Finale Doshi-Velez

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Education

- **Doctor of Philosophy**, Computer Science.
  Massachusetts Institute of Technology, September 2005 – June 2012
  Thesis: Bayesian Nonparametric Methods for Reinforcement Learning in Partially Observable Domains.
- **Master of Science**, Engineering.
  University of Cambridge, October 2007 – August 2009.
  Thesis: The Indian Buffet Process: Scalable Inference and Extensions.
- **Master of Science**, Computer Science.
  Massachusetts Institute of Technology, September 2005 – June 2007
  Thesis: Efficient Model Learning for Dialog Management
- **Bachelor of Science**, Aerospace Engineering with a minor in Creative Writing
  Bachelor of Science, Physics
  Massachusetts Institute of Technology, September 2001 – June 2005

Academic Research Experience

- **Research Associate** August 2012 – present
  Center for Biomedical Informatics, Harvard Medical School. Developing machine learning methodologies to combine clinical data and expert-curated information to derive data-driven phenotypes of disease. Applying these techniques to understand the heterogeneous nature of autism, inflammatory bowel disease, and diabetes. Secondary affiliations: Fellow, School of Engineering and Applied Sciences, Harvard; Research Associate, Brigham and Women's Hospital; Affiliate, Boston Children's Hospital.
- **Research Assistant** September 2005 – December 2012
  Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology. Developed techniques for learning parameters of dialog managers online (masters thesis). Designed Bayesian nonparametric models and inference techniques for reinforcement learning applications (doctoral thesis).
- **Research Assistant** October 2007 – August 2009
  Computational and Biological Learning Laboratory, University of Cambridge. Developed efficient inference techniques for the Indian Buffet process.
- **Undergraduate Research Projects** February 2002 – June 2005
  Massachusetts Institute of Technology. Completed a variety of projects, including designing an alternative keyboard (self-directed); testing fault-detection software for autonomous rovers (Model-based Embedded Robotic Systems Group); designing fly-wheel circuitry (Space Systems Lab); creating a gesture recognition interface (self-directed); and improving video alignments for robot localization (Vision Group).

Teaching Experience

- **Instructor** Winter 2010-2012, Summer 2011
  Massachusetts Institute of Technology. 6.085: Statistics for Research Projects. Developed and taught a half-course on statistics for undergraduate researchers. Teaching rated 6.3/7.0 (departmental average is 5.3).
- **Program Director** Winter 2005, 2006
  Massachusetts Institute of Technology. 6.185: Mobile Autonomous Systems Laboratory. Directed a completely volunteer, student-run autonomous vision-based navigation robotics contest. Duties included organizing the production of student kits, raising $25K, designing curriculum, and managing a 10-person teaching staff in addition to teaching and lab duties (also staff in 2007).

- **Instructor** Fall 2005, 2006
  Massachusetts Institute of Technology. 18.01: Single Variable Calculus; 18.02: Multivariable Calculus.
- **Supervisor** (teaching assistant) Fall 2007, 2008; Winter 2008
  University of Cambridge. Tutoring, practicals for undergraduate signals and systems and statistical modeling.
- **Teaching Assistant** Spring 2002 – Fall 2006, Spring 2007
  Massachusetts Institute of Technology. Undergraduate Courses: 18.01: Single Variable Calculus, 18.02: Multivariable Calculus, 18.03: Differential Equations, 8.022 Electricity and Magnetism; Graduate Course: 6.437 Inference and Information. Prepared tutorials, office hours. Teaching for 6.437 rated 6.3/7.0 (departmental average is 5.6): "was highly praised as an amazing TA. Students complemented her knowledge of the field, great blackboard techniques, and clear explanations."

Honors

- Postdoctoral:
  - Named one of IEEE's AI "10 to Watch" (2013)
  - NSF CiTraCS Postdoctoral Fellow (2012)
  - Invited participant at the Rising Stars in EECS workshop, organized by MIT (2012)
- Graduate:
  - Hugh Hampton Young Fellowship recipient (2010-2011)
  - Marshall Scholar (2006)
  - Trinity Prince of Wales Research Student, Trinity College External Research Studentship (2007)
  - NDSEG Fellowship recipient (2005)
  - NSF Graduate Fellowship recipient (2005)
- Undergraduate:
  - Honor Society Memberships: Phi Beta Kappa, Sigma Gamma Tau (aerospace honors society), Sigma Pi Sigma (physics honor society)
  - Awards: Goddard Research Award for best research project at the NASA Academy (2004), Manufacturing Award for undergraduate junior-senior design project (2005), Athletics Gold Award for Service for founding Club Sports Council (2005), Todd Anderson Teaching Award for excellence in teaching in the MIT Experimental Studies Group (2005).

Publications

Journal

- Prevalence of Inflammatory Bowel Disease Among Patients with Autism Spectrum Disorder. Finale Doshi-Velez, Athos Bousvaros, Nathan Palmer, Isaac Kohane. In submission.
- Discovering Relevant Pathways to Autism through a Topological Analysis of Pathways. Ariel Carmeli, Finale Doshi-Velez, Isaac Kohane. In submission.
- Comorbidity Clusters in Autism Spectrum Disorders: A Time-Series Analysis using Electronic Health Records, Finale Doshi-Velez, Yaorong Ge, Isaac Kohane. Pediatrics. To appear.
- Bayesian Nonparametric Methods for Reinforcement Learning in Partially Observable Domains. Finale Doshi-Velez, David Pfau, Frank Wood, Nicholas Roy. Transactions of Pattern Analysis and Machine Intelligence. To appear.
- Improving Safety and Operational Efficiency in Residential Care Settings with WiFi-based Localization. Finale Doshi-Velez, William Li, Yoni Battat, Jun-geun Park, Ben Charrow, Dorothy Curtis, Sachi Hemachandra, Bryan Reimer, Javier Velez, Cynthia Walsh, Don Fredette, Nicholas Roy, Seth Teller. Journal of the American Medical Directors Association 13(6), July 12, 558-563.
- Reinforcement Learning with Limited Reinforcement: Bayes Risk for Active Learning in POMDPs. Finale Doshi-Velez, Joelle Pineau, Nicholas Roy. AI Journal, Volumes 187–188, August 2012, 115–132.
- A Bayesian nonparametric approach to modeling motion patterns. Joshua Joseph, Finale Doshi-Velez, Albert Huang, Nicholas Roy. Autonomous Robots 31(4): 383-400 (2011).
- Spoken Language Interaction with Model Uncertainty: An Adaptive Human-Robot Interaction System. Finale

Doshi, Nicholas Roy. Connection Science 20(4): December 2008.

Conference

- A Bayesian Nonparametric Approach to Modeling Battery Health. Joshua Joseph, Finale Doshi-Velez, Nicholas Roy. International Conference on Robotics and Automation (ICRA) 2012.
- Infinite Dynamic Bayesian Networks. Finale Doshi-Velez, David Wingate, Joshua Tenenbaum, Nicholas Roy. Proceedings of the International Conference on Machine Learning (ICML) 2011.
- Online Discovery of Feature Dependencies. Alborz Geramifard, Finale Doshi-Velez, Joshua Redding, Nicholas Roy, Jonathan P. How. Proceedings of the International Conference on Machine Learning (ICML) 2011.
- A Comparison of Human and Agent Reinforcement Learning in Partially Observable Domains. Finale Doshi-Velez and Zoubin Ghahramani. Proceedings of the 33rd Annual Meeting of the Cognitive Science Society (CogSci) 2011.
- Nonparametric Bayesian Policy Priors for Reinforcement Learning. Finale Doshi-Velez, David Wingate, Nicholas Roy, Josh Tenenbaum. Advances in Neural Information Processing Systems (NIPS) 2010
- A Bayesian Nonparametric Approach to Modeling Mobility Patterns. Josh Joseph, Finale Doshi-Velez, Nicholas Roy. Proceedings of Association for the Advancement of Artificial Intelligence (AAAI) 2010
- The Infinite Partially Observable Markov Decision Process. Finale Doshi-Velez. Advances in Neural Information Processing Systems (NIPS) 2009
- Large Scale Nonparametric Bayesian Inference: Data Parallelisation in the Indian Buffet Process. Finale Doshi-Velez, David Knowles, Shakir Mohammed, Zoubin Ghahramani. Advances in Neural Information Processing Systems (NIPS) 2009
- Correlated Non-Parametric Latent Feature Models. Finale Doshi-Velez, Zoubin Ghahramani. Proceedings of Uncertainty in Artificial Intelligence (UAI) 2009
- Accelerated Gibbs Sampling for the Indian Buffet Process. Finale Doshi-Velez, Zoubin Ghahramani. Proceedings of International Conference on Machine Learning (ICML) 2009
- Variational Inference for the Indian Buffet Process. Finale Doshi-Velez, Kurt Miller, Jurgen Van Gael, Yee Whye Teh. AISTATS 2009 (**Best Paper Nominee**)
- Reinforcement Learning with Limited Reinforcement: Using Bayes-Risk for Active Learning in POMDPS. Finale Doshi, Joelle Pineau, Nicholas Roy. Proceedings of International Conference on Machine Learning (ICML) 2008
- The Permutable POMDP: Fast Solutions to POMDPs for Preference Elicitation. Finale Doshi, Nicholas Roy. Proceedings of Autonomous Agents and Multi-Agent Systems (AAMAS) 2008 (**Best Paper Nominee**)
- Collision Detection in Legged Locomotion using Supervised Learning. Finale Doshi, Emma Brunskill, Alex Shkolnik, Tom Kollar, Khash Rohanimanesh, Russ Tedrake, Nicholas Roy. Proceedings of Intelligent Robots and Systems (IROS) 2007
- Efficient Model Learning for Dialog Management. Finale Doshi, Nicholas Roy. Proceedings of Human Robot Interaction (HRI) 2007

Refereed Workshop and Symposia

- Deriving Clinical Phenotypes in Autism Spectrum Disorder from Electronic Health Record Data. Finale Doshi-Velez, Ryan Adams, Isaac Kohane. Symposium on the Meaning Use of Complex Medical Data 2013.
- Transfer Learning by Discovering Latent Task Parameterizations. Finale Doshi-Velez and George Konidaris. NIPS 2012 Workshop: Bayesian Nonparametric Models for Reliable Planning and Decision-Making Under Uncertainty
- An Analysis of Activity Changes in MS Patients: A Case Study in the Use of Bayesian Nonparametrics. Finale Doshi-Velez, Nicholas Roy. NIPS 2011 Workshop: Bayesian Nonparametrics, Hope or Hype?
- Bayesian Nonparametric Approaches to Reinforcement Learning in Partially Observable Domains. Finale Doshi-Velez. Association for the Advancement of Artificial Intelligence Doctoral Consortium 2010
- Nonparametric Bayesian Methods for Finding Software Bugs. Finale Doshi and Jurgen Van Gael. Centre for Research in Statistical Methodology (CRiSM) Workshop on High Dimensional Data, 2008.
- Reinforcement Learning with Limited Reinforcement: Using Bayes Risk for Active Learning in POMDPs. Finale Doshi and Nicholas Roy. International Symposium on Artificial Intelligence and Mathematics (ISAIM) 2008

- Learning User Models with Limited Reinforcement: An Adaptive Human-Robot Interaction System. Finale Doshi and Nicholas Roy. Symposium on Language and Robotics (LANGRO) 2007
- Efficient Model Learning for Dialog Management. Finale Doshi and Nicholas Roy. Association for the Advancement of Artificial Intelligence 2007 Spring Symposium
- Model Learning for Dialog Management. Finale Doshi and Nicholas Roy. Advances in Neural Information Processing Systems (NIPS) 2006 Workshop on Reinforcement Learning.

Theses

- Bayesian Nonparametric Approaches for Reinforcement Learning in Partially Observable Domains. PhD Thesis, MIT, 2012.
- The Indian Buffet Process: Scalable Inference and Extensions. Masters Thesis, Cambridge, 2009.
- Efficient Model Learning for Dialog Management. Masters Thesis, MIT, 2007

Patents

- Assessing Compressed-Database Raw Size, #20130212075. Lyric Pankaj Doshi and Finale Doshi-Velez. Issued August 2013.

Professional and Academic Service

- **Workshops Organized:**
    - NIPS Workshop 2013 on Machine Learning for Clinical Data Analysis
    - ICML Workshop 2011 on Decision-Making with Uncertain Models.
    - AAAI Spring Symposium 2011 on Computational Physiology.
    - Workshop for Women in Machine Learning: Executive Board President 2012—present, Co-founder and interim Co-chair of the Executive Board, Organizer 2009, Fundraiser, 2008. Organizer and fundraiser duties involved raising $25K from industry sponsors, program chairing, managing publicity; Executive Board duties included co-writing (multiple, successful) NSF grant for multi-year funding and organizing multi-year financial and information technology infrastructure.
    - Interdisciplinary Graduate Conference, Cambridge, 2009. (Program chair and organizer)
- **Reviewer** for the journals: Autonomous Robots, Autonomous Agents; the conferences: AAAI 2008, RSS 2011, IROS 2011, NIPS 2009-2013, AISTATS 2010-2013, ICML 2010-2014.
- **University and Departmental Service:**
    - Committee on Foreign Scholarships, Massachusetts Institute of Technology, 2009-Present. Coached students applying for foreign scholarships, participated in mock interviews.
    - REF, EECS Department, MIT Summer 2010-Summer 2012. Peer mediator, conflict coach, and stress reduction resource for graduate students. Certification includes 32 hours of mediation training.
    - Graduate leadership: Massachusetts Institute of Technology: Graduate Resident Tutor 2006-2007. EECS Orientation Co-chair 2006. Grad Women in EECS Discussion Coordinator 2007. Program chair of CSAIL Student Workshop 2007. EECS Academic Chair 2010. Organizer/Founder of Robotics Tea 2010. University of Cambridge: Co-founder of Engineering Students Executive Committee 2007-2008. Group Social Chair 2007-2009.
    - Undergraduate leadership: Massachusetts Institute of Technology: Officer, Club Sports Council, 2002-2003 (Athletics Department Gold Award for Service); Taekwondo Club President 2002-2005. Hall Chair 2004-2005.

Projects Supervised

- Project Mentor, Winter 2013—Present. Massachusetts Institute of Technology. Supervised two undergraduate students to apply basic machine learning techniques to predict diagnoses in autism spectrum disorders and inflammatory bowel disease.
- Bachelors Thesis Mentor, Winter 2012—present, Wellesley College. Co-supervised two undergraduate

theses to predict energies of solvation based on molecular features.

- Project Mentor, Fall 2012-Spring 2013. Harvard. Supervised a project to classify pot-holes based on smart phone accelerometer data.
- Project Mentor, Summer 2012, Harvard Medical School. Supervised an undergraduate project looking at pathways with high differential gene expression between autistic individuals and a healthy population.
- Project Mentor, Summer 2010, Massachusetts Institute of Technology. Helped supervise an undergraduate project for localizing wheelchairs using wifi signal strengths.
- Masters Thesis Mentor, Fall 2008 – Spring 2009, University of Cambridge. Helped supervise a masters thesis on learning Bayesian network structure with large missing data and an application to water and sanitation.
- Project Mentor, Spring 2007, Massachusetts Institute of Technology. Helped supervise a junior-senior design project in the effectiveness of wheelchair dialog managers.

Invited Seminars and Guest Lectures

- Invited Speaker, February 2014, Duke University.
- Invited Speaker, December 2013, NIPS Workshop on Causal Reason. Tutorial of POMDPs for Causal Reasoning.
- Panelist, October 2013, Health 2.0 Conference. Machine Learning for Medical Data Panel.
- Guest Lecturer, October 2013, Harvard University, CS281: Advanced Machine Learning (advanced graduate course). Prepared and presented a lecture on Monte Carlo techniques.
- Speaker, July 2013, BIGG Fellows Program at Harvard Medical School. Machine Learning for Discovering Phenotypes in Autism Spectrum Disorders.
- Speaker, May 2013, Northeastern University. Bayesian Nonparametric Methods for Timeseries Analysis.
- Speaker, March 2013. Vecna. Characterizing Temporal Patterns in Autism Spectrum Disorder from Electronic Health Records.
- Speaker, September 2012. Institute for Computational and Experimental Research in Mathematics at Brown University. Bayesian nonparametric Approaches to Reinforcement Learning in Partially Observable Domains.
- Speaker, November 2011. Tufts University, Computer Science Seminar Series. Bayesian Nonparametric Approaches to Reinforcement Learning in Partially Observable Domains.
- Guest Lecturer, October 2011, Harvard University. CS281: Advanced Machine Learning (advanced graduate course). Prepared and presented a pair of lectures on inference in time series.
- Speaker, July 2011. Wellesley College, Summer Seminar Series. Towards Better AI: Using Bayesian Nonparametric Methods to Build More Flexible Agents.
- Guest Lecturer, June 2011, Planning Under Uncertainty Course; Lincoln Labs. Bayesian Reinforcement Learning for Dialog Management.
- Speaker, April 2011. University of Toronto, Machine Learning Seminar. Bayesian Nonparametric Approaches to Reinforcement Learning in Partially Observable Domains.
- Speaker, March 2011. Rutgers University, Rutgers Laboratory for Real-Life Reinforcement Learning Group. Bayesian Nonparametric Approaches to Reinforcement Learning in Partially Observable Domains: The Nuts and Bolts.
- Guest Lecturer, Fall 2010, Massachusetts Institute of Technology. 16.420: Planning Under Uncertainty (advanced graduate course). Prepared and presented a pair of lectures on time series analysis and Bayesian model learning.
- Speaker, November 2010, University of Massachusetts Amherst: Bayesian Nonparametric Approaches to Reinforcement Learning in Partially Observable Domains.
- Speaker, April 2010, Brown University. Efficient Inference for the Indian Buffet Process.

Community Outreach

- **Statistical Consulting**

- Volunteer Analyst, Statistics without Borders. 2009—present. Projects: Re-analyzed data from a study on the effectiveness of maternal health education on social and health outcomes for CARE in Bangalore, India (Winter 2011). Analyzed influences on choices surrounding the consumption of animal products for the Farm Sanctuary (Fall 2013).
- Volunteer Analyst, Learning Unlimited, 2011-2012. Organized focus groups to determine what aspects of MIT's Educational Studies Program's events had the most lasting effects on students.
- Expert reviewer for 'A Preliminary Assessment of the Impact of the Liberian Truth and Reconciliation Commission,' an independent evaluation undertaken as part of the Human Rights Data Analysis Group (HRDAG) at Benetech, January 2010.
- Statistical consultant for a Millennium Villages project on evaluating effectiveness of various diarrhea treatment programs in Africa, Winter 2010.

- **Educational Outreach**
  - Speaker, Maggie L. Walker Governor's School, Spring 2011. Invited talk for the Mu Alpha Theta Math Honors Society on Bayesian Nonparametric Methods for Reinforcement Learning; guest lecturer for the Linear Algebra and Math Modeling classes.
  - Speaker, MIT Women's Initiative, Winter 2011, Massachusetts Institute of Technology.
  - Speaker, Young Jain Convention Summer 2010, 2012.
  - Educational Studies Program, Fall 2002—2012. Massachusetts Institute of Technology. Co-chair, Treasurer, Publicity Chair. Directed SAT prep and enrichment programs for 1000+ students and managed $60K budgets. Taught classes for up to 250 students ranging from statistics to story-telling.
  - Intern, Science Museum of Virginia, Richmond VA, Summer 2003.

Industry Experience

- **Bioinformatics Analyst** April 2012 – August 2012
  Brigham and Women's Hospital, Boston MA. Applied machine learning techniques to characterize cardiovascular risk among healthy women.
- **Intern** Summer 2007
  ITA Software. Boston, MA. Applied machine learning techniques for econometric analysis of flight data.
- **Research Associate** Summer 2004
  NASA Academy, NASA Goddard. Developed algorithms for minimum-fuel spacecraft rendezvous.
- **Lab Assistant** Summer 2003
  Sentor Technologies Inc., Richmond, VA. Programmed and built control circuitry for a gamma ray detector.