Muse, currently in the PhD Program)
29. I. Ramirez, PhD '11 (currently Professor, Universidad de la Republica, Uruguay)
30. F. Lecumberry, PhD '12 (currently Professor, Universidad de la Republica, Uruguay)
31. P. Sprechmann, PhD '12 (currently postdoctoral associate, Duke University)
32. L. Yatziv, PhD '12 (currently at Google)
33. A. Castrodad, PhD '12 (currently at the National Geospatial-Intelligence Agency)
34. J. Hashemi, MSc, May '13 (currently PhD student at Duke University)

### **Current**

1. J. Strup, PhD (joint with Prof. K. Ugurbil, Center for Magnetic Resonance Research)
2. J. Hashemi, PhD
3. K. Jinyoung, PhD (joint with Prof. N. Harel, Center for Magnetic Resonance Research)
4. M. Fiori, PhD (joint with Prof. P. Muse, Uruguay)

## **POST-DOCTORAL ASSOCIATES**

1. Santiago Betelu (currently Associate Professor, University of North Texas).
2. Michael Hofer (currently at Vienna University of Technology).
3. Gloria Haro (currently Assistant Professor, Pompeu Fabra, Barcelona).
4. Leah Bar (currently at Teal Aviv University).
5. Christophe Lenglet (joint with Prof. K. Ugurbil, currently Assistant Professor, Radiology, University of Minnesota)
6. Guoshen Yu (currently in a Hedge Fund, Geneva).
7. Oleg Kuybeda (currently at NIH).
8. Julio M. Duarte-Carvajalino (current).
9. Mariano Tepper (current).
10. Zhongwei Tang (current)
11. P. Sprechmann (current)

## **UNDERGRADUATE RESEARCH ASSISTANTS**

1. Jeremiah Remus, 2001
2. Andy Doucette, 2003
3. T. Do Trung, 2008
4. Flavien Leger, 2010
5. Karl Otness, 2011 (high school student)

## **VISITING RESEARCH ASSISTANTS**

1. Alvaro Pardo (PhD student in Uruguay)
2. Luis Vazquez (PhD student in Uruguay)
3. Andres Sole (PhD student, Pompeu Fabra, Barcelona)
4. Omar Gil (Prof., Department of Mathematics, Uruguay)



5. Carsten Moenning (PhD student, Cambridge University)
6. Julien Mairal (PhD Student in France)
7. Alexis Protiere (PhD student in France)
8. Fernando Rodriguez (MSc student in Spain)
9. Florent Couzinie-Devy (PhD student in France)
10. Gregory Randall (Vice-Rector for Research, University of Uruguay)