Matthew Toews
Curriculum Vitae – March, 2014

Brigham and Women's Hospital
Harvard Medical School
75 Francis Street
Boston, MA, USA, 02115

mt@bwh.harvard.edu
Phone: 617-732-6536/514-489-6059
Fax: 617-732-7963
www.matthewtoews.com

Education

2003-2008	PhD, Electrical and Computer Engineering, McGill University.
2001-2003	M. Eng, Electrical and Computer Engineering, McGill University.
1995-2000	B. Eng, Electrical Engineering, University of British Columbia.

Work Experience

2009-Present	Postdoctoral Research Fellow, Brigham and Women's Hospital, Harvard Medical School. Developed algorithms for 3D biomedical image analysis and image-guided neurosurgery.
2004-2008	Tutorial Assistant, McGill University, Montreal, Canada. Presented theory, problem sets and solutions for undergraduate and graduate courses in electrical engineering.
2000-2012	Computer Vision Consultant, Vancouver/Montreal, Canada. Developed algorithms and software for image segmentation, compression, detection and graphics applications.
1999-2000	Computer Vision Engineer, Point Grey Research, Vancouver, Canada. Developed software for a stereo camera system: stereo vision, object tracking, image rectification, device drivers.
1998	GPS Software Developer, Leica Geosystems, Herbrugg, Switzerland. Developed a GPS data processing application within an engineering team.
1997-1998	Image Compression Engineer, Toshiba, Kawasaki, Japan. Developed an MPEG1 video compression CODEC, ported the code to firmware.
1996	Fax Imaging Software Developer. Spittin' Image Software, Vancouver, Canada. Tested, Debugged and developed fax print driver software.

Awards and Distinctions

2010	Outstanding Reviewer Award, Asian Conference on Computer Vision (ACCV 2010)
2009	MICCAI Travel Award, $600
2008-2010	NSERC Postdoctoral Fellowship Award, $40,000/year
2004-2006	NSERC Post Graduate Doctoral Scholarship Award, McGill, $21,000/year
2003	Dean's Honor List, Master's Thesis, McGill University
1999-2000	NSERC Undergraduate Student Research Award, UBC, $9,000
1995-2000	Charles and Jane Banks Entrance Scholarship, UBC, $6,000
1999-2000	Undergraduate Scholar Program Scholarship, UBC, $2,500

Research Publications

Refereed Journals

[1] Modeling and Aligning Volumetric Images using 3D Scale-Invariant Features.
M. Toews and William M. Wells III. Medical Image Analysis, Vol. 17(3), 2013, pp. 271-282.
Impact Factor: **4.087**

[2] Feature-Based Morphometry: Discovering Group-related Anatomical Patterns.
M. Toews, William M. Wells III, D. Louis Collins and T. Arbel. NeuroImage, Vol. 49(3), pp. 2318-2327, 2010. ***Impact Factor:*** **6.252**

[3] Detection, Localization and Sex Classification of Faces from Arbitrary Viewpoints and Under Occlusion.
M. Toews and T. Arbel. IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 31(9), pp. 1567-1581, 2009. ***Impact Factor:*** **4.795**

[4] A Statistical Parts-based Appearance Model of Anatomical Variability.
M. Toews and T. Arbel. IEEE Transactions on Medical Imaging, Special Issue on Computational Neuroanatomy, Vol. 26(4), pp. 497-508, 2007. ***Impact Factor:*** **4.027**

Book Chapters

[5] Chapter 1: Shape Analysis for Brain Structures.
B. Ng, **M. Toews**, S. Durrleman, Y. Shi. Advances of Shape Analysis in Medical Image Analysis. Springer, Editors Shuo Li and João Manuel R. S. Tavares, 2014.

[6] Chapter 3: Image Registration and Segmentation.
T. Kapur, **M. Toews**, J. Egger, William M. Wells III. Intraoperative Imaging and Image Guided Therapy. Springer, Editor F. Jolesz, MD. 2014.

[7] Chapter 10: Parts-based Modeling of Medical Imagery.
M. Toews and T. Arbel. Computational Intelligence in Medical Imaging: Tools and Applications. CRC Press, Editors G. Schaefer, A. Hassanien, J. Jiang. February, pp. 291-326, 2009.

Peer-reviewed Conferences and Workshops

[8] Probabilistic Diffeomorphic Registration: Representing Uncertainty.
D. Wasserman, **M. Toews**, M. Neithammer, W. Wells III. International Workshop on Biomedical Image Registration, *To Appear*, 2014. **Oral Presentation.**

[9] Invariant Feature-based Alignment of Volumetric Multi-modal Images.
M. Toews, L. Zollei, W. Wells III. Image Processing in Medical Imaging, Vol. 23, pp. 25-36, 2013. **Oral Presentation.**

[10] Inter-slice Correspondence for 2D Ultrasound-guided Procedures.
M. Toews, A. Golby, W. Wells III. Workshop on Clinical Image-based Procedures: Translational Research in Medical Imaging, MICCAI 2013. **Oral Presentation.**

[11] An Automated Initialization System for Robust Model-Based Segmentation of Lungs in CT Data.
G. Gill, **M. Toews**, and R. R. Beichel. 5th Intl. Workshop on Pulmonary Image Analysis, pp. 111-122, 2013.

[12] Fiber feature map based landmark initialization for highly deformable DTI registration.
A. Gupta, **M. Toews**, R. Janardhana, Y. Rathi, J. Gilmore, M. Escolar, M.A. Styner. SPIE Medical Imaging, 2013.

[13] A Feature-based Developmental Model of the Infant Brain in Structural MRI.
M. Toews, W. Wells III, L. Zollei. International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2012.

[14] A Mutual-Information Scale-space for Image Feature Detection and Feature-based Classification of Volumetric Brain Images.

M. Toews, William M. Wells III. IEEE CVPR Workshop on Mathematical Methods in Biomedical Image Analysis (MMBIA), 2010.

[15] Gender Classification from Unconstrained Video Sequences.
M. Demirkus, **M. Toews**, J. Clark, T. Arbel. IEEE CVPR Workshop on Analysis and Modelling of Faces and Gestures (AMFG), 2010.

[16] Exploring Cortical Folding Pattern Variability Using Local Image Features.
R. Rajamalingham, **M. Toews**, D Louis Collins, T. Arbel. MICCAI Workshop on Medical Computer Vision (MCV), 2010.

[17] Feature-based Morphometry.
M. Toews, William M. Wells III, D. Louis Collins and T. Arbel. International Conference on Medical Image Computing and Computer Assisted Intervention, 2009. **32% acceptance rate**.

[18] Bayesian Registration via Local Image Regions: Information, Selection and Marginalization.
M. Toews and William Wells III. Image Processing in Medical Imaging, 2009. **17% acceptance rate (oral presentation)**.

[19] SIFT-Rank: Ordinal Descriptors for Invariant Feature Correspondence.
M. Toews and William Wells III. International Conference on Computer Vision and Pattern Recognition, 2009. **26% acceptance rate**.

[20] Automatically Learning Cortical Folding Patterns.
M. Toews, D. Louis Collins and T. Arbel. IEEE International Symposium on Biomedical Imaging, 2009.

[21] Detecting, Localizing and Classifying Visual Traits from Arbitrary Viewpoints using Probabilistic Local Feature Modeling.
M. Toews and T. Arbel. IEEE Workshop on Analysis and Modeling of Faces and Gestures, 2007. **15% acceptance rate (oral presentation)**.

[22] Detecting and Localizing 3D Object Classes using Viewpoint Invariant Reference Frames. **M. Toews** and T. Arbel. ICCV Workshop on 3D Representation for Recognition, 2007. **40% acceptance rate**.

[23] Detection Over Viewpoint via the Object Class Invariant.
M. Toews and T. Arbel. International Conference on Pattern Recognition, 2006. **42% acceptance rate**.

[24] A Statistical Parts-based Appearance Model of Intersubject Variability.
M. Toews, D. Louis Collins and T. Arbel. International Conference on Medical Image Computing and Computer Assisted Intervention, 2006. **33% acceptance rate**.

[25] Fundamental Matrix Estimation via TIP - Transfer of Invariant Parameters.
F. Riggi, **M. Toews** and T. Arbel. International Conference on Pattern Recognition, 2006. **15% acceptance rate (oral presentation)**.

[26] Maximum A Posteriori Local Histogram Estimation for Image Registration.
M. Toews, D. Louis Collins and T. Arbel. International Conference on Medical Image Computing and Computer Assisted Intervention, 2005. **38% acceptance rate**.

[27] Entropy-of-likelihood Feature Selection for Image Correspondence.
M. Toews and T. Arbel. IEEE International Conference on Computer Vision, 2003. **20% acceptance rate**.

Abstracts

[28] Detecting Rapid Organ Motion using a Hybrid MR-Ultrasound Setup and Bayesian Data Processing.
M. Toews, C.S. Mei, R. Chu, W. S. Hoge, L. P. Panych, B. Madore. Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM), 2014. **Oral Presentation.**

[29] Boosting MR Temporal Resolution using Rapid Ultrasound Measurements, for Motion-Tracking Purposes.
M. Toews, C.S. Mei, R. Chu, W. S. Hoge, B. M. Schwartz, L. P. Panych, B. Madore. Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM), 2013. **Oral Presentation.**

[30] Strategy for simultaneous region-tracking and temperature-monitoring in the liver during free-breathing.
B. Madore, **M. Toews**, C.S. Mei, R.Chu, S.W. Hoge, L.P. Panych. Proceedings of the International Society for Magnetic Resonance in Medicine (ISMRM), 2012.

Theses

[31] A Probabilistic Model to Learn, Detect, Localize and Classify Patterns in Arbitrary Images.
M. Toews, PhD thesis, 2008.

[32] Entropy-of-likelihood Feature Point Selection for Image Correspondence.
M. Toews, Master's thesis, 2003. **Dean's honor list**.

Academic Presentations

Detecting Rapid Organ Motion using a Hybrid MR-Ultrasound Setup and Bayesian Data Processing
* International Society for Magnetic Resonance in Medicine, Milan, Italy, 2014.

Boosting MR Temporal Resolution using Rapid Ultrasound Measurements
* International Society for Magnetic Resonance in Medicine, Salt Lake City, USA, 2013.

Feature Detection and Retrieval in Big Image Databases
* BWH Radiology Research Symposium, Harvard Medical School, Boston, USA, 2013.

Registration and Visualization for Ultrasound Neuronavigation
* National Image-Guided Therapy Workshop, Washington DC, USA, 2013.

Analyse des images d'objets 3D
* Laval University, Laval, QC, Canada, 2013.

MR-Ultrasound Fusion for Image-guided Neurosurgery
* Golby Laboratory, Harvard Medical School, USA, 2011.

Modeling and Alignment of 3D Medical Images from Scale-Invariant Features
* Surgical Planning Laboratory, Harvard Medical School, 2011.
* Laboratory of Mathematics in Imaging, Harvard Medical School, 2011.

Feature-based Morphometry: Discovering Group-related Anatomical Patterns in Brain Imagery
* University of Montreal, Montreal Canada, 2010.
* National Sciences and Research Council, Ottawa Canada, 2010.
* University of Sherbrooke, Sherbrooke Canada, 2010.
* Montreal Neurological Institute, Montreal Canada, 2010.
* McGill University Center for Intelligent Machines, Montreal Canada, 2010.

Invariant Features for Group Analysis of Brain Images
* Bioengineering 2009 Conference, Oxford University, Oxford England, 2009.

Modeling Appearance via the Object Class Invariant
* Biomedical Imaging and Analysis Seminar Series, Massachusetts Institute of Technology, 2008.

Object Class Invariant Modeling of Brain Appearance
* Surgical Planning Laboratory, Harvard Medical School, 2008.

Parts-based Modeling of Brain Appearance
* Data Analysis Workgroup Series, Montreal Neurological Institute, 2007.

Modeling Appearance Patterns in Image Sets
* Machine Learning Seminar Series, University of Montreal/McGill, 2007.

Fundamental Matrix Estimation via TIP - Transfer of Invariant Parameters
* International Conference on Pattern Recognition, Hong Kong, 2006.

Parts-based Modeling of the Human Brain
* Montreal-Rennes Medical Imaging Workshop, 2006.

MAP Histogram Estimation for Image Registration
* Montreal-Toronto Computer Vision Workshop, Montreal Canada, 2005.

Entropy-of-likelihood Feature Selection
* Montreal-Toronto Computer Vision Workshop, University of Toronto, Toronto Canada, 2004.

Multiple Solutions in Bayesian Image Correspondence
* Montreal-Toronto Computer Vision Workshop, McGill University, Montreal Canada, 2003.

Entropy-of-likelihood Feature Selection
* Perception Seminar Series, Center for Intelligent Machines, McGill University, Montreal Canada 2003.

Teaching

Student Co-Supervision

* Master's Research Co-supervision: B-mode Ultrasound for Neurosurgical Guidance
D. Kostro, 2013, Harvard Medical School.

* PhD Research Co-supervision: Gender Classification from Free-form Video Sequences
M. Demirkus, 2008-2011, McGill University.

* ECSE 498 Honor's Thesis Co-supervision: Feature-based Analysis of the Cortex
R. Rajalingham, 2009-2010, McGill University.

* NSERC Undergraduate Research Project: OCI Model-based Face Recognition
R. Rajalingham, 2008, McGill University.

* ECSE 494 Software Design, Group Project Design and Co-supervision: OCI Model Visualization
H. Al-Muscati, R. Beainy, Y. Bouabdallaoui, 2007, McGill University.

* Master's Research Co-supervision: Invariant Features for Scene Geometry Estimation
F. Riggi, 2005-2006, McGill University.

* NSERC Undergraduate Research Project: Feature-based MRI Brain Registration, E. Tseng, 2004.

* ECSE 494 Software Design Project: Entropy-based Brain Registration, M. Faraj, 2003.

Course Development and Lecturing

HST 525: Biomedical Signal and Image Processing – **Massachusetts Institute of Technology**
* Lecture 21: Image Segmentation, April 29, 2014.

ESCE 626: Statistical Methods in Computer Vision – **McGill University**
* Bayesian Face Detection, 2007, 2011.
* Image Alignment via Scale-invariant Features, 2006-2007, 2011.
* Bayesian Image Registration, 2006-2007.

Tutorial Assistant

ECSE 626: Statistical Methods in Computer Vision, 2006, 2008.
ECSE 323: Digital System Design, 2005-2006.
ECSE 221: Introduction to Computer Engineering, 2004.

Activities

Academic Reviewer

* **Journals**: IEEE Trans. on Pattern Analysis and Machine Intelligence, IEEE Trans. on Medical Imaging, Computer Vision and Image Understanding, IEEE Trans. on Image Processing, IEEE Trans. on Signal Processing, IEEE Trans. on Biomedical Engineering, IEEE Sensors Journal, Pattern Recognition, PLoS One, Journal of Neuroscience Methods, Computers in Biology and Medicine, Journal of Machine Learning and Cybernetics, Information Fusion, Journal of Pattern Recognition Research, Machine Vision and Applications, IEEE Signal Processing Letters, IEEE Trans. on Information Forensics and Security.

* **Conferences**: IEEE Computer Vision and Pattern Recognition, IEEE International Conference on Computer Vision , IEEE International Conference on Pattern Recognition, European Conference on Computer Vision, Asian Conference on Computer Vision, Canadian Conference on Computer and Robot Vision, IEEE Symposium on Biomedical Engineering, Medical Imaging and Computer Assisted Intervention, Information Processing in Medical Imaging.

Organization

* Program Committee: Medical Computer Vision 2013, Asian Conference of Computer Vision, 2012.

* Workshop Organizer: National Alliance for Medical Image Computing Project Week,
"Ultrasound Visualization and Navigation in Neurosurgery", 2014
"Registration of Difficult Medical Images", 2012

* Workshop Organizer: "MR-Ultrasound Image Registration for Neurosurgery and Brachytherapy"
Image-guided Therapy Project Week, 2008

Academic References

Dr. William M. Wells III
Relationship: Postdoctoral supervisor 2009-present, Harvard Medical School.
Address: Department of Radiology, Brigham and Women's Hospital
75 Francis Street, Boston, MA, USA, 02115
Phone: (617) 899-3772
Email: sw@bwh.harvard.edu

Dr. Bruno Madore
Relationship: Postdoctoral supervisor 2011-present, Harvard Medical School.
Address: Department of Radiology, Brigham and Women's Hospital
75 Francis Street, Boston, MA, USA, 02115
Phone: (617) 899-3772
Email: bruno@bwh.harvard.edu

Dr. Lilla Zöllei
Relationship: Postdoctoral collaborator 2011-present, Harvard Medical School.
Address: A.A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital
149 Thirteenth Street, Rm 2301, Charlestown, MA 02129
Phone: (617) 643-7791
Email: lzollei @nmr.mgh.harvard.edu

Dr. Tal Arbel
Relationship: Master's and PhD Supervisor 2001-2008, collaborator 2008-2010, McGill University.
Address: McConnell Engineering Bldg., Room 425, McGill University
3480 University Street, Montreal, Quebec, CANADA, H3A 2A7
Phone: (514) 398-8204
Email: arbel@cim.mcgill.ca

Dr. Louis Collins
Relationship: Collaborator 2003-2010, Montreal Neurological Institute.
Address: McConnell Brain Imaging Center, Montreal Neurological Institute
WB-315, 3801 University Street, Montreal, Quebec, CANADA, H3A 2B4
Phone: (514) 398-4227
Email: louis.collins@mcgill.ca

Industrial References

Jean-Sebastien Lessard, President & CEO, Nomad Logic Inc.

Address: 2202-5530 Saint-Patrick St
Montreal, QC, H4E 1A8, Canada
Phone: (514) 871-2002
Email: jslessard@nomadlogic.com
Web: www.nomadlogic.com

Roberto Caniglia, Co-founder & Owner, 36pix Inc.

Address: 1751 Rue Richardson #5515
Montreal, QC, H3K 1G6, Canada
Phone: (514) 448-7788
Email: rcaniglia@36pix.com
Web: www.36pix.com