

# Scott Kuindersma

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## ACADEMIC POSITIONS

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<b>Harvard University</b> Assistant Professor of Engineering and Computer Science John A. Paulson School of Engineering and Applied Sciences	Cambridge, MA <i>July 2015–present</i>
<b>Massachusetts Institute of Technology</b> Postdoctoral Associate, Robot Locomotion Group, CSAIL	Cambridge, MA <i>Sept 2012–June 2015</i>

## EDUCATION

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<b>University of Massachusetts Amherst</b> Doctor of Philosophy, Computer Science Thesis: <i>Variable Risk Policy Search for Dynamic Robot Control</i> Advisors: Roderic Grupen & Andrew Barto	Amherst, MA <i>Sept 2012</i>
<b>University of Massachusetts Amherst</b> Master of Science, Computer Science	Amherst, MA <i>Feb 2009</i>
<b>Bryant University</b> Bachelor of Science, <i>summa cum laude</i> , Information Technology (Computer Science)	Smithfield, RI <i>May 2006</i>

## RESEARCH EXPERIENCE

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<b>Harvard University</b> <i>Director, Harvard Agile Robotics Laboratory</i> Leading a team of students and postdocs conducting research on planning, control, and estimation for dynamic walking, grasping, and flying robots.	Cambridge, MA <i>July 2015–present</i>
<b>Massachusetts Institute of Technology</b> <i>Postdoctoral Associate, Robot Locomotion Group, CSAIL</i> Planning and Control Lead for the MIT DARPA Robotics Challenge team. Developed feedback controllers for legged locomotion using convex optimization.	Cambridge, MA <i>Sept 2012–June 2015</i>
<b>University of Massachusetts Amherst</b> <i>Research Assistant, Laboratory for Perceptual Robotics</i> Created Bayesian optimization algorithms for risk-sensitive policy search and applied them to learning dynamic controllers on the uBot-5.	Amherst, MA <i>June 2008–Aug 2012</i>
<b>NASA Johnson Space Center</b> <i>Graduate Fellow Intern, Robonaut 2 Laboratory</i> Created a dynamic simulator for Robonaut 2 and implemented prototype zero-gravity body orientation controllers. Contributed autonomous manipulation software used on Robonaut 2.	Houston, TX <i>Summer 2011</i>
<b>NASA Johnson Space Center</b> <i>Graduate Fellow Intern, Dexterous Robotics Laboratory</i> Developed controllers in simulation for a humanoid designed to operate autonomously on the moon.	Houston, TX <i>Summer 2010</i>
<b>University of Massachusetts Amherst</b> <i>Research Assistant, Computational Biology Laboratory</i> Designed coarse-to-fine supervised learning algorithms for microarray cancer classification.	Amherst, MA <i>Jan 2007–May 2008</i>

## TEACHING

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<b>Harvard University</b>	Cambridge, MA
<i>Instructor, CS 182: Artificial Intelligence</i>	<i>Fall 2016-17</i>
<i>Instructor, CS 284: Optimization Algorithms for Robotics</i>	<i>Spring 2016</i>
<i>Guest Lecturer, Econ 1000: Growth, Technology, Inequality, Education</i>	<i>Fall 2017</i>
<i>Guest Lecturer, CS 189: Autonomous Robot Systems</i>	<i>Spring 2016</i>
<i>Guest Lecturer, ES 158: Feedback Systems</i>	<i>Fall 2015</i>
<i>Guest Lecturer, CS 182: Artificial Intelligence</i>	<i>Fall 2015</i>
<b>Massachusetts Institute of Technology</b>	Cambridge, MA
<i>Guest Lecturer, 6.832: Underactuated Robotics</i>	<i>Fall 2014</i>
<b>University of Massachusetts Amherst</b>	Amherst, MA
<i>Teaching Assistant, CS 187: Data Structures</i>	<i>Fall 2006</i>
<i>Guest Lecturer, CS 603: Robotics</i>	<i>Fall 2009</i>

## ADVISING

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### Postdoctoral Research Fellows

Zachary Manchester (PhD, Cornell)	<i>Oct 2015–Present</i>
Myunghee Kim (PhD, CMU)	<i>Apr 2016–Present</i>
Ye Zhao (PhD, UT)	<i>Nov 2016–Present</i>

### PhD Students

Irina Tolkova, Applied Mathematics (G1)	<i>Sep 2017–Present</i>
Mark Petersen, Mechanical Engineering (G1)	<i>Sep 2017–Present</i>
Patrick Varin, Computer Science (G2)	<i>Sep 2016–Present</i>
Zachary Zieper, Mechanical Engineering (G2)	<i>Sep 2016–Present</i>

### ME Students

Brian Plancher, Electrical Engineering (G2)	<i>Sep 2016–Present</i>
Charles Liu, Applied Computation (G3)	<i>May 2016–Present</i>

### Undergraduate Theses

Timothy Tamm, Computer Science	<i>May 2018 (expected)</i>
Jenny Horing, Mechanical Engineering	<i>May 2018 (expected)</i>
Brian Krentz, Electrical Engineering (Dean's Award Honorable Mention)	<i>May 2017</i>
Ivan Cisneros, Electrical Engineering (Dean's Award Honorable Mention)	<i>Dec 2016</i>

**PhD Thesis Committee:** Michael Neunert (ETH Zurich, 2017), Benjamin Goldberg (Harvard, 2017)

## AWARDS AND RECOGNITION

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Sony Faculty Innovation Award	<i>Jun 2017</i>
Best 2016 Paper Award, IEEE-RAS Technical Committee on Whole-Body Control	<i>May 2017</i>
Google Faculty Research Award	<i>Feb 2017</i>
NSF CISE Research Initiation Initiative Award	<i>Jan 2017</i>
MIT Technology Review Breakthrough Technologies of 2014 (feat. our control work)	<i>Jun 2014</i>
DARPA Robotics Challenge Finalist, with Team MIT as the Controls Lead	<i>Dec 2013</i>
NASA Graduate Fellowship	<i>Sept 2009–Aug 2012</i>
Best Spotlight Talk & Electronic Poster, Robotics: Science & Systems (RSS)	<i>July 2012</i>
National ICT Australia (NICTA) Student Fellowship, RSS	<i>July 2012</i>
Best Student Video, AAAI 2011 Video Competition	<i>Aug 2011</i>
Massachusetts Space Grant Fellowship	<i>Sept 2008 &amp; June 2009</i>
George J. Kelley Award, Bryant University (ranked 1 <sup>st</sup> in graduating class of over 700)	<i>May 2006</i>

## JOURNAL PAPERS

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1. M. Kim, Y. Ding, P. Malcolm, J. Speeckaert, C. Siviyy, C. Walsh, and S. Kuindersma, Human-in-the-loop Bayesian optimization of wearable device parameters, *PLoS ONE* 12(9): e0184054, 2017.
2. P. Marion, R. Deits, A. Valenzuela, C. Perez D'Arpino, G. Izatt, L. Manuelli, M. Antone, H. Dai, T. Koolen, J. Carter, M. Fallon, S. Kuindersma, R. Tedrake. Director: A User Interface Designed for Robot Operation with Shared Autonomy, *Journal of Field Robotics*, December 2016.
3. S. Kuindersma, R. Deits, M. Fallon, A. Valenzuela, H. Dai, F. Permenter, T. Koolen, P. Marion, R. Tedrake. Optimization-based Locomotion Planning, Estimation, and Control Design for the Atlas Humanoid Robot, *Autonomous Robots*, 40(3):429-455, February 2016. **Voted Best 2016 Paper by IEEE-RAS Technical Committee on Whole-Body Control.**
4. M. Fallon, S. Kuindersma, S. Karumanchi, M. Antone, T. Schneider, H. Dai, C. Pérez D'Arpino, R. Deits, M. DiCiccio, D. Fourie, T. Koolen, P. Marion, M. Posa, A. Valenzuela, K. Yu, J. Shah, K. Iagnemma, R. Tedrake, S. Teller. An Architecture for Online Affordance-based Perception and Whole-body Planning, *Journal of Field Robotics*, 32(2):229-254, March 2015.
5. S. Kuindersma, R.A. Grupen, and A.G. Barto. Variable Risk Control via Stochastic Optimization. *International Journal of Robotics Research*, 32(7):806-825, June 2013.
6. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. Robot Learning from Demonstration by Constructing Skill Trees. *International Journal of Robotics Research*, 31(3):360-375, March 2012.
7. B.S. Blais, M.Y. Frenkel, S. Kuindersma, R. Muhammad, H.Z. Shouval, L.N. Cooper, and M.F. Bear. Recovery from monocular deprivation using binocular deprivation: Experimental observations and theoretical analysis. *J Neurophysiol*, 100(4):2217-2224, October 2008.
8. S. Kuindersma and B.S. Blais. Teaching Bayesian Model Comparison With the Three-Sided Coin. *The American Statistician*, 61(3):239-244, August 2007.

## CONFERENCE PAPERS

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9. Z. Manchester and S. Kuindersma, Variational Contact-Implicit Trajectory Optimization, In *Proceedings of the International Symposium on Robotics Research (ISRR)*, Puerto Varas, Chile, 2017.
10. B. Plancher, Z. Manchester, and S. Kuindersma, Constrained Unscented Dynamic Programming, In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Vancouver, BC, September 2017.
11. Z. Manchester and S. Kuindersma, DIRTREL: Robust Trajectory Optimization with Ellipsoidal Disturbances and LQR Feedback, *Robotics: Science and Systems (RSS)*, Cambridge, MA, 2017.
12. Z. Manchester, J. I. Lipton, R. J. Wood, and S. Kuindersma, A Variable Forward-Sweep Wing Design for Improved Perching in Micro Aerial Vehicles, In *Proceedings of the 55th AIAA Aerospace Sciences Meeting, AIAA SciTech Forum*, January 2017.
13. Z. Manchester and S. Kuindersma. Derivative-Free Trajectory Optimization using Unscented Dynamic Programming, In *Proceedings of the 55th Conference on Decision and Control (CDC)*, Las Vegas, NV, December 2016.
14. M. Posa, S. Kuindersma, R. Tedrake. Optimization and stabilization of trajectories for constrained dynamical systems, In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Stockholm, Sweden, May 2016.
15. R. Tedrake, S. Kuindersma, R. Deits, K. Miura. A closed-form solution for real-time ZMP gait generation and feedback stabilization, In *Proceedings of the International Conference on Humanoid Robotics*, October 2015.
16. S. Kuindersma, F. Permenter, and R. Tedrake. An Efficiently Solvable Quadratic Program for Stabilizing Dynamic Locomotion. In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Hong Kong, China, May 2014.

17. S. Kuindersma, R.A. Grupen, and A.G. Barto. Variational Bayesian Optimization for Runtime Risk-Sensitive Control. In *Robotics: Science and Systems VIII (RSS)*, Sydney, Australia, July 2012. **Best Spotlight Talk and Poster Award.**
18. S. Kuindersma, R.A. Grupen, and A.G. Barto. Learning Dynamic Arm Motions for Postural Recovery. In *Proceedings of the 11th IEEE-RAS International Conference on Humanoid Robots*, Bled, Slovenia, October 2011. **Selected for oral presentation.**
19. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. Autonomous Skill Acquisition on a Mobile Manipulator. In *Proceedings of the 25th Conference on Artificial Intelligence (AAAI-11)*, San Francisco, CA, August 2011.
20. G.D. Konidaris, S. Kuindersma, A.G. Barto, and R.A. Grupen. Constructing Skill Trees for Reinforcement Learning Agents from Demonstration Trajectories. In *Advances in Neural Information Processing Systems 23 (NIPS)*, Vancouver, BC, December 2010.
21. S. Kuindersma, E. Hannigan, D. Ruiken, and R.A. Grupen. Dexterous Mobility with the uBot-5 Mobile Manipulator. In *Proceedings of the 14th International Conference on Advanced Robotics*, Munich, Germany, June 2009.

## WORKSHOP PAPERS AND ABSTRACTS

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22. Z. Manchester and S. Kuindersma. Variational Contact-Implicit Trajectory Optimization, (extended abstract), In *RSS 2017 Workshop on Revisiting Contact*, Cambridge, MA, July 2017.
23. M. Posa, S. Kuindersma, R. Tedrake. Whole-Body Dynamic Planning and Stabilization with Contact. *Dynamic Walking*, Columbus, Ohio, July 2015.
24. R. Tedrake, M. Fallon, S. Karumanchi, S. Kuindersma, M. Antone, T. Schneider, T. Howard, M. Walter, H. Dai, R. Deits, M. Fleder, D. Fourie, R. Hammoud, S. Hemachandra, P. Iardi, C. Perez-D'Arpino, S. Pillai, A. Valenzuela, C. Cantu, C. Dolan, I. Evans, S. Jorgensen, J. Kristeller, J. Shah, K. Iagnemma, S. Teller. A Summary of Team MIT's Approach to the Virtual Robotics Challenge. In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, Hong Kong, China, May 2014.
25. G.D. Konidaris, S. Kuindersma, S. Niekum, R.A. Grupen, and A.G. Barto. Robot Learning: Some Recent Examples. In *Proceedings of the Sixteenth Yale Workshop on Adaptive and Learning Systems*, Yale University, New Haven CT, June 2013.
26. S. Kuindersma, R.A. Grupen, and A.G. Barto. Learning to Exploit Dynamics with Variable Risk Policy Search. In *RSS 2012 Workshop on Biologically-Inspired Robotics*, Sydney, Australia, July 2012.
27. S. Kuindersma, R.A. Grupen, and A.G. Barto. Variable Risk Dynamic Mobile Manipulation. In *RSS 2012 Mobile Manipulation Workshop*, Sydney, Australia, July 2012.
28. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. CST: Constructing Skill Trees by Demonstration. In *Proceedings of the ICML Workshop on New Developments in Imitation Learning*, Bellevue, WA, July 2011.
29. G.D. Konidaris, S. Kuindersma, R.A. Grupen, and A.G. Barto. Acquiring Transferrable Mobile Manipulation Skills. In *RSS 2011 Workshop on Mobile Manipulation: Learning to Manipulate*, Los Angeles, CA, June 2011.
30. S. Kuindersma, G.D. Konidaris, R.A. Grupen, and A.G. Barto. Learning from a Single Demonstration: Motion Planning with Skill Segmentation. In *NIPS Workshop on Learning and Planning from Batch Time Series Data*, Whistler, BC, December 2010.
31. S. Kuindersma. Control Model Learning for Whole-Body Mobile Manipulation (extended abstract). In *Proceedings of the Twenty-Fourth Conference on Artificial Intelligence (AAAI-10)*, Atlanta, GA, July 2010.

32. B.S. Blais and S. Kuindersma. A Hierarchical Spatiotemporal Model of Neocortex with Probabilistic Feedback. In *Proceedings of the 12th International Conference on Cognitive and Neural Systems (ICCN 2008)*, Boston, MA, May 2008.
33. B.S. Blais and S. Kuindersma. Developing receptive fields in spiking-rate models of synaptic plasticity. In *Society for Neuroscience Conference Abstracts*, Washington, DC, November 2005.
34. B.S. Blais, M.Y. Frenkel, S. Kuindersma, and M.F. Bear. Exploring the roles of structure and noise in the mouse visual system. In *Proceedings of the 9th International Conference on Cognitive and Neural Systems (ICCN 2005)*, Boston, MA, May 2005.

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## THESES AND BOOK CHAPTERS

35. P.-B. Wieber, R. Tedrake, and S. Kuindersma. Modeling and Control of Legged Systems, *Springer Handbook of Robotics, 2nd Ed.*, 2016.
36. S. Kuindersma. Variable Risk Policy Search for Dynamic Robot Control. PhD Thesis, Department of Computer Science, University of Massachusetts Amherst, September 2012.

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## TECHNICAL REPORTS

37. S. Kuindersma, R.A. Grupen, and A.G. Barto. Episodic Risk-Sensitive Actor-Critic. Technical Report UM-CS-2012-017, Department of Computer Science, University of Massachusetts Amherst, June 2012.

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## INVITED TALKS AND PANELS

IROS-17 Workshop on Planning Legged and Aerial Locomotion, Vancouver, BC	<i>Sept 2017</i>
MIT, 1st Summer School on Cognitive Robotics, Cambridge, MA	<i>June 2017</i>
Johns Hopkins Applied Physics Laboratory, Baltimore, MD	<i>April 2017</i>
ETH Zurich, DLMC, Switzerland	<i>July 2016</i>
ICML Workshop on On-Device Intelligence, New York, NY	<i>June 2016</i>
Boston Dynamics, Waltham, MA	<i>March 2016</i>
Informatics Optimization Society Conference, Princeton University	<i>March 2016</i>
Northeast Robotics Colloquium (Keynote), WPI, Worcester, MA	<i>Nov 2015</i>
University of Washington, Computer Science and Engineering Colloquium	<i>March 2015</i>
Harvard University, SEAS Seminar	<i>March 2015</i>
Georgia Institute of Technology, Interactive Computing Seminar	<i>March 2015</i>
California Institute of Technology, Mechanical and Civil Engineering Seminar	<i>March 2015</i>
Worcester Polytechnic Institute, Robotics Engineering Colloquium	<i>Feb 2015</i>
University of Massachusetts Amherst, Computer Science Seminar	<i>Feb 2015</i>
Boston University, Mechanical Engineering Seminar	<i>Feb 2015</i>
Northeastern University, Computer and Information Science Colloquium	<i>Feb 2015</i>
University of Michigan, Engineering Seminar, Ann Arbor, MI	<i>Sept 2014</i>
Panelist, NASA Blue Sky Meeting on Robotics for Exploration Missions, Pensacola, FL	<i>Sept 2014</i>
RSS Workshop on Dynamic Locomotion, Berkeley, CA	<i>July 2014</i>
ICRA Workshop on Hydraulic Robots, Hong Kong, China	<i>June 2014</i>
IHMC Workshop on Humanoid Control	<i>March 2014</i>
RSS Workshop on the Virtual Robotics Challenge, Berlin	<i>June 2013</i>
MIT, CSAIL Seminar, Cambridge, MA	<i>Aug 2012</i>
University of Texas at Austin, Mechanical Engineering Seminar, Austin, TX	<i>June 2012</i>

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## PROFESSIONAL SERVICE

- *Publication Chair*: Robotics: Science and Systems (RSS), 2017

- *Co-organizer*: RSS-17 Workshop on Challenges in Dynamic Legged Locomotion; Humanoids-15 Workshop on Reusable and Open-Source Modules for Humanoid Robots; RSS-14 Workshop on the DARPA Robotics Challenge
- *Editor*: IJRR Special Issue on Robotics: Science and Systems 2017
- *Associate Editor*: ICRA-17, HUMANOIDS 2015–17
- *Assistant Editor*: Robotics & Autonomous Systems, 2009–2013
- *Senior Program Committee*: IJCAI-15
- *Program Committee*: RSS-17, WAFR-16, AAI-17 Video Awards, AAI-13, IJCAI-13, NEMS-10
- *Journal/book chapter reviewing*: IJRR, IEEE TRO, Autonomous Robots, Journal of Field Robotics, JAIR, JMLR, IEEE Transactions on Mechatronics, Robotics & Autonomous Systems, IEEE Robotics and Automation Letters, Neural Computation, Geometric and Numerical Foundations of Movement, Journal of Aerospace Science and Technology
- *Conference reviewing*: ICRA, IROS, WAFR, RSS, Humanoids, ISRR, AAI, IJCAI, AAI SSS, Control of Cyber-Physical Systems, NESCAI
- *Book proposal reviewing*: MIT Press, CRC Press
- *Student Volunteer*: AAI-11
- *Member*: AAAS, IEEE, ASEE, IEEE Controls Society, IEEE Robotics and Automation Society (RAS), IEEE Technical Committee on Cyber Physical Systems, IEEE-RAS Technical Committees on Mobile Manipulation, Whole-Body Control, and Model-Based Optimization for Robotics

## HARVARD SERVICE

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- Faculty Advisor for the Harvard Undergraduate Robotics Club, Fall 2016–Present
- Computing Advisory Committee, AY 2017-18
- Tenure Track Search Committee Member, Electrical Engineering, AY 2016-17
- Tenure Track Search Committee Member, Biomechanics and Neuromotor Control, AY 2017-18
- Committee on Higher Degrees (CHD) (Applied Math/Computer Science), AY 2016-17
- Selection Committee, Herchel-Smith Summer Undergraduate Science Research Program, 2016, 2017
- Speaker, *Our Campus Our World* event, March 2017
- Panelist, Harvard Global Advisory Council Meeting, October 2015

## OUTREACH AND MEDIA

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- Volunteer Judge at the 4th Annual International Development Hackathon, Tufts University, Medford, MA, February 2016
- Technology Review article entitled “Agile Robots” highlighted our work on balance control with Atlas, April 2014
- Technology Review article entitled “Readying Robots for the Real World” discussed our efforts toward making Atlas a reliable disaster response machine, June 2014
- Several research videos featured by Engadget, Gizmodo, IEEE Spectrum Video Friday, and Tech Crunch (over 200,000 total views), 2013–2015
- MIT EECS Connector article, “Team MIT takes on the DARPA Robotics Challenge,” Spring 2014
- Robot Magazine article entitled “Service Oriented Architectures” highlighted our work with the uBot-5, February 2011
- Spoke to Boston Public High School students about robotics, April 2014