

# IGOR YANOVSKY

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## EDUCATION

- Ph.D., *Applied Mathematics*, University of California, Los Angeles** 2008  
Dissertation: Unbiased Nonlinear Image Registration  
Advisor: Stanley Osher, GPA: 3.9
- M.A., *Applied Mathematics*, University of California, Los Angeles** 2002  
GPA: 4.0, Summa Cum Laude
- B.S., *Applied Mathematics*, University of California, Los Angeles** 2002  
GPA: 3.9, Summa Cum Laude, Computing Specialization  
Graduated with College and Departmental Highest Honors

## EMPLOYMENT

- Research Associate** 2005 – 2008  
Advisor: Stanley Osher  
Research: Image registration, segmentation, restoration,  
medical image analysis, surface denoising and reconstruction,  
inverse scale spaces, multiscale methods.
- Teaching Associate** 2006 – 2007  
Classes taught: Software Engineering for Scientific Computation,  
Applied Numerical Methods I and II
- Research Assistant** 2002 – 2003  
Advisor: Stanley Osher  
Research: Level set methods, variational methods,  
compressible and incompressible computational fluid dynamics
- Programmer Analyst** 2000 – 2005  
UCLA Institute for Pure and Applied Mathematics (IPAM)
- Systems Analyst** 1998 – 2000  
UCLA David Geffen School of Medicine

## INTERNSHIPS

- National Science Foundation (NSF) VIGRE internship 06-09, 2007
- Developed software solutions for image registration applications
  - Mentor: Paul Thompson
- National Science Foundation (NSF) and National Institutes of Health (NIH) funded internship 06-09, 2005
- Developed software solutions for image segmentation applications
  - Mentor: Ivo Dinov

## RESEARCH EXPERIENCE

- Image Processing and Computer Vision
- Medical Image Analysis
- Variational Methods, Level Set Methods
- Computational Fluid Dynamics
- Scientific Computing

## REFEREED PUBLICATIONS

- Igor Yanovsky, Stanley Osher, Paul Thompson, Alex Leow, *Log-Unbiased Large-Deformation Image Registration*, Computer Vision Theory and Applications, vol. 1, pp. 272-279, March 2007.
- Igor Yanovsky, Ming Chiang, Paul Thompson, Andrea Klunder, James Becker, Simon Davis, Arthur Toga, Alex Leow, *Quantifying Deformation Using Information Theory: The Log-Unbiased Nonlinear Registration*, IEEE International Symposium on Biomedical Imaging, pp. 13-16, April 2007.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Alex Leow, *Topology Preserving Log-Unbiased Nonlinear Image Registration: Theory and Implementation*, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp. 1-8, June 2007.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Luminita Vese, Alex Leow, *Multiphase Segmentation of Deformation using Logarithmic Priors*, IEEE Computer Society Workshop on Image Registration and Fusion, pp. 1-6, June 2007.
- Alex Leow, Igor Yanovsky, Ming Chiang, Agatha Lee, Andrea Klunder, Allen Lu, James Becker, Simon Davis, Arthur Toga, Paul Thompson, *Statistical Properties of Jacobian Maps and the Realization of Unbiased Large-Deformation Nonlinear Image Registration*, IEEE Transactions on Medical Imaging, vol. 26, no. 6, pp. 822-832, 2007.
- Igor Yanovsky, Paul Thompson, Andrea Klunder, Arthur Toga, Alex Leow, *Local Volume Change Maps in Nonrigid Registration: When Are Computed Changes Real?*, International Conference on Medical Image Computing and Computer Assisted Intervention, Workshop on Statistical Registration, November 2007.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Alex Leow, *Multimodal Unbiased Image Matching via Mutual Information*, Computational Imaging VI, IS&T/SPIE Electronic Imaging, Vol. 6814, January 2008.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Xue Hua, David Shattuck, Arthur Toga, Alex Leow, *Validating Unbiased Registration on Longitudinal MRI Scans from the ADNI*, IEEE International Symposium on Biomedical Imaging, pp. 1091-1094, May 2008.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Alex Leow, *Asymmetric and Symmetric Unbiased Image Registration: Statistical Assessment of Performance*, Mathematical Methods in Biomedical Image Analysis, 2008.
- Igor Yanovsky, Carole Le Guyader, Alex Leow, Paul Thompson, Luminita Vese, *Unbiased Volumetric Registration via Nonlinear Elastic Regularization*, submitted for publication, 2008.
- Jian Ye, Igor Yanovsky, Bin Dong, Rima Gandlin, Achi Brandt, Stanley Osher, *Multigrid Narrow Band Surface Reconstruction via Level Set Functions*, to be submitted for publication, 2008.

## TECHNICAL REPORTS

- Igor Yanovsky and Alex Leow, *An Information Theory Approach to Nonlinear Image Registration*, UCLA Computational and Applied Mathematics Report 06-64, 2006.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Alex Leow, *Large Deformation Unbiased Diffeomorphic Nonlinear Image Registration: Theory and Implementation*, UCLA Computational and Applied Mathematics Report 06-71, 2006.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Luminita Vese, Alex Leow, *Multiphase Segmentation of Deformation using Logarithmic Priors*, UCLA Computational and Applied Mathematics Report 07-05, 2007.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Alex Leow, *Asymmetric and Symmetric Unbiased Image Registration: Statistical Assessment of Performance*, UCLA Computational and Applied Mathematics Report 07-49, 2007.
- Igor Yanovsky, Carole Le Guyader, Alex Leow, Paul Thompson, Luminita Vese, *Unbiased Volumetric Registration via Nonlinear Elastic Regularization*, UCLA Computational and Applied Mathematics Report 08-27, 2008.
- Igor Yanovsky, *Unbiased Nonlinear Image Registration*, Ph.D. Dissertation, University of California, Los Angeles, May 2008.

## INVITED PRESENTATIONS

- Tutorial on Image Registration and Fusion, IEEE Conference on Computer Vision and Pattern Recognition, Anchorage, Alaska, June 24-26, 2008.
- IS&T/SPIE 20<sup>th</sup> Annual Symposium on Electronic Imaging, *Multimodal Unbiased Image Matching via Mutual Information*, San Jose, California, January 27-31, 2008.
- International Conference on Medical Image Computing and Computer Assisted Intervention, Workshop on Statistical Registration: Pair-wise and Group-wise Alignment and Atlas Formation, *Local Volume Change Maps in Nonrigid Registration*, Brisbane, Australia, November 2, 2007.
- IEEE Computer Society Workshop on Image Registration and Fusion, *Multiphase Segmentation of Deformation using Logarithmic Priors*, Minneapolis, Minnesota, June 23, 2007.
- IEEE Conference on Computer Vision and Pattern Recognition (CVPR), *Topology Preserving Log-Unbiased Nonlinear Image Registration: Theory and Implementation*, Minneapolis, Minnesota, June 18-21, 2007.
- IEEE International Symposium on Biomedical Imaging (ISBI), *Quantifying Deformation Using Information Theory: The Log-Unbiased Nonlinear Registration*, Washington D.C., April 12-15, 2007.
- International Conference on Computer Vision Theory and Applications (VISAPP), *Log-Unbiased Large-Deformation Image Registration*, Barcelona, Spain, March 8-11, 2007.
- Statistical Programming, Computation and Visualization, Statistics Department, UCLA, *Total Variation Image Restoration and Mumford-Shah Image Segmentation*, March, 2004.
- Seminar on Nonlinear Partial Differential Equations with application to Fluid Dynamics and Image Processing, Mathematics Department, UCLA, *Image Segmentation with Active Contours without Edges*, February, 2004.

## ABSTRACTS and POSTERS

- Igor Yanovsky, Luminita Vese, Carole Le Guyader, Alex Leow, Stanley Osher, Paul Thompson, *Unbiased Nonlinear Registration via Nonlinear Elastic and Viscous Fluid Regularizations*, Institute for Pure and Applied Mathematics (IPAM) Conference on Numerics and Dynamics of Optimal Transport, Los Angeles, California, April, 2008.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Alex Leow, *Unbiased Nonlinear Registration Methods: Statistical and Calibration Assessment of Performance*, NSF VIGRE Research, University of California, Los Angeles, September, 2007.
- Igor Yanovsky, Paul Thompson, Stanley Osher, Luminita Vese, Alex Leow, *Topology Preserving Diffeomorphic Image Registration and its Application to Tracking of Deforming Shapes*, NSF/IPAM Conference on Image Processing for Random Shapes: Applications to Brain Mapping, Geophysics and Astrophysics, Los Angeles, California, May, 2007.
- Alexandre Cunha, Igor Yanovsky, Ginmo Chung, Yonggang Shi, Stanley Osher, Luminita Vese, Alex Leow, Ivo Dinov, Paul Thompson, Arthur Toga, *The Variational Brain*, SIAM Conference on Computational Science & Engineering, Costa Mesa, California, February, 2007.
- Igor Yanovsky, Luminita Vese, Stanley Osher, Ivo Dinov, *Multiphase Segmentation of Volumetric MRI Images*, NSF VIGRE Research, University of California, Los Angeles, September, 2005.

## PRINTED HANDBOOKS:

- Igor Yanovsky, *Ordinary Differential Equations: Graduate Level Problems and Solutions*, pp. 1-128, 2005, [www.math.ucla.edu/~yanovsky/handbooks/](http://www.math.ucla.edu/~yanovsky/handbooks/).
- Igor Yanovsky, *Partial Differential Equations: Graduate Level Problems and Solutions*, pp. 1-396, 2005.
- Igor Yanovsky, *Real Analysis and Multivariable Calculus: Graduate Level Problems and Solutions*, pp. 1-46, 2005.
- Igor Yanovsky, *Linear Algebra: Graduate Level Problems and Solutions*, pp. 1-36, 2005.

## SOFTWARE DEVELOPED

The tools below were developed for the Center for Computational Biology (CCB) through the National Institutes of Health (NIH) Roadmap for Medical Research.

- ***Unbiased Large Deformation Image Registration.*** Author: Igor Yanovsky.  
Description: We have introduced a novel framework for constructing large deformation log-unbiased image registration models that generate theoretically and intuitively correct deformation maps. The software package incorporates these ideas into a toolkit, which is useful for brain anatomists when recovering voxel-wise maps of local tissue change.
- ***Viscous Fluid Image Matching.*** Author: Igor Yanovsky.  
Description: The software package is designed to match two images, such as two serial MRI volumes, using the viscous fluid image matching model.
- ***Multiphase Level Set Based Segmentation.*** Author: Igor Yanovsky.  
Description: This package includes the implementations of active contours without edges level set based segmentation models. These are based on the Chan-Vese version of the Mumford-Shah functional. The software package is designed to segment two and three-dimensional images. In particular, three-dimensional MRI brain images are classified into white matter, gray matter, and CSF regions.
- ***Inverse Total Variation Denoising.*** Author: Igor Yanovsky.  
Description: This image denoising software package includes implementations of total variation (TV),  $L^1$  and  $L^2$  - based denoising and corresponding inverse denoising models. The software package is useful in the medical imaging field as the data obtained by the MRI scanners is often noisy.
- ***Surface Denoising with Inverse Curvature Flow.*** Author: Igor Yanovsky.  
Description: We have extended the inverse scale space method for image restoration to surfaces in three dimensions. Surface denoiser restores the surfaces using the inverse TV- $L^1$  and inverse TV- $L^2$  flows. In particular, noisy surfaces of brain regions are enhanced for further analysis.
- ***Multigrid Narrow Band Surface Reconstruction.*** Authors: Jian Ye and Igor Yanovsky.  
Description: This software package implements our proposed algorithm and is used to reconstruct surfaces from unorganized data points or noisy point clouds.

## MENTORING ACTIVITIES

- Assisted four undergraduate students in a computer vision research project 06-09, 2007
- Advised three undergraduate students in medical imaging research projects 06-09, 2005

## COMPUTER SKILLS

- Programming languages: C/C++, JAVA, Fortran
- Programming environments: MS Visual Studio, MS Foundation Classes (MFC), Eclipse, QT
- Inter-language and cross-platform programming
- Image processing, visualization and graphics: Open GL, DirectX, POV-Ray, Java Native Interface
- Mathematical software: Matlab, Maple, Mathematica, LaTeX
- Operating systems: Windows, Linux, Unix, Mac

## CERTIFICATIONS

- Microsoft Certified Systems Engineer 2000
- Microsoft Certified Professional 1999

## RECENT AWARDS AND HONORS

- Paper "Quantifying Deformation Using Information Theory: The Log-Unbiased Nonlinear Registration" selected among best papers at IEEE International Symposium on Biomedical Imaging 2007
- IEEE/NIH travel grant award 2007
- IEEE Pattern Recognition and Machine Intelligence travel grant 2007
- National Institutes of Health (NIH) Grant 2005-2007
- National Science Foundation (NSF) Grant 2005
- Regents Registration Fee Grant, UCLA 2002-2007
- First place on the Animation contest, Computer Graphics, UCLA 2003
- Dean's Honors List, UCLA 1997-2002
- Provost's Honors List, UCLA 1997-2002
- Daus Award in Mathematics, UCLA 2002

- Departmental Honors Program in Mathematics, UCLA 1998-2000
- UCLA College Honors graduate 1996-2000

### **PROFESSIONAL ACTIVITIES**

- Wrote grant proposals for research funding
- Served as Journal Reviewer for IEEE Transactions on Pattern Recognition and Machine Intelligence (PAMI)
- Membership: IEEE, AMS, SPIE

### **PERSONAL**

U.S. Citizen