

Scott Niekum

Assistant Professor
Department of Computer Science
The University of Texas at Austin

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Academic Employment

Assistant Professor Aug. 2015 – present
The University of Texas at Austin, Department of Computer Science

Postdoctoral Research Fellow Aug. 2013 – Aug. 2015
Carnegie Mellon University, The Robotics Institute
Mentor: Christopher G. Atkeson

Education

Doctor of Philosophy Sept. 2009 – Sept. 2013
Computer Science Department, University of Massachusetts Amherst
Dissertation: *Semantically Grounded Learning from Unstructured Demonstrations*
Advisor: Professor Andrew G. Barto

Master of Science Feb. 2010
Computer Science Department, University of Massachusetts Amherst

Bachelor of Science with Honors Sept. 2001 – May 2005
School of Computer Science, Carnegie Mellon University
Additional major in Cognitive Science

Teaching

- **The University of Texas at Austin**

- CS 395T: *Robot Learning*, Fall 2015, Fall 2016, Fall 2017
Average instructor rating: **4.9/5.0**

- CS 343: *Artificial Intelligence*, Spring 2017, Spring 2018, Fall 2018, Spring 2019
Average instructor rating: **4.5/5.0**

Grants and Awards

- **PI: UT Austin Good Systems Grand Challenge**

Probabilistically Safe and Correct Imitation Learning

Award amount: \$100,000

Dates: June 1, 2019 – May 31, 2020

- **Co-PI: Amazon Research Award**

Language-Aided Learning from Demonstration

Award amount: \$55,000

Dates: Mar 1, 2019 – Feb 28, 2020

- **PI: NSF CAREER Award**

IIS-1749204: *Safe and Efficient Robot Learning from Demonstration in the Real World*

Award amount: \$524,605

Dates: June 1, 2018 – May 31, 2023

- **PI: NSF – Smart and Autonomous Systems**

IIS-1724157: *Socially-Aware Autonomy for Long-Term Deployment of Always-On Heterogeneous Robot Teams*

Award amount: \$1,378,736

Dates: June 1, 2017 – May 31, 2021

- **Co-PI: Office of Naval Research**

Off-Policy Evaluation for Grounded Simulation Learning

Award amount: \$900,000

Dates: May 1, 2017 – April 30, 2021

- **PI: NSF – National Robotics Initiative**

IIS-1638107: *Scalable Robot Autonomy through Remote Operator Assistance and Lifelong Learning*

Award amount: \$486,276

Dates: Sept 1, 2016 – Aug 31, 2019

- **PI: NSF – Robust Intelligence**

IIS-1617639: *High Confidence, Efficient Learning Under Rich Task Specifications*

Award amount: \$470,000

Dates: Aug 1, 2016 – July 31, 2019

- **PI: NSF – National Robotics Initiative**

IIS-1208497: *Multiple Task Learning from Unstructured Demonstrations*

Award amount: \$499,911

Dates: Oct 1, 2012 – Sept 30, 2016

- **National Science Foundation CAREER Award, 2018.**

- Robocup@Home Domestic Standard Platform League, Third Place. Nagoya, Japan, July 2017. (Team Co-PI)

- Peter O'Donnell, Jr. Computer Sciences Endowed Faculty Fellowship, Sept 1, 2015 – Aug 31, 2020.
- NSF Graduate Research Fellowship Program, honorable mention, 2009, 2010.
- Carnegie Mellon Alumni Award for Excellence in Undergraduate Research, 2005.

Invited Talks and Panels

- UC Berkeley CPAR/DREAMS Seminar. *Scaling Probabilistically Safe Learning to Robotics*. Berkeley, CA. April 2019.
- Toyota Technological Institute. *Scaling Probabilistically Safe Learning to Robotics*. Chicago, IL. November 2018.
- Time Machine AI Conference. *Where's my Robot: Challenges and Progress in Personal Robotics*. Austin, TX. November 2018.
- Army Research Lab. *Efficient and Safe Learning from Demonstration*. Adelphi, MD. November 2017.
- Distinguished Speaker, Association for Computing Machinery (ACM) Annual Banquet, Lamar University. *"But What About Skynet?": Separating Fact from Fiction in Artificial Intelligence*. Beaumont, TX. April 2017.
- Panelist, *Beyond BB-8: When Robots Start Acting Human*. South by Southwest Interactive Track. Austin, TX. March 2017.
- Panelist, *Science Writing: Inside AI*. National Association of Science Writers Conference. San Antonio, TX. October 2016.
- Northwestern University. *Discovering Structure in Robotics Tasks via Demonstrations and Active Learning*. Evanston, IL. October 2016.
- INRIA Workshop on Algorithmic Human-Robot Interaction. *Non-Policy Learning from Demonstration and Interaction*. Paris, France. July 2016.
- TTI / Vanguard Conference on "Big Understanding". *From Robot Learning to Embodied Understanding*. Austin, TX. February 2016.
- AI for Human-Robot Interaction Symposium, AAAI Fall Symposium Series. *Discovering Structure in Robotics Tasks via Demonstrations and Active Learning*. Arlington, VA. November 2015.
- Brown University. *Online Bayesian Changepoint Detection for Articulated Motion Models*. Providence, RI. October 2014.
- University of Michigan. *Online Bayesian Changepoint Detection for Articulated Motion Models*. Ann Arbor, MI. September 2014.
- Georgia Institute of Technology. *Online Bayesian Changepoint Detection for Articulated Motion Models*. Atlanta, GA. August 2014.

- University of Southern California. *Grounded Learning from Unstructured Demonstrations*. Los Angeles, CA. May 2014.
- Worcester Polytechnic Institute. *Online Bayesian Changepoint Detection for Articulated Motion Models*. Worcester, MA. May 2014.
- Carnegie Mellon University. *Semantically Grounded Learning from Unstructured Demonstrations*. Pittsburgh, PA. April 2013.
- Massachusetts Institute of Technology. *Semantically Grounded Learning from Unstructured Demonstrations*. Cambridge, MA. March 2013.

Professional Activities

Event Organizing

- Organizer, *RSS 2019 Workshop on Robust Autonomy: Safe Robot Learning and Control in Uncertain Real-World Environments*, July 2019.
- Co-chair, *AAAI 2017 video competition*, February 2017.
- Organizer, *RSS 2016 Workshop on Bootstrapping Manipulation Skills*, July 2016.
- Organizer, *AAAI 2015 Tutorial on Robot Learning from Demonstration*, January 2015.
- Organizer, *RSS 2013 Workshop on Human-Robot Collaboration*, June 2013.

Area Chair / Associate Editor

- International Conference on Learning Representations (2019)
- IEEE International Conference on Robotics and Automation (2019)
- AAAI Conference on Artificial Intelligence (2018)

Senior Program Committee

- AAAI Conference on Artificial Intelligence (2017)
- International Joint Conference on Artificial Intelligence (2016)

Conference Reviewing / Program Committee

- Neural Information Processing Systems (2019, 2018, 2015, 2011)
- Robotics: Science and Systems (2019, 2018, 2017, 2015, 2014)
- The Multi-Disciplinary Conference on Reinforcement Learning and Decision Making (2019)

- IEEE International Conference on Robotics and Automation (2018, 2017, 2016, 2015, 2014)
- Conference on Robot Learning (2018)
- International Conference on Intelligent Robots and Systems (2018, 2017, 2015, 2014, 2013)
- International Conference on Human Robot Interaction (2017, 2012, 2013)
- International Conference on Humanoid Robots (2014)
- AAAI Special Robotics Track (2013)
- International Joint Conference on Artificial Intelligence (2013)
- AAAI Spring Symposium (2013)
- North East Student Colloquium on Artificial Intelligence (2010)

Journal Reviewing

- International Journal of Robotics Research (2018, 2017, 2016)
- Autonomous Agents and Multi-Agent Systems (2016, 2015, 2014)
- IEEE Robotics and Automation Letters (2015)
- Artificial Intelligence (2014)
- Frontiers in Computational Neuroscience (2013)
- IEEE Transactions on Autonomous Mental Development (2013)
- IEEE Transactions on Systems, Man, and Cybernetics (2013, 2012)
- Journal of Machine Learning Research (2011)
- Neurocomputing (2010)

Departmental and University Service

- Faculty Search Committee, Chair (2018/2019)
- Doctoral Admissions Committee, Member (2017/2018)
- Faculty Evaluation Committee (2017)
- College of Natural Sciences 21st Century Curriculum Planning Implementation Task Force (2016–2017)
- Doctoral Admissions Committee, Co-chair (2016/2017)
- Doctoral Admissions Committee, Member (2015/2016)
- Robotics Seminar Series, Co-organizer (2015–2018)

Outreach

- Exhibitor, Explore UT (2018)
- Speaker, Code Longhorn computer science camp for underrepresented high school students (2016–2018)
- Speaker, First Bytes computer science camp for high school women (2016–2018)
- Faculty Volunteer, Women in CS Faculty Lunch Program (2017)

Advising and Thesis Committees

PhD Supervisor (The University of Texas at Austin, unless stated otherwise)

- Akanksha Saran, Department of Computer Science (Fall 2015–)
- Yuchen Cui, Department of Computer Science (Fall 2015–)
- Ajinkya Jain, Department of Mechanical Engineering (Spring 2016–)
- Daniel Brown, Department of Computer Science (Fall 2016–)
- Raymundo Gutierrez, Department of Computer Science (Co-Advised with Andrea Thomaz, Fall 2016–)
- Wonjoon Goo, Department of Computer Science (Fall 2016–)
- Caleb Chuck, Department of Computer Science (Fall 2017–)
- Prasoon Goyal, Department of Computer Science (Co-advised with Ray Mooney, Spring 2017–)

Masters Thesis Supervisor

- Joel Iventosch, Department of Computer Science
A Deep Learning Framework for Model-free 6 Degree of Freedom Object Tracking (Fall 2015—Spring 2017)

Undergraduate Honors Turing Thesis Supervisor

- Rohan Ramchand, Department of Computer Science
An Artificial Intelligence Approach to Redistricting (Spring 2017–Fall 2017)

Doctoral Committee Member

- Yu-Chuan Su, Computer Science. Supervisor: Kristen Grauman
Learning for 360 Video Compression, Recognition, and Display

- Bo Xiong, Computer Science. Supervisor: Kristen Grauman
Learning to Compose Photos from Passive Cameras
- Josiah Hanna, Computer Science. Supervisor: Peter Stone
Data Efficient Reinforcement Learning with Off-Policy and Simulated Data
- Matthew Horn, Mechanical Engineering. Supervisor: Sheldon Landsberger
Trust and Safety in Robotic Applications
- Adam Allevato, Electrical and Computer Engineering. Supervisor: Andrea Thomaz
- Pravesh Ranchod, Computer Science, University of the Witwatersrand. Supervisor: George Konidaris
Skill Discovery from Multiple Related Demonstrators
- Lijia Liu, Computer Science. Supervisor: Dana Ballard
Cognitive Control of Motor Synergies
- Alex Broad, Department of Electrical Engineering and Computer Science, Northwestern University. Supervisor: Brenna Argall
Model-Based Shared Control of Human-Machine Systems with Unknown Dynamics
- Jesse Thomason, Computer Science. Supervisor: Raymond Mooney
Continuously Improving Natural Language Understanding for Robotic Systems through Semantic Parsing, Dialog, and Multi-modal Perception
- Sanmit Narvekar, Computer Science. Supervisor: Peter Stone
Curriculum Learning in Reinforcement Learning
- Elad Liebman, Computer Science. Supervisor: Peter Stone
Sequential Decision Making in Artificial Musical Intelligence
- Dinesh Jayaraman, Computer Science. Supervisor: Kristen Grauman
Embodied Learning For Visual Recognition
- Jake Menashe, Computer Science. Supervisor: Peter Stone
Intrinsically-motivated Hierarchical Reinforcement Learning
- Suyog Jain, Computer Science. Supervisor: Kristen Grauman
Active Image and Video Segmentation
- Patrick MacAlpine, Computer Science. Supervisor: Peter Stone
Multilayered Skill Learning and Movement Coordination for Autonomous Robotic Agents in Spatial Domains
- Kai-Yang Chiang, Computer Science. Supervisor: Inderjit Dhillon
Analysis of Dyadic Interactions Using Machine Learning Methods
- Piyush Khandelwal, Computer Science. Supervisor: Peter Stone
On-Demand Coordination of Multiple Service Robots
- Reza Mahjourian, Computer Science. Supervisor: Risto Miikkulainen
Neuroevolutionary Planning for Robotic Control

- Aditya Rawal, Computer Science. Supervisor: Risto Miikkulainen
Evolving Neural Networks for Sequence Processing
- Parham Pournazari, Mechanical Engineering. Supervisor: Eric van Oort
Real-time Learning of Dynamical Drilling Models for Event Detection and Robust Optimal Control

Master's Committee Member

- Prabhat Nagarajan, Computer Science. Supervisor: Peter Stone
Nondeterminism as a Reproducibility Challenge for Deep Reinforcement Learning

Undergraduate Honors Turing Thesis Committee Member

- Brahma Pavse, Computer Science. Supervisor: Peter Stone
Reinforced Inverse Dynamics Modeling for Learning from a Single Observed Demonstration
- Harsh Goyal, Computer Science. Supervisor: Peter Stone
Holistic Action Transforms
- Kamil Ali, Computer Science. Supervisor: Philipp Krahenbuhl
Can We Predict Actions Independent of the Actor?

Publications

Highly Refereed Journal and Conference Publications

1. D. Brown, W. Goo, P. Nagarajan, and **S. Niekum**. Extrapolating Beyond Suboptimal Demonstrations via Inverse Reinforcement Learning from Observations. International Conference on Machine Learning (ICML), June 2019.
2. J.P. Hanna, **S. Niekum**, and P. Stone. Importance Sampling Policy Evaluation with an Estimated Behavior Policy. International Conference on Machine Learning (ICML), June 2019.
3. W. Goo and **S. Niekum**. One-Shot Learning of Multi-Step Tasks from Observation via Activity Localization in Auxiliary Video. IEEE International Conference on Robotics and Automation (ICRA), May 2019.
4. Y. Cui, D. Isele, **S. Niekum**, and K. Fujimura. Uncertainty-Aware Data Aggregation for Deep Imitation Learning. IEEE International Conference on Robotics and Automation (ICRA), May 2019.
5. D. Brown and **S. Niekum**. Machine Teaching for Inverse Reinforcement Learning: Algorithms and Applications. AAAI Conference on Artificial Intelligence, February 2019.
6. A. Jain and **S. Niekum**. Efficient Hierarchical Robot Motion Planning Under Uncertainty and Hybrid Dynamics. Conference on Robot Learning (CoRL), October 2018.

7. D.S. Brown, Y. Cui, and **S. Niekum**. Risk-Aware Active Inverse Reinforcement Learning. Conference on Robot Learning (CoRL), October 2018.
8. A. Saran, S. Majumdar, E.S. Short, A.L. Thomaz, and **S. Niekum**. Human Gaze Following for Human-Robot Interaction. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), October 2018.
9. Y. Cui and **S. Niekum**. Active Reward Learning from Critiques. IEEE International Conference on Robotics and Automation (ICRA), May 2018.
10. R.A. Gutierrez, V. Chu, A.L. Thomaz, and **S. Niekum**. Incremental Task Modification via Corrective Demonstrations. IEEE International Conference on Robotics and Automation (ICRA), May 2018.
11. D.S. Brown and **S. Niekum**. Efficient Probabilistic Performance Bounds for Inverse Reinforcement Learning. AAAI Conference on Artificial Intelligence, February 2018.
12. M. Alshiekh, R. Bloem, R. Ehlers, B. Könighofer, **S. Niekum**, and U. Topcu. Safe Reinforcement Learning via Shielding. AAAI Conference on Artificial Intelligence, February 2018.
13. A. Saran, B. Lakic, S. Majumdar, J. Hess, and **S. Niekum**. Viewpoint Selection for Visual Failure Detection. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), September 2017.
14. H.A. Poonawala, M. Alshiekh, **S. Niekum**, and U. Topcu. Classification Error Correction: A Case Study in Brain-Computer Interfacing. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), September 2017.
15. J.P. Hanna, P.S. Thomas, P. Stone, and **S. Niekum**. Data-Efficient Policy Evaluation Through Behavior Policy Search. Proceedings of the 34th International Conference on Machine Learning (ICML), August 2017.
16. J.P. Hanna, P. Stone, and **S. Niekum**. Bootstrapping with Models: Confidence Intervals for Off-Policy Evaluation. Proceedings of the 16th International Conference on Autonomous Agents and Multiagent Systems (AAMAS), May 2017.
17. P. Khandelwal, E. Liebman, **S. Niekum**, and P. Stone. On the Analysis of Complex Backup Strategies in Monte Carlo Tree Search. International Conference on Machine Learning (ICML), June 2016.
18. P.S. Thomas, **S. Niekum**, G. Theodorou, and G.D. Konidaris. *Policy Evaluation Using the Omega-Return*. Advances in Neural Information Processing Systems (NIPS), December 2015.
19. **S. Niekum**, S. Osentoski, C.G. Atkeson, and A.G. Barto. *Online Bayesian Changepoint Detection for Articulated Motion Models*. IEEE International Conference on Robotics and Automation (ICRA), May 2015.
20. K. Hausman, **S. Niekum**, S. Osentoski, and G. Sukhatme. *Active Articulation Model Estimation through Interactive Perception*. IEEE International Conference on Robotics and Automation (ICRA), May 2015.
21. **S. Niekum**, S. Osentoski, G.D. Konidaris, S. Chitta, B. Marthi, and A.G. Barto. *Learning Grounded Finite-State Representations from Unstructured Demonstrations*. International Journal of Robotics Research (IJRR), January 2015.

22. **S. Niekum**, S. Osentoski, S. Chitta, B. Marthi, and A.G. Barto. *Incremental Semantically Grounded Learning from Demonstration*. Robotics: Science and Systems (RSS), June 2013.
23. **S. Niekum**, S. Osentoski, G.D. Konidaris, and A.G. Barto. *Learning and Generalization of Complex Tasks from Unstructured Demonstrations*. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), October 2012.
24. **S. Niekum** and A.G. Barto. *Clustering via Dirichlet Process Mixture Models for Portable Skill Discovery*. Advances in Neural Information Processing Systems (NIPS), December 2011.
25. G.D. Konidaris, **S. Niekum**, and P.S. Thomas. *TD_γ: Reevaluating Complex Backups in Temporal Difference Learning*. Advances in Neural Information Processing Systems (NIPS), December 2011.
26. **S. Niekum**, A.G. Barto, L. Spector. *Genetic Programming for Reward Function Search*. IEEE Transactions on Autonomous Mental Development, vol.2, no.2, pp.83-90, June 2010.
27. D.R. Thompson, **S. Niekum**, T. Smith, and D. Wettergreen. *Automatic Detection and Classification of Geological Features of Interest*. IEEE Aerospace Conference, March 2005.
28. T. Smith, **S. Niekum**, D.R. Thompson, and D. Wettergreen. *Concepts for Science Autonomy During Robotic Traverse and Survey*. IEEE Aerospace Conference, March 2005.

Lightly Refereed Workshops, Symposia, and Posters

29. D.S. Brown and **S. Niekum**. *Toward Probabilistic Safety Bounds for Robot Learning from Demonstration*. AAAI Fall Symposium on Artificial Intelligence for Human-Robot Interaction, November 2017.
30. Y. Cui and **S. Niekum**. *Active Learning from Critiques via Bayesian Inverse Reinforcement Learning*. Robotics: Science and Systems (R:SS) Workshop on Mathematical Models, Algorithms, and Human-Robot Interaction, July 2017.
31. T.K. Faulkner, A.L. Thomaz, and **S. Niekum**. *Robot Dialog Optimization via Modeling of Human Belief Updates*. Robotics: Science and Systems (R:SS) Workshop on Robot Communication in the Wild, July 2017.
32. R.A. Gutierrez, V. Chu, A.L. Thomaz, and **S. Niekum**. *Incremental Task Model Updates from Demonstration*. Robotics: Science and Systems (R:SS) Workshop on Mathematical Models, Algorithms, and Human-Robot Interaction, July 2017.
33. A. Jain and **S. Niekum**. *Belief Space Planning under Approximate Hybrid Dynamics*. Robotics: Science and Systems (R:SS) Workshop on POMDPs in Robotics, July 2017.
34. A. Saran and **S. Niekum**. *Visual Grounding of Spatial Relationships for Failure Detection*. Robotics: Science and Systems (R:SS) Workshop on Spatial-Semantic Representations in Robotics, July 2017.
35. **S. Niekum**, S. Osentoski, C.G. Atkeson, A.G. Barto. *Learning Articulation Changepoint Models from Demonstration*. RSS Workshop on Learning Plans with Context from Human Signals. July 2014.
36. G.D. Konidaris, S. Kuindersma, **S. Niekum**, R.A. Grupen and A.G. Barto. *Robot Learning: Some Recent Examples*. The Sixteenth Yale Workshop on Adaptive and Learning Systems, June 2013.

37. **S. Niekum.** *An Integrated System for Learning Multi-Step Robotic Tasks from Unstructured Demonstrations.* AAAI Spring Symposium: Reintegrating AI II, March 2013.
38. **S. Niekum.** *Complex Task Learning from Unstructured Demonstrations.* AAAI Doctoral Consortium, July 2012.
39. **S. Niekum** and A.G. Barto. *Clustering via Dirichlet Process Mixture Models for Portable Skill Discovery.* AAAI Workshop on Lifelong Learning from Sensorimotor Experience, August 2011.
40. **S. Niekum**, L. Spector, and A.G. Barto. *Evolution of Reward Functions for Reinforcement Learning* (poster abstract). Genetic and Evolutionary Computation Conference, June 2011.
41. **S. Niekum.** *Evolved Intrinsic Reward Functions for Reinforcement Learning* (extended abstract). Proceedings of the Twenty-Fourth Conference on Artificial Intelligence (AAAI), July 2010.

Dissertations and Technical Reports

42. **S. Niekum**, S. Osentoski, C.G. Atkeson, A.G. Barto. *CHAMP: Changepoint Detection Using Approximate Model Parameters.* Technical report CMU-RI-TR-14-10, Robotics Institute, Carnegie Mellon University, June 2014.
43. **S. Niekum.** *Semantically Grounded Learning from Unstructured Demonstrations.* Doctoral Dissertation, University of Massachusetts Amherst, September 2013.
44. **S. Niekum.** *Reliable Rock Detection and Classification for Autonomous Science.* Carnegie Mellon Senior Thesis, April 2005.