David Held

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http://davheld.github.io/

My research investigates how robots can understand complex environments by learning how the environment can change. By modeling how object appearance can change over time, robots can learn to perceive objects in crowded scenes despite partial occlusions, viewpoint changes, motion, and lighting variations. Robots can also learn how to act to cause the changes needed to achieve their tasks. This work suggests a future in which robots learn about the world by predicting changes, recording observations, and inferring how to behave in their environment.

Education

U.C. Berkeley (Post-doctoral Scholar)   Feb 2016 - Present
Post-doctoral scholar in the Department of Electrical Engineering and Computer Sciences
Advised by Pieter Abbeel

Stanford University (Ph.D.)   Feb 2016
Ph.D. in Computer Science.
Thesis: Deep Learning and Probabilistic Methods for Robotic Perception from Streaming Data
Advised by Sebastian Thrun and Silvio Savarese.

Stanford University (M.S.)   September, 2012
Masters of Science in Computer Science.
Advised by Sebastian Thrun and Vaughan Pratt.

Massachusetts Institute of Technology (M.S)   September 2007
Masters of Science in Mechanical Engineering.

Massachusetts Institute of Technology (B.S.)   June 2005
Bachelor of Science in Mechanical Engineering with a concentration in Controls Engineering.

Publications

The top-tier venues in robotics are IJRR, T-RO, RSS, ICRA, and IROS.

Held, D., McCarthy, Z., Zhang, M., Shentu, F., Abbeel, P., Probabilistically Safe Policy Transfer. *International Conference of Robotics and Automation (ICRA), 2017.* **(Under Review)**

Held, D., Thrun, S., Savarese, S., Learning to Track at 100 FPS with Deep Regression Networks. *European Conference on Computer Vision (ECCV), 2016 (In press)*

Held, D., Guillory, D., Rebsamen, B., Thrun, S., Savarese, S., A Probabilistic Framework for Real-time 3D Segmentation using Spatial, Temporal, and Semantic Cues. *Robotics: Science and Systems (RSS), 2016.*

Held, D., Thrun, S., Savarese, S. Robust Single-View Instance Recognition. *International Conference of Robotics and Automation (ICRA), 2016.*

Held, D., Levinson, J., Thrun, S., Savarese, S. Robust Real-Time Tracking Combining 3D Shape, Color, and Motion. *International Journal of Robotics Research (IJRR), 2016.*

Held, D., Levinson, J., Thrun, S., Savarese, S. Combining 3D Shape, Color, and Motion for Robust Anytime Tracking. *Robotics: Science and Systems (RSS), 2014.*

Held, D., Levinson, J., Thrun, S. Precision Tracking with Sparse 3D and Dense Color 2D Data *International Conference of Robotics and Automation (ICRA), 2013.* **Best Vision Paper Finalist**

Held, D., Levinson, J., Thrun, S. <u>A Probabilistic Framework for Car Detection in Images using Context and Scale.</u> *International Conference of Robotics and Automation (ICRA), 2012.*

Held, D., Yekutieli, Y., Flash, T. <u>Characterizing Stiffness of Multi-Segment Flexible Arm Movements.</u> International Conference of Robotics and Automation. *International Conference of Robotics and Automation (ICRA), 2012.*

Levinson, J.; Askeland, J.; Becker, J.; Dolson, J.; **Held, D.**; Kammel, S.; Kolter, J.Z.; Langer, D.; Pink, O.; Pratt, V.; Sokolsky, M.; Stanek, G.; Stavens, D.; Teichman, A.; Werling, M.; Thrun, S. (2011) <u>Towards Fully Autonomous Driving: Systems and Algorithms.</u> Intelligent Vehicles Symposium (IV), IEEE, June 2011.

Jones, L.A., **Held, D.** & Hunter, I. <u>Surface Waves and Spatial Localization in Vibrotactile Displays.</u> Proceedings of the IEEE Haptics Symposium, 2010.

Jones, L.A. & **Held, D.** <u>Characterization of Tactors Used in Vibrotactile Displays.</u> Journal of Computing and Information Sciences in Engineering, 2008.

Jin, Z., Waydo, S., Wildanger, E.B., Lammers, M., Scholze, H., Foley, P., **Held, D.**, Murray, R.M. <u>MVWT-II: The Second Generation Caltech Multi-Vehicle Wireless Testbed.</u> 2004 American Control Conference (ACC), 2004.

Awards	Best Vision Paper Finalist: ICRA 2013

Best Master's Thesis of 2012 in Stanford's Computer Science Department
M.S. Thesis: "Autonomous Driving: Car Detection, Tracking, and Street Sign Detection," co-advised by Sebastian Thrun and Vaughan Pratt.

Research Experience

U.C. Berkeley Robot Learning Lab
Feb 2016 - Present. Post-doctoral Researcher. Teaching robots how to manipulate objects by transferring knowledge from simulation to the real world (ICRA 2017, in press).

Stanford Autonomous Driving Team
Stanford Computational Vision and Geometry Lab
Sept 2010 – Feb 2016. Ph.D. Designed various algorithms for object detection, segmentation, and tracking for autonomous driving (IV 2011, ICRA 2012, ICRA 2013, RSS 2014, IJRR 2016, ICRA 2016, RSS 2016, ECCV 2016).

Weizmann Laboratory for Vision Research and Robotics
Sept 2009 – Aug 2010. Research Assistant. Designed a novel method to compute stiffness for a hyper-redundant simulated octopus arm (ICRA 2011).

MIT Bioinstrumentation Lab
February 2006 – September 2007, Master's Thesis. Modeled the interaction of tactors with skin for a vibrotactile display worn on the user's back (JCISE 2008, Haptics Symposium 2010).

Harvard Social Psychology Lab
July – December 2005. Research Assistant. Designed and implemented experiments to test the contrast effect with images.

MIT Aerospace Controls Lab
Summer 2004. Research Assistant. Analyzed signals from a digital magnetometer for controlling a UAV.

Caltech Controls and Dynamical Systems
Summer 2003. Research Assistant. Designed an outdoor testbed of 12 miniature hovercrafts (ACC 2004).

Work Experience	**Google**
	June 2013 – Sept 2013. Software Developer, Summer Intern, Self-Driving Car Team. Worked on perception system for Google's self-driving car.
	Evolven Software
	February 2008 – Sept 2009. Software Developer, Server Team. Developed enterprise software for configuration management.
Patents	Robust Anytime Tracking Combining 3D Shape, Color, and Motion with Annealed Dynamic Histograms (Provisional Patent: 14/733,902)
Teaching and Mentoring	Teaching Assistant: CS 229 Machine Learning - In addition to the traditional TA responsibilities, I gave two lectures: Probability Theory and Hidden Markov Models, and I assisted students with their class projects.
	Teaching Assistant: CS 231A Computer Vision: From 3D Reconstruction to Recognition - In addition to the traditional TA responsibilities, I was a guest lecturer on Segmentation and Scene Understanding.
	Mentoring: Michael Zhang, Fred Shentu, Xinyang Geng, Devin Guillory, Helen Jiang, Derin Dutz, Naor Brown, Jacquelyn Kunkel, Elizabeth Kim, Katherine Ray
Service	Associate Editor: International Conference on Robotics and Automation (ICRA), 2017
	Organizer: Deep Learning for Action and Interaction, NIPS Workshop 2016 Stanford AI Lab Distinguished Speaker Series 2014-2015 Bay Area Vision Meeting 2014
	Program Committee: Computer Vision in Vehicle Technology, CVPR 2015 Workshop
	Student Volunteer: ONR Workshop on Structured Learning for Scene Understanding 2014
	Reviewer: RSS 2016, IROS 2013-2016, ICRA 2014-2016, IETE Journal of Research 2016, T-RO 2015, CVPR 2015, CVPR Workshop 2015, ITS 2011-2014