

Danielle F. Pace, Ph.D.

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EDUCATION

Massachusetts Institute of Technology, Cambridge, MA, USA Sept 2013-Jun 2020
Ph.D., Computer Science (GPA: 4.9/5.0)

- Thesis: "Image segmentation for highly variable anatomy: Applications to congenital heart disease"
- Selected Coursework: Machine Learning, Inference and Information, Advances in Computer Vision, Shape Analysis
- Advisor: Dr. Polina Golland

The University of North Carolina at Chapel Hill, Chapel Hill, NC, USA Apr 2012-May 2013
Non-Degree Graduate Studies, Mathematics (part-time)

The University of Western Ontario, London, ON, Canada Sept 2007-Mar 2010
M.E.Sc., Biomedical Engineering (Avg: 92/100)

- Thesis: "Real-time 4D ultrasound reconstruction for image-guided intracardiac interventions"
- Advisor: Dr. Terry Peters

Queen's University, Kingston, ON, Canada Sept 2003-Apr 2007
B.Comp.H., Biomedical Computing (Avg: 91/10)

- Undergraduate Project: "Visualization for computer-assisted image-free total hip replacement"
- Advisor: Dr. Randy Ellis

EXPERIENCE

The Broad Institute of MIT and Harvard, Cambridge, MA, USA Jul 2023-now
Senior Machine Learning Scientist II, Machine Learning for Health (ML4H) team

- Machine learning methods development using large clinical datasets, including imaging, electronic health record data, electrocardiogram (ECG) waveforms and genetic information, in collaboration with clinician scientists
- On-going projects encompass dataset curation and characterization, development of novel imaging phenotypes, disease risk prediction, representation learning, and discovering associations between genetics and clinical outcomes

A. A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Boston, MA, USA Jul 2020-Jul 2023
Research Fellow

- Developed new deep learning and anatomical modelling algorithms for neuroimaging data, by combining deep Bayesian image segmentation with image synthesis for robust segmentation of contrast-agnostic MR scans
- Advisors: Dr. Adrian Dalca and Dr. Bruce Fischl

Computer Science and Artificial Intelligence Laboratory, MIT, Cambridge, MA, USA Jun-Jul 2020
Research Specialist

- Refined machine learning-based cardiac segmentation algorithms for patients with congenital heart disease
- Advisor: Dr. Polina Golland

Computer Science and Artificial Intelligence Laboratory, MIT, Cambridge, MA, USA Sept 2013-Jun 2020
Ph.D. Graduate Student Researcher

- Conceived and implemented new machine learning algorithms for image segmentation, from data collection and annotation through algorithm development and experimental validation
- Demonstrated improved accuracy in cardiac MR datasets with extreme variability caused by severe congenital heart defects that alter the size, shape, number, location and connectivity of cardiac structures ([link](#))
- Advisor: Dr. Polina Golland

Philips Research, Hamburg, Germany Jun-Aug 2017
Visiting Ph.D. Candidate

- Collaborated with Philips researchers on my Ph.D. projects on machine learning for cardiac image segmentation
- Advisor: Dr. Jürgen Weese

Kitware Inc., Carrboro, NC, USA Jul 2010-Jun 2013
Research and Development Engineer

- Conducted research formulating, implementing and validating a new deformable image registration method to better model the sliding motion of the lungs and abdominal organs ([link](#))
- Wrote custom C++ software in a multi-developer team for a major orthopedic device manufacturer, including bone morphological population analyses and implant design. Progressed to co-lead responsible for defining software requirements, conducting code reviews, supervising personnel, and leading customer presentations
- Led and co-wrote two successful NIH grants on medical image analysis, in collaboration with academic partners
- Advisor: Dr. Stephen Aylward

Robarts Research Institute /

Dept. of Biomedical Engineering, The University of Western Ontario, London, ON, Canada

Sept 2007-Mar 2010

M.E.Sc. Graduate Student Researcher

- Research in ultrasound reconstruction for augmented reality in minimally invasive cardiac procedures
- Advisor: Dr. Terry Peters

Brigham & Women's Hospital and Harvard Medical School, Boston, MA, USA

May-Aug 2007

Research Assistant

- Developed a tutorial software module with LEGO robot integration to demonstrate the main steps of image-guided therapy using the 3D Slicer software package
- Advisor: Dr. Nobuhiko Hata

Dept. of Physiology, Queen's University, Kingston, ON, Canada

May 2005-Aug 2006

Research Assistant

- Created computational models of motoneurons to investigate how background synaptic activity affects firing rate
- Advisor: Dr. Ken Rose

TEACHING AND MENTORSHIP

MIT, Cambridge, MA, USA

Jan 2016-Jul 2020

Undergraduate Mentorship

- Mentored six MIT undergraduate students for projects in machine learning and image annotation

Dept. of Electrical Engineering and Computer Science, MIT, Cambridge, MA, USA

Sept-Dec 2016

Teaching Assistant, "Introduction to Inference"

- Offered weekly lectures reviewing class material for 85 students, held weekly office hours and developed class assignments, achieving an excellent student rating (6.5/7)

Dept of Electrical and Computer Engineering, The University of Western Ontario, London, ON, Canada

Jan-Apr 2009

Teaching Assistant, "Algorithms and Data Structures for Object-Oriented Design"

- Designed and graded assignments and weekly labs, and ran office hours

National Center for Image-Guided Therapy (NCIGT)

Mar-Dec 2008

Training Specialist

- Developed new 3D Slicer tutorials for image-guided therapy, and presented interactive training workshops

Dept. of Electrical and Computer Engineering, The University of Western Ontario, London, ON, Canada

Sept-Dec 2007

Teaching Assistant, "Programming Fundamentals for Engineers"

- Taught core principles and debugging strategies to novice programmers

AWARDS

- **Outstanding Reviewer Award**, MICCAI, 2021 (top 10/1220 reviewers)
- **Best Presentation**, New England Computer Vision Workshop, 2018
- **NSERC Canada Graduate Scholarship (Doctoral)**, 2013-2016 (\$63,000)
- **Best Student Poster**, International Society for Computer Aided Surgery, 2010
- **1st Poster in Imaging for Cardiovascular Therapeutics**, 7th Symposium of Imaging Network Ontario, 2008
- **NSERC Canada Graduate Scholarship (Master's)**, 2007-2009 (\$35,000)
- **Ontario Graduate Scholarship**, Government of Ontario, 2007 (\$15,000, declined to take up NSERC)
- **Advanced Undergraduate Project Award**, School of Computing, Queen's University, 2007
- **Best Undergraduate Contribution**, Canadian Student Conference on Biomedical Computing, 2006
- **HSBC Bank Malta Undergraduate Scholarship**, 2003-2007 (\$10,000)
- **Principal's Scholarship in Computing**, Queen's University, 2003-2005 (\$8,000)

SERVICE

Organizing Committee:

- **MedNeurIPS Workshop (NeurIPS 2022)**: Medical Imaging meets NeurIPS
- **HVSMR Challenge (MICCAI 2016)**: Whole Heart and Great Vessel Segmentation from 3D Cardiovascular Magnetic Resonance Images in Congenital Heart Disease

Leadership:

- **MICCAI Student Board**: Advisory Member (2018-2020), Educational Officer (2017-2018), Professional Students Event Officer (2016-2017), Executive Member (2015-2016)
- **MIT Canadians Club**: Deputy Prime Minister (2014-2015 and 2016-2017), Minister of Finance (2015-2016)

Technical Reviewer:

- IEEE Transactions on Medical Imaging (TMI)
- Medical Image Analysis (MEDIA)
- Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- Journal of Cardiovascular Magnetic Resonance (JCMR)
- Journal of Medical Imaging (JMI)
- Ultrasonics
- Medical Image Computing and Computer Assisted Intervention (MICCAI)
- Neural Information Processing Systems (NeurIPS)
- Association for the Advancement of Artificial Intelligence Conference on Artificial Intelligence (AAAI)
- ACM Conference on Health, Inference, and Learning (ACM-CHIL)
- NeurIPS Machine Learning for Health (ML4H)
- Information Processing in Computer Assisted Interventions (IPCAI)
- MICCAI Workshop on Clinical Image-Based Procedures (CLIP)
- MICCAI Workshop on Computational and Clinical Applications in Abdominal Imaging (ABDI)

SKILLS

Technical: Python, C++, TensorFlow, Keras, NumPy, ITK, VTK, MATLAB, SQL, Git/GitHub, Bash, DICOM

Languages: English (native), German (limited working proficiency)

PEER-REVIEWED JOURNAL PUBLICATIONS

1. **D.F. Pace**, H.T.M Contreras, J. Romanowicz, S. Ghelani, I. Rahaman, Y. Zhang, P. Gao, M.I. Jubair, T. Yeh, P. Golland, T. Geva, S. Ghelani, A.J. Powell, M.H. Moghari. HVSMR-2.0: A 3D cardiovascular MR dataset for whole-heart segmentation in congenital heart disease. *Nature Scientific Data* 11:721, 2024.
2. V. Nauffal, M.D.R. Klarqvist, M.C. Hill, **D.F. Pace**, P. Di Achille, S.H. Choi, J.T. Rämö, J.P. Pirruccello, P. Singh, S. Kany, C. Hou, K. Ng, A.A. Philippakis, P. Batra, S.A. Lubitz, P.T. Ellinor. Non-invasive assessment of organ-specific and shared pathways in multi-organ fibrosis using T1 mapping. *Nature Medicine* 30:1749-1760, 2024.
3. S.T. Arasteh, J. Romanowicz, **D.F. Pace**, P. Golland, A.J. Powell, A.K. Maier, D. Truhn, T. Brosch, J. Weese, M. Lotfinia, R.J. van der Geest, M.H. Moghari. Automated segmentation of 3D cine cardiovascular magnetic resonance imaging, *Frontiers in Cardiovascular Medicine* 10, 2023.
4. **D.F. Pace**, A.V. Dalca, T. Brosch, T. Geva, A.J. Powell, J. Weese, M.H. Moghari, P. Golland. Learned iterative segmentation of highly variable anatomy from limited data: Applications to whole heart segmentation for congenital heart disease, *Medical Image Analysis* 80:102469, 2022.
5. A. Bayat, **D.F. Pace**, A. Sekuboyina, C. Payer, D. Stern, M. Urschler, J.S. Kirschke, Bjoern H. Menze, Anatomy-aware inference of the 3D standing spine posture from 2D radiographs, *Tomography* 8(1):479-496, 2022.
6. C. Herz, **D.F. Pace**, N.H. Nam, A. Lasso, P. Dinh, P. Golland, M.A. Jolley, Segmentation of tricuspid valve leaflets from transthoracic 3D echocardiograms of children with hypoplastic left heart syndrome using deep learning, *Frontiers in Cardiovascular Medicine* 8, 2021.
7. **D.F. Pace**, S.R. Aylward, M. Niethammer, A locally adaptive regularization based on anisotropic diffusion for deformable image registration, *IEEE Transactions on Medical Imaging*; 32(11): 2114-2126, 2013.
8. A. Irimia, B. Wang, S. Aylward, M. Prastawa, **D.F. Pace**, M. Niethammer, G. Gerig, D.A. Hovda, R. Kikinis, P.M. Vespa, J.D. Van Horn, Neuroimaging of structural pathology and neuroconnectivity in traumatic brain injury: towards personalized outcome prediction, *NeuroImage: Clinical*; 1:1-17, 2012.

PEER-REVIEWED CONFERENCE PROCEEDINGS

9. **D.F. Pace**, A.V. Dalca, T. Brosch, T. Geva, A.J. Powell, J. Weese, M.H. Moghari, P. Golland, Iterative segmentation from limited training data: Applications to congenital heart disease, *MICCAI Workshop on Deep Learning in Medical Image Analysis*, LNCS 11045:334-342, 2018.
10. **D.F. Pace**, A.V. Dalca, T. Geva, A.J. Powell, M.H. Moghari, P. Golland, Interactive whole-heart segmentation in congenital heart disease, *Medical Image Computing and Computer Assisted Interventions (MICCAI)*, LNCS 9351:80-88, 2015.
11. R. Kwitt, **D.F. Pace**, M. Niethammer, S.R. Aylward, Studying cerebral vasculature using structure proximity and graph kernels, *Medical Image Computing and Computer Assisted Interventions (MICCAI)*, LNCS 8150:534-541, 2013.
12. **D.F. Pace**, M. Niethammer, S.R. Aylward, Sliding geometries in deformable image registration, *MICCAI Workshop on Computational and Clinical Applications in Abdominal Imaging*, LNCS 7029:141-148, 2011.
13. M. Niethammer, G.L. Hart, **D.F. Pace**, P.M. Vespa, A. Irimia, J.D. Van Horn, S.R. Aylward, Geometric Metamorphosis, *Medical Image Computing and Computer Assisted Interventions (MICCAI)*, LNCS 6892:639-646, 2011.
14. **D.F. Pace**, A. Enquobahrie, H. Yang, S.R. Aylward, M. Niethammer, Deformable image registration of sliding organs using anisotropic diffusive regularization, *International Symposium on Biomedical Imaging (ISBI)*, 30:407-413, 2011.
15. T. Peters, **D.F. Pace**, P. Lang, G. Guiraudon, D. Jones, C. Linte, Ultrasound image guidance of cardiac interventions, *Proceedings of SPIE Medical Imaging*; 7968:79680T, 2011.
16. C.A. Linte, M. Carias, S.D. Cho, **D.F. Pace**, J. Moore, C. Wedlake, D. Bainbridge, B. Kiaii, T.M. Peters, Estimating heart shift and morphological changes during minimally invasive cardiac interventions, *Proceedings of SPIE Medical Imaging*; 7625:762509, 2010.

17. **D.F. Pace**, D.G. Gobbi, C. Wedlake, J. Gumprecht, J. Boivert, J. Tokuda, N. Hata, T.M. Peters, An open-source real-time ultrasound reconstruction system for four-dimensional imaging of moving organs, MICCAI Workshop on Systems and Architectures for Computer Assisted Intervention, 2009.
18. J. Moore, C. Clarke, D. Bainbridge, C. Wedlake, A.D. Wiles, **D.F. Pace**, T.M. Peters, Image guidance for spinal facet injections using tracked ultrasound, Medical Image Computing and Computer Assisted Interventions (MICCAI), LNCS 5761:516-523, 2009.
19. T.M. Peters, C.A. Linte, J. Moore, A. Wiles, J. Lo, **D.F. Pace**, C. Wedlake, D. Bainbridge, D.L. Jones, G.M. Guiraudon, Cardiac imaging and modeling for guidance of minimally invasive beating heart interventions, Functional Imaging and Modeling of the Heart, LNCS 5528:466-475, 2009.
20. **D.F. Pace**, A.D. Wiles, J. Moore, C. Wedlake, D.G. Gobbi, T.M. Peters, Validation of four-dimensional ultrasound for targeting in minimally-invasive beating-heart surgery, Proceedings of SPIE Medical Imaging; 7261:726115, 2009.
21. J. Jomier, L. Ibanez, A. Enquobahrie, **D.F. Pace**, K. Cleary, An open-source testing framework for tracking devices using Lego Mindstorms™, Proceedings of SPIE Medical Imaging; 7261:72612S, 2009.
22. **D.F. Pace**, R. Kikinis, N. Hata, An accessible, hands-on tutorial system for image-guided therapy and medical robotics using a robot and open source software, MICCAI Workshop on Open Source and Open Data, 2007.

PEER-REVIEWED CONFERENCE ABSTRACTS

- D.F. Pace**, Polina Golland, David Annese, Tal Geva, Andrew J. Powell, M.H. Moghari, Creating 3D heart models of children with congenital heart disease using magnetic resonance imaging, International Society for Magnetic Resonance in Medicine (ISMRM), 2015.
23. Y. Dai, **D.F. Pace**, J. Bischoff, Anthropometric differences in natural posterior tibial slope, Orthopaedic Research Society (ORS), 2014.
 24. **D.F. Pace**, A. Enquobahrie, P. Reynolds, J. Jomier, E. Bullitt, S.R. Aylward, TubeTK: An open-source toolkit of algorithms operating on images of tubes, 26th International Congress and Exhibition on Computer Assisted Radiology and Surgery (CARS), International Journal of CARS; 7 (S1):S79-S80, 2012.
 25. **D.F. Pace**, D. Bainbridge, J. Moore, C. Wedlake, G. Guiraudon, D.L. Jones, T.M. Peters, Real-time 4D ultrasound reconstruction for improved intraoperative imaging during image-guided beating-heart interventions, 24th International Congress and Exhibition on Computer Assisted Radiology and Surgery (CARS), International Journal of CARS; 5(S1):S271-S273, 2010.
Won International Society for Computer Aided Surgery (ISCAS) Best Student Poster award.
 26. C.A. Linte, D.S. Cho, M. Carias, **D.F. Pace**, J. Moore, C. Wedlake, D. Bainbridge, B. Kiaii, T.M. Peters, Estimating heart movement and morphological changes during robot-assisted coronary artery bypass graft interventions, 24th International Congress and Exhibition on Computer Assisted Radiology and Surgery (CARS), 2010.
 27. **D.F. Pace**, T. Bui, P.K. Rose, Computational estimates of the effect of asynchronous synaptic activity on fluctuations in the membrane potential of motoneurons, Society for Neuroscience (SfN), 2006.

BOOKS AND PROCEEDINGS

M.A. Zuluaga, K. Bhatia, B. Kainz, M.H. Moghari, **D.F. Pace** (eds). Reconstruction, segmentation and analysis of medical images, First International Workshops, RAMBO 2016 and HVSMR 2016. LNCS 10129, 2016.

THESES

28. **D.F. Pace**, Image segmentation for highly variable anatomy: Applications to congenital heart disease, Ph.D. Thesis, Cambridge, MA, USA: Massachusetts Institute of Technology, June 2020.
29. **D.F. Pace**, Real-time 4D ultrasound reconstruction for image-guided intracardiac interventions, M.E.Sc. Thesis. London, ON, Canada: The University of Western Ontario, March 2010.