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Lilla Zöllei

Education

2001-2006 Massachusetts Institute of Technology Cambridge, MA

Ph.D., Electrical Engineering and Computer Science

Thesis: Unified Information Theoretic Framework for Pair- and Group-wise Registration of Medical Images

Advisors: Prof E. Grimson, Prof W.M. Wells

1999-2001 Massachusetts Institute of Technology Cambridge, MA

MS., Electrical Engineering and Computer Science

Thesis: 2D-3D Rigid-Body Registration of X-Ray Fluoroscopy and CT Images

Advisors: Prof E. Grimson, Prof W.M. Wells

1995-1999 Mount Holyoke College South Hadley, MA

BA., Computer Science and Mathematics (**summa cum laude**)

Thesis: Place Recognition Using Color Region Analysis

Advisor: Prof C. Fennema

Work and Research Experience

2014–present Massachusetts General Hospital Charlestown, MA

Assistant Professor in Radiology and Assistant in Neuroscience: Designing algorithmic tools to analyze in-vivo and ex-vivo MRI acquisitions of the developing infant brain (spatial correspondence, automatic segmentation) and analyzing diffusion weighted images.

2010–2013 Massachusetts General Hospital Charlestown, MA

Instructor in Radiology and Assistant in Neuroscience: Designing algorithmic tools to analyze MRI acquisitions of the developing infant brain (spatial correspondence, automatic segmentation) and analyzing diffusion weighted images.

2006–2010 Massachusetts General Hospital Charlestown, MA

Research Fellow: Finding mathematical correspondence between various types of MRI acquisitions of the brain; statistical comparison of control and diseased groups.

2005–2006 Ecole Centrale de Paris Paris, France

Postdoctoral Researcher and Lecturer: Analyzed Diffusion Tensor MRI images of skeletal muscle.

Designed and taught introductory image processing class (Image Processing: Basics, Challenges and Perspectives)

1999–2005 Massachusetts Institute of Technology Cambridge, MA

Research and Teaching Assistant: Investigated 2D/3D and 3D/3D correspondence of MRI, CT and fluoroscopy images. Lectured and assisted in the graduate level biomedical image processing class (Biomedical Signal and Image Processing).

Summer 2002 Project Odyssee, INRIA Sophia Antipolis, France

Visiting Researcher: Identified effects of physiological noise in functional MRI.

Summer 2000 Visualization Technology, Inc Lawrence, MA
Software Consultant: Integrated a 3D-3D CT-MRI rigid body alignment algorithm into a commercial software package.

Summer 1999 Small Business Group, Microsoft, Co Redmond, WA
Software Design Engineer: Designed and tested modules for initiating outgoing and monitoring incoming phone calls in Outlook.

Summer 1998 GTE Laboratories Waltham, MA
Software Developer: Helped designing a Web-based telecommunications ordering system.

Grants / funding

Age-Dependent Analysis Techniques for Pediatric Structural and Diffusion MRI Data (NIH Pathway to Independence (PI) Award (5K99HD61485-2 / R00 HD061485-03)); July 1, 2010 - present; Role: PI

mi2b2 Enabled Pediatric Radiological Decision Support (1 R01 EB014947-01); Oct 1, 2012 - present; Role: personnel

Software Tools for Automated Modeling of White Matter Fascicles from Diffusion MR (1R01NS070963-01A1); April 1, 2011 - present; Role: personnel;

Publications

(Peer-reviewed Journal Papers)

K. de Macedo Rodrigues, E. Ben-Avi, D.D. Sliva, M. Choe, M. Drottar, R. Wang, B. Fischl, P.E. Grant, **L. Zöllei** (2015) A FreeSurfer-compliant consistent manual segmentation of infant brains spanning the 0–2 year age range. Front. Hum. Neurosci. 9:21. doi: 10.3389/fnhum.2015.00021 PMID: 25741260 PMCID: PMC4332305

J.A. Miller*, S. Ding* at al., Transcriptional Landscape of the Prenatal Human Brain, Nature 508, 199–206, (10th April 2014); PMCID: PMC4105188

J. Kolasinski+, E. Takahashi+, A. Stevens, T. Benner, B. Fischl, **L. Zöllei***, P.E. Grant*: Radial and Tangential Neuronal Migration Pathways in the Human Fetal Brain: Anatomically Distinct Patterns of Diffusion MRI Coherence, NeuroImage 2013 Oct;79:412-22 (+/* joint first / last authors); PMID: 23672769

A. Yendiki, P. Panneck, P. Srinivasan, A. Stevens, **L. Zöllei**, J. Augustinack, R. Wang, D. Salat, S. Ehrlich, T. Behrens, S. Jbabdi, R. Gollub, B. Fischl: Automated probabilistic reconstruction of white-matter pathways in health and disease using an atlas of the underlying anatomy, Frontiers in Neuroinformatics, 2011; PMID: 22016733; PMCID: PMC3193073

B.T. Yeo, F.M. Krienen, J. Sepulcre, M.R. Sabuncu, D. Lashkari, M. Hollinshead, J.L. Roffman, J.W. Smoller, **L. Zöllei**, J.R. Polimeni, B. Fischl, H. Liu, R.L. Buckner: The organization of the human cerebral cortex estimated by intrinsic functional connectivity, Journal of Neurophysiology, 2011;106(3):1125-65; PMID: 21653723; PMCID: PMC3174820

L. Zöllei, A. Stevens, K. Huber, S. Kakunoori, B. Fischl: Improved Tractography Alignment Using Combined Volumetric and Surface Registration, NeuroImage 51 (2010), 206-213; PMID: 20153833; PMCID: PMC2847021

R.E. Propper, L. O'Donnell, S. Whalen, Y. Tie, I.H. Norton, R.O. Suarez, **L. Zöllei**, A. Radmanesh, A.J. Golby: A Combined FMRI and DTI Examination of Functional Language Lateralization and Arcuate Fasciculus Structure: Effects of Degree versus Direction of Hand Preference; Brain and Cognition 2010 Jul;73(2):85-92; PMID: 20378231; PMCID: PMC2880216

P. Tu, R.L. Buckner, **L. Zöllei**, K.A. Dyckman, D.C. Goff, D.S. Manoach: Reduced functional connectivity in a right-hemisphere network for volitional ocular motor control in schizophrenia, Brain, 2010 Feb;133(Pt 2):625-37; PMID: 20159769; PMCID: PMC2858012

J.C. Augustinack, K. Helmer, K.E. Huber, S. Kakunoori, **L. Zöllei**, B. Fischl: Direct visualization of the perforant pathway in the human brain with ex vivo diffusion tensor imaging, Frontiers in Human Neuroscience, 2010, 4:42; PMID: 20577631; PMCID: PMC2889718

G.M. Postelnicu*, **L. Zöllei***, B. Fischl: Combined Volumetric and Surface Registration, IEEE Transactions on Medical Imaging, Vol 28 (4), April 2009, p. 508-522 (*joint first author); PMID: 19273000; PMCID: PMC2761957

A. Mewes, **L. Zöllei**, P. Hüppi, H. Als, G. McAnulty, T.E. Inder, W. M. Wells, S.K. Warfield: Displacement of Brain Regions in Preterm Infants with Non-Synostotic Dolichocephaly Investigated by MRI, NeuroImage 36 (2007) pp. 1074-1085; PMID: 17513129; PMCID: PMC3358776

A. Yezzi, **L. Zöllei**, T. Kapur: A Variational Framework for Integrating Segmentation and Registration Through Active Contours, Medical Image Analysis, Volume 7, Issue 2, June 2003, pp. 171-185; PMID: 12868620

Publications

(Peer-reviewed Conferences

E. Schwartz, A. Jakab, **L. Zöllei**, and G. Langs: A Locally Linear Method for Enforcing Temporal Smoothness in Serial Image Registration, Spatiotemporal Image Analysis for Longitudinal and Time-Series Image Data, MICCAI 2014

M. Toews, **L. Zöllei**, W. Wells: Feature-based Alignment of Volumetric Multi-modal Images, Information Processing in Medical Imaging (IPMI) 2013, LNCS 7917, 2013, pp 25-36

M. Toews, W.M. Wells, **L. Zöllei**: A Feature-based Developmental Model of the Infant Brain in Structural MRI, MICCAI 2012, 204-211; PMID: 23286050

L. Zöllei, A. Petrović: Probabilistic Diffusion Tractography-based Parcellation of the Human Infant Thalamus, MICCAI 2012, Workshop on Perinatal and Paediatric Imaging (PaPI), Nice, France

A. Petrović, **L. Zöllei**: Evaluating Volumetric Brain Registration Performance Using Structural Connectivity Information, MICCAI 2011, 524-531; PMID: 21995069 NIHMSID: 495968; PMCID: PMC3743551

A. Yendiki, A. Stevens, J. Augustinack, D.H. Salat, **L. Zöllei**, B. Fischl: Anatomical Priors for Global Probabilistic Diffusion Tractography; ISBI 2009: 630-633

L. Zöllei, W. Wells: On the Optimality of Mutual Information as an Image Registration Objective Function, International Conference of IEEE International Conference on Image Processing, Cairo, Egypt, November 2009

M. Maddah, **L. Zöllei**, W.E.L. Grimson, C.F. Westin, W.M. Wells III: A Mathematical Framework for Incorporating Anatomical Knowledge in DT-MRI Analysis, International Symposium on Biomedical Imaging (ISBI): From Nano to Macro, May 2008, Paris, France; PMID: 19212449; PMCID: PMC2638065

M. Maddah, **L. Zöllei**, W.E.L. Grimson, W.M. Wells III: Modeling of Anatomical Information in Clustering of White Matter Fiber Trajectories Using Dirichlet Distribution, Mathematical Methods in Biomedical Image Analysis (MMBIA), June 2008, Anchorage, Alaska; PMID: 21625356; PMCID: PMC3101585

L. Zöllei, M. Jenksinon, S. Timoner, W.M. Wells III: A Marginalized MAP Approach and EM Optimization for Pair-wise Registration, Information Processing in Medical Imaging (IPMI) 2007, LNCS 4584, pp. 662-674; PMID: 17633738; PMCID: PMC3681203

G. Postelnicu, **L. Zöllei**, R. Desikan, B. Fischl: Geometry Driven Volumetric Registration; Information Processing in Medical Imaging (IPMI) 2007;20:675-86; PMID: 17633739

L. Zöllei, M. Shenton, W.M. Wells III, K. Pohl: The Impact of Atlas Formation Methods on Atlas-Guided Brain Segmentation, Statistical Registration: Pair-wise and Group-wise Alignment and Atlas Formation workshop at MICCAI 2007, Brisbane, Australia, Nov 2007

L. Zöllei, W.M. Wells III: Multi-modal Image Registration Using Dirichlet-encoded Prior Information, WBIR 2006.

L. Zöllei, E. Learned-Miller, E. Grimson, W.M. Wells III: Efficient Population Registration of 3D Data, (Best Paper Award) Computer Vision for Biomedical Image Applications, ICCV 2005.

L. Zöllei, L.P. Panych, W.E.L. Grimson, W.M. Wells III: Exploratory Identification of Cardiac Noise in fMRI Images; Int Conf Med Image Comput Comput Assist Interv. 2003;6(Pt 1):475-483.

L. Zöllei, J. Fisher, W.M. Wells III: A Unified Statistical and Information Theoretic Framework for Multimodal Image Registration, Information Processing in Medical Imaging (IPMI) 2003, LNCS 2732, pp. 366-377; PMID: 15344472

L. Zöllei, E. Grimson, A. Norbash, W. Wells: 2D-3D Rigid Registration of X-Ray Fluoroscopy and CT Images Using Mutual Information and Sparsely Sampled Histogram Estimators, IEEE CVPR, 2001.

A. Yezzi, **L. Zöllei**, T. Kapur: A Variational Framework for Joint Segmentation and Registration; Proc Workshop Math Methods Biomed Image Analysis. 2001;

Publications

(Non-peer-reviewed Conferences)

M. Alegro, E. Alho, R. de Deus Lopes, **L. Zöllei**, E. Amaro Jr: A Computational Pipeline for Full Brain Histology to MRI Registration, HBM 2015

Y. Ou, C. Jaimes, R. Gollub, K. Retzepis, S. Bates, S. Murphy, P.E. Grant, **L. Zöllei**: Neonatal Brain Injury Detection in MRI: An Atlas-based Fully Automatic Approach, HBM 2015

C. Jaimes, H. Cheng, J. Newburger, J. Soul, Y. Rathi, B. Gagoski, P.E. Grant, **L. Zöllei**: Probabilistic Tractography-based Thalamic Parcellation in Neonates with Congenital Heart Disease, HBM 2015

C. Jaimes, Y. Ou, J. Shih, S. Bates, D. O'Reilly, J. Soul, R. Gollub, P. Grant, **L. Zöllei**: Apparent

Diffusion Coefficient Z-score Maps Compared to Normative Atlas in Neonatal Hypoxic Ischemic Encephalopathy, ASNR 2015

K. Retzepis, Y. Ou, **L. Zöllei**, N. Reynolds, V. Castro, S. Pieper, S.N. Murphy, P.E. Grant, R.L. Gollub: Using clinical images to study the evolution of mean ADC values and brain volume of healthy pediatric subjects, SFN 2014

Y. Ou, K. Andriole, R. Gollub, E.P. Grant, C. Herrick, S. Murphy, R. Pienaar, S. Pieper, N. Reynolds, D. Sack, Y. Wang, T. Wang, **L. Zöllei**: Developmental Brain ADC Atlas Creation from Clinical Images, HBM 2014

K. de Macedo Rodrigues, E. Ben-Avi, M. Choe, M. Drottar, P. E. Grant, **L. Zöllei**: Feasibility of Neonatal Thalamic Parcellation Based on Probabilistic Neocortical Connections, ASNR 2013

K. de Macedo Rodrigues, E. Ben-Avi, M. Choe, M. Drottar, P. E. Grant, **L. Zöllei**: Thalamic Parcellation based on Probabilistic Neocortical Connections in a Neonatal Population, ISMRM 2013

K. de Macedo Rodrigues, P.E. Grant, **L. Zöllei**: The Impact of Maximum Turning Angle in Different Deterministic Tractography Algorithms Applied in Pediatric Populations, ISMRM 2012

R. Gollub, V. Roch, E.P. Grant, R. Pienaar, **L. Zöllei**, Y. Wang, D. Sack, K. Andriole, J. Wei, W. Tellier, D. Marcus, S. Pieper, C. Herrick, S. Murphy: Developmental Brain ADC Atlas Creation from Clinical Images, Human Brain Mapping 2011

L. Zöllei, B. Fischl: Automatic Segmentation of Ex-vivo MRI Images using CVS in FreeSurfer; Human Brain Mapping, 2011

L. Zöllei, A. Stevens, K. Huber, S. Kakunoori, B. Fischl: Improved Tractography Alignment Using Combined Volumetric and Surface Registration, Human Brain Mapping, June 2010

L. Zöllei, A. Stevens, B. Fischl: Non-linear registration of intra-subject ex-vivo and in-vivo brain acquisitions, Human Brain Mapping, June 2010

L. Zöllei, A. Stevens, K. Huber, S. Kakunoori, B. Fischl: Difusion Weighted Information Used in a Combined Volumetric and Surface-based Brain Registration Framework; Human Brain Mapping, June 2009

L. Zöllei, C.L. Fennema, Jr.: Place recognition using color region analysis; Proc. SPIE 3837, Intelligent Robots and Computer Vision XVIII: Algorithms, Techniques, and Active Vision, 175 (August 26, 1999);

Publications

(Books and Chapters)

J.C. Gee, S.C. Joshi, K.M. Pohl, W.M. Wells III, **L. Zöllei** (Eds.): Information Processing in Medical Imaging - 23rd International Conference, IPMI 2013, Asilomar, CA, USA, June 28-July 3, 2013. Proceedings. Lecture Notes in Computer Science 7917, Springer 2013, ISBN 978-3-642-38867-5

L. Zöllei, J.W. Fisher III, W.M. Wells III: An Introduction to Statistical Methods of Medical Image Registration; Mathematical Models in Computer Vision: The Handbook, Springer 2005

Publications

(Theses)

L. Zöllei: A Unified Information Theoretic Framework for Pair- and Group-wise Registration of Medical Images; Ph.D. Thesis, MIT, 2006.

L. Zöllei: 2D-3D Rigid-Body Registration of X-Ray Fluoroscopy and CT Images; Master's Thesis, MIT, 2001.

Publications

(Others)

L. Zöllei, J. Fisher, W.M. Wells III: A Unified Statistical and Information Theoretic Framework for Multi-modal Image Registration; AI Memo #AIM-2004-011

Invited talks

Ex-vivo and In-vivo Image Registration using Combined Volumetric and Surface-based Registration; Preliminary FreeSurfer Processing Tools for Infant Brain MRI Analysis; Optical Coherence Tomography: an Update; Universite Francois Rabelais de Tours, Tours, France; July 2013

Preliminary FreeSurfer Processing Tools for Infant Brain MRI Analysis, Universite de Geneve, Geneva, Switzerland; August 2013

VU University Medical Center, Amsterdam, The Netherlands, FreeSurfer Course (27-29 June 2012)

Auckland, New Zealand, FSL/FreeSurfer Course (14-18 May 2012)

Robust and Accurate Registration of Structural MRI Images, Ex-vivo to In-vivo Acquisitions and Diffusion Tractography; Advanced Tools / Future Research Directions using Freesurfer; Madrid - MIT M+Vision Consortium Mini Courses; Alzheimer Center, Madrid, Spain; July 6, 2012

Registration: Practice, Sunrise Educational Course, Image Analysis, ISMRM 2011, May 6-13, 2011

Medical Image Processing in Pediatric and Ex-vivo vs In-vivo Brain MRI, M+Vision Open House, Oct 12, 2011

Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo, Brazil; Freesurfer Workshop, (April 16-18, 2011)

Histology and Ex-vivo Registration, First Monday Seminar, Brigham and Women's Hospital, Boston, MA, Feb 7, 2011

Robust and Accurate Registration of Structural MRI Images, Ex-vivo to In-vivo Acquisitions and Diffusion Tractography; 8th Conference of the Hungarian Association for Image Processing and Pattern Recognition; Szeged, Hungary, Jan 25-28, 2011

Lecturer, Robust and Accurate Alignment of Structural MRI Images and Diffusion Tractography; IEEE EMBS 8th International Summer School on Biomedical Imaging; Berder, France, (June 18-26, 2010)

Advance Neuroimaging Techniques, Boston, MA, Probabilistic Tractography (October 19-20, 2009)

Hospital das Clinicas da Faculdade de Medicina da Universidade de Sao Paulo, Brazil; Freesurfer Workshop, (March 11-12, 2009)

Section of Biomedical Image Analysis, University of Pennsylvania, Combined Volumetric and Surface Registration (January 5, 2009)

Max Planck Institute for Human Development, Berlin, Germany; Freesurfer Workshop, (Aug 4-8, 2008)

Sackler Summer Institute, Cornell University, Ithaca, NY; Neuroanatomical Image Analysis, (June 23, 2008)

Center for Biomedical Imaging, University Hospitals of Geneva, Geneva, Switzerland; Combined Cortical and Subcortical Spatial Normalization and Tractography Clustering, (March 7, 2008)

FMRIB, University of Oxford, Oxford, UK; Combined Volumetric and Surface Registration, (March 4, 2008)

Computer Science and Artificial Intelligence Laboratory, MIT; Combined Volumetric and Surface Registration; (December 7, 2007)

Department of Electrical and Computer Engineering, University of Iowa; Efficient Group-wise Registration of Volumetric Data Sets, (January 21, 2007)

EPFL, Lausanne, Switzerland; Efficient Population Registration of 3D Data, (May 1, 2006).

Service Hospitalier Frederic Joliot, Orsay, France; Group-wise Registration of Medical Image Volumes, (December 19, 2005)

Stochastic Systems Group, CSAIL, MIT; A Unified Information Theoretic Framework for Pair- and Group-wise Registration of Medical Images, *(Nov 16, 2005)*

Image Processing and Analysis Group, Yale University; Efficient Population Registration of 3D Data; (June 20, 2005)

Siemens Corporate Research, Princeton, NJ; Efficient Population Registration of 3D Data; (Aug 2, 2005)

Medical University of Szeged, Oncology Department, Szeged, Hungary; Medical Image Registration in Practice; (Aug 4, 2004)

Scientific Service

Reviewer: IEEE Transactions on Medical Imaging, NeuroImage, IEEE Transactions Service on Image Processing, IEEE Transactions on Biomedical Engineering, Pattern Recognition Letters, Computer Vision and Image Understanding, International Conference on Pattern Recognition, European Conference on Computer Vision and Computer Vision and Pattern Recognition.

Organizing Committee, Information Processing in Medical Imaging (IPMI) 2013, June 29 - July 3, 2013; Asilomar, CA, USA

Co-organizer of " Perinatal and Paediatric Imaging" at *MICCAI 2012* with Profs M. Murgasova, F. Rousseau, D. Rueckert, J. Schnabel, C. Studholme, G. Gerig (Oct 1, 2012).

Co-organizer of "Image Analysis for the Human Brain Development" at *MICCAI 2011* with Profs Colin Studholme, Piotr Habas, Francois Rousseau and Sandy Wells (Sept 22, 2011).

Co-organizer, lecturer: FreeSurfer Tutorial and Workshop (approx 40-60 people per event, 4-5 events per year), 2006-present, (*http://surfer.nmr.mgh.harvard.edu/fswiki/FreeSurferWiki*)

Co-organizer, host, lecturer: Why & How Seminar Series (2008-10), Martinos Center, MGH

Co-host: Workshop on Statistical Registration: Pair-wise and Group-wise Alignment and Atlas Formation, MICCAI 2007, Brisbane, Australia (> 90 participants) (*http://www.nmr.mgh.harvard.edu/martinos/training/nonlocal/miccai07-workshop/*)

Co-organizer and host: MIT AI Student Seminar (2001-02), MIT CSAIL Student Seminar (2003-

04)

Computer Skills and Languages

C/C++, Matlab, HTML, Perl

Operating systems: Linux, Unix, Windows, Macintosh

Hungarian (fluent), English (fluent), French (fluent), Spanish (intermediate)

Mentorship

Post-doctoral students: Yangming Ou

Clinical fellows: Elmar Grosskurth, MD; Katyucia Macedo Rodrigues, MD; Camilo E. Jaimes Cobos, M.D; Luiz Fernando Ferraz da Silva, MD

Research Assistants: Emma Ben-Avi

PhD Students: Aleksandar Petrovic (Oxford University; Siemens), Ahmed Serag (Oxford University), James Kolasinski (Oxford University; Harvard University), Priya Lakhsmi (University of Cape Town), Maryana Alegro (University of Sao Paolo), Barthelemy Serres (University of Tours), Ernst Schwartz (Medical University of Vienna)

MS students: Vincent Roch (EPFL), Ernie Fok (Harvard Graduate School of Education)

Interns / summer students / volunteers: Dan Turtel (college sophomore), Nicole Santos (high school senior), Klea Kalionzes (MS students), Diana Teremzawi (college sophomore), Jessica Owen (high school student)

References

Available upon request.