Thomas F. Kollar

CONTACT INFORMATION

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EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT), Cambridge, MA USA

Ph.D., Electrical Engineering and Computer Science **June 2011**

- Title: Learning to Understand Spatial Language for Robotic Navigation and Mobile Manipulation
- Area: Robotics, Grounded Language Acquisition, Human-Robot Interaction
- Committee: Nicholas Roy (Adviser), Leslie Kaelbling, Antonio Torralba, Dieter Fox

M.S., Electrical Engineering and Computer Science **May 2007**

- Title: Optimizing Robot Trajectories using Reinforcement Learning
- Area: Probabilistic Robotics
- Adviser: Nicholas Roy

UNIVERSITY OF ROCHESTER, Rochester, NY USA

B.S., Computer Science **June 2004**
B.A., Mathematics **June 2004**

- Minor: Psychology as a Social Science
- *Cum Laude* with highest honors
- Research Advisers: Professor Chris Brown and Professor Steven Gonek

EXPERIENCE

AMAZON INC., Sunnyvale, CA

Senior Research Scientist **Jan. 2017 to present**

- Models for understanding complex spoken language; robotics.

Research Scientist **July 2015 to Jan. 2017**

- Key areas of innovation include knowledge graphs, semantic parsing, neural network models for natural language understanding and hierarchical classification.

APPLE INC., Cupertino, CA

Research Scientist **July 2013 to July 2015**

- Developed machine learning algorithms for natural language understanding to improve the accuracy and functionality of Siri. Key areas of innovation included structured prediction, natural language understanding, semantic parsing, domain classification, weakly supervised learning and data analytics.

CARNEGIE MELLON UNIVERSITY, Pittsburgh, PA

Postdoctoral Fellow **September 2011 to July 2013**

- Conducted research in grounded language acquisition, knowledge representation, multi-modal human-robot interaction and human-robot dialog. Designed and implemented machine learning algorithms and a human-robot dialog system to enable a service robot to understand speech commands. The approach, called Logical Semantics with Perception (LSP), used weakly-supervised training to learn to identify objects and relations in images from highly variable natural language phrases.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT), Cambridge, MA

Research Assistant **June 2004 to September 2011**

- Designed and implemented algorithms to enable a micro-air vehicle, a 6,000 lb. robotic forklift and a robotic wheelchair to understand and execute natural language commands. The software infrastructure included machine learning, natural language processing, computer vision, data visualization and feature libraries as well as a dataset that has been used by other research groups.

Teaching Assistant **Fall 2007**

- Instructor: Professor Patrick Winston
- Course: Artificial Intelligence (6.034)
- Instructed five weekly tutorials, graded lab reports, and wrote/graded exams.

Teaching Assistant **Spring 2007**

- Instructor: Professor Nicholas Roy
- Course: Real-Time Systems and Software (16.35)
- Held office hours, reviewed assignments, and graded bi-weekly assignments.

UNIVERSITY OF ROCHESTER, Rochester, NY

Undergraduate Researcher and Teaching Assistant **September 2002 to May 2004**

- Led a Undergraduate Robot Research team, which created a service robot that delivered hors-d'oeuvres to conference participants at AAAI.
- Courses: Created and lectured in a robotics recitation for an Artificial Intelligence course.

SERVICE WORK

HRI PIONEERS WORKSHOP AT THE 2011 CONFERENCE ON HRI, Lausanne, Switzerland

General Chair **Fall 2010-Spring 2011**

- Won an NSF grant (1115939) for student funding to bring together 30+ participants from 10+ countries around the topic of Human-Robot Interaction.

WORKSHOP ON GROUNDING HUMAN-ROBOT DIALOG FOR SPATIAL TASKS, Los Angeles, CA

Workshop organizer at Robotics: Science and Systems (RSS) **July 2011**

- Organized workshop that brought together researchers in perception, natural language understanding and dialog with the goal of building robust dialog systems for robots.

MIDDLE EAST EDUCATION THROUGH TECHNOLOGY (MEET), Jerusalem, Israel

Year 3 Program Director and Instructor **Summer 2007-Summer 2011**

- Directed the year 3 instructor team in the preparation of the summer curriculum and projects.
- Instructor for the third-year students in a program that brings Israeli and Palestinian youth together around a curriculum of Computer Science and business.
- Developed a web application to organize procedures for Nesher, an Israeli concrete company.

JOURNAL AND MAGAZINE PUBLICATIONS

- Thomas Kollar, Stefanie Tellex, Matthew R. Walter, Albert Huang, Abraham Bachrach, Sachi Hemachandra, Emma Brunskill, Ashis Banerjee, Deb Roy, Seth Teller, Nicholas Roy, "Generalized Grounding Graphs: A Probabilistic Framework for Understanding Grounded Commands," submitted to JAIR, 2018 (expected).
- Vittorio Perera, Robin Soetens, Thomas Kollar, Mehdi Samadi, Yichao Sun, Daniele Nardi, Rene van de Molengraft and Manuela Veloso, "Learning Task Knowledge from Dialog and Web Access," Robotics, 2015.
- Krishnamurthy, J. and T. Kollar, "Jointly Learning to Parse and Perceive: Weakly-Supervised Grounded Language Acquisition," The Transactions of the ACL, 2013.
- Tellex, S., Kollar, T., Dickerson, S., Walter, M., Banerjee, A., Teller, S. and N. Roy, "Approaching the Symbol Grounding Problem with Probabilistic Graphical Models." AI Magazine, 2011.
- Kollar, T. and N. Roy, "Trajectory Optimization using Reinforcement Learning for Map Exploration." The International Journal of Robotics Research 27 (2), 175-196, February 2008.

CONFERENCE PUBLICATIONS

- Perera, V., Chung, T., Kollar, T. and E. Strubell, "Multi-task Learning for Parsing the Alexa Meaning Representation Language." Proceedings of the AAAI Conference on Artificial Intelligence (AAAI), 2018.
- Kollar T., Tellex S., Roy D., Roy N., "Grounding Verbs of Motion in Natural Language Commands to Robots." Experimental Robotics. Springer Tracts in Advanced Robotics, vol 79. Springer, Berlin, Heidelberg, 2014.

- Kollar, T., Krishnamurthy, J. and G. Strimel. "Toward Interactive Grounded Language Acquisition." Proceedings of Robotics: Science and Systems (RSS), 2013.
- Duvallet, F., Kollar, T. and T. Stentz, "Imitation Learning for Natural Language Direction Following Through Unknown Environments," Proceedings of the International Conference on Robotics and Automation (ICRA), 2013 **[Best Cognitive Robotics Paper nominee]**.
- Kollar, T., Perera, V., Nardi, D. and M. Veloso, "Learning Environmental Knowledge From Task-Based Human-Robot Dialog," Proceedings of the International Conference on Robotics and Automation (ICRA), 2013.
- Kollar, T., Vedantham, A., Sobel, C., Chang, C., Perera, V. and M. Veloso, "A Multimodal Approach for Natural Human-Robot Interaction," Proceedings of the International Conference on Social Robots (ICSR), 2012.
- Samadi, M., Kollar T. and M. Veloso, "Using the Web to Interactively Learn to Find Objects," Proceedings of the 26th Conference on Artificial Intelligence (AAAI), 2012.
- Tellex, S., Thaker, P., Deits, R., Simeonov, D., Kollar, T. and N. Roy, "Toward Information Theoretic Human-Robot Dialog," Proceedings of Robotics: Science and Systems (RSS), 2012.
- Kollar, T., Tellex, S., Dickerson, S., Walter, M., Banerjee, A., Teller, S. and N. Roy, "Understanding Natural Language Commands for Robotic Navigation and Mobile Manipulation," Proceedings of the 25th Conference on Artificial Intelligence (AAAI), 2011. **[Most cited paper of AAAI 2011]**
- Hemachandra, S., Kollar, T., Roy, N. and S. Teller, "Following and Interpreting Narrated Guided Tours," Proceedings of the International Conference on Robotics and Automation (ICRA), 2011.
- Tellex, S., Kollar, T., Shaw, G., Roy, N. and D. Roy, "Grounding Spatial Language for Video Search." Proceedings of the Eleventh International Conference on Multimodal Interfaces (ICMI), 2010 **[Best Student Paper]**.
- Huang, A., Tellex, S., Bachrach, A., Kollar, T., Roy, D. and N. Roy, "Natural Language Command of an Autonomous Micro-Air Vehicle," Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2010.
- Kollar, T., Tellex, S., Roy, D. and N. Roy, "Toward Understanding Natural Language Directions," Proceedings of the 5th ACM/IEEE International Conference on Human-Robot Interaction (HRI), 2010 **[Most cited paper from HRI 2010]**.
- Espinace, P., Kollar, T., Soto, A. and N. Roy. "Indoor Scene Recognition Through Object Detection," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2010.
- Kollar T., Tellex S., Roy D., Roy N., "Grounding Verbs of Motion in Natural Language Commands to Robots." ISER 2010.
- Kollar, T. and N. Roy. "Utilizing object-object and object-scene context when planning to find things," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2009.
- Wei, Y., Brunskill, E., Kollar, T. and N. Roy, "Where to Go: Interpreting Natural Directions Using Global Inference". Proceedings of the International Conference on Robotics and Automation (ICRA), 2009.
- Kollar, T. and N. Roy, "Efficient optimization of information-theoretic exploration in SLAM." Proceedings of the Twenty-Third AAAI Conference on Artificial Intelligence (AAAI), Physically Grounded AI track. pp. 1369-1375, 2008.
- Brunskill, E., Kollar, T. and N. Roy, "Topological Mapping Using Spectral Clustering and Classification." Proceedings of the International Conference on Intelligent Robots and Systems (IROS), pp. 3491-3496, 2007.
- Doshi, F., Brunskill, E., Shkolnik, A., Kollar, T., Rohanimanesh, K., Tedrake, R. and N. Roy, "Collision Detection in Legged Locomotion using Supervised Learning." Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). San Diego, 2007.
- Kollar, T. and N. Roy, "Using Reinforcement Learning to Improve Exploration Trajectories for Error Minimization." Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), pp. 3338-3343, 2006.

WORKSHOP PUBLICATIONS

- Kollar, T., Samadi, M. and M. Veloso, "Enabling Robots to Find and Fetch Objects by Querying the Web," the 11th International Conference on Autonomous Agents and Multiagent Systems, 2012 (Extended Abstract).
- Kollar, T., Tellex, S. and N. Roy, "A Discriminative Model for Understanding Natural Language

Route Directions", AAAI Fall Symposium Series, 2010.
- Kollar, T. et. al., "Mabel: Extending Human Interaction and Robot Rescue Designs", Journal of Undergraduate Research, v. 2, no. 2, pp. 9-13, 2004.
- Kollar, T. et. al., "Mabel: Extending Human Interaction and Robot Rescue Designs", AAAI Mobile Robot Competition Workshop, Acapulco, Mexico, TR WS-03-01, pp. 20-29, 2003.
- Schmid, J., Kollar, T. et. al, "Mabel: Building a Robot Designed for Human Interaction." AAAI Mobile Robot Competition Workshop, Edmonton, Alberta, TR WS-02-18, p.24-32, 2002.