

# David Held

dheld@andrew.cmu.edu  
<http://www.cs.cmu.edu/~dheld>

---

<b>Current appointment</b>	Assistant Professor, Robotics Institute, Carnegie Mellon University	2017 - Present
----------------------------	---	----------------

<b>Education/</b>	U.C. Berkeley	2016 - 2017
-------------------	---------------	-------------

<b>Post-Doc</b>	Post-doctoral researcher. Advised by Pieter Abbeel.	
-----------------	--	--

	Stanford University Ph.D. in Computer Science. Thesis: Deep Learning and Probabilistic Methods for Robotic Perception from Streaming Data Advised by Sebastian Thrun and Silvio Savarese.	2012 - 2016
--	--	-------------

	Stanford University Masters of Science in Computer Science. Thesis: Autonomous Driving: Car Detection, Tracking, and Street Sign Detection Advised by Sebastian Thrun and Vaughan Pratt.	2010 - 2012
--	---	-------------

	Massachusetts Institute of Technology Masters of Science in Mechanical Engineering.	2006 - 2007
--	--	-------------

	Massachusetts Institute of Technology Bachelor of Science in Mechanical Engineering with a concentration in Controls Engineering.	2001 - 2005
--	--	-------------

## **Publications:**

### **Journals**

Gu, Q., Okorn, B., **Held, D.**, OSSID: Online Self-Supervised Instance Detection by (and for) Pose Estimation, Robotics and Automation Letters (RA-L), 2022 with presentation at the International Conference of Robotics and Automation (ICRA), 2022

Weng, T., Pallankize, A., Tang, Y., Kroemer, O., **Held, D.**, Multi-modal Transfer Learning for Grasping Transparent and Specular Objects, Robotics and Automation Letters (RA-L) with presentation at the International Conference of Robotics and Automation (ICRA), 2020

Hu, P., **Held, D.**, Ramanan, D., Learning to Optimally Segment Point Clouds, Robotics and Automation Letters (RA-L) with presentation at the International Conference of Robotics and Automation (ICRA), 2020

**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.

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) Towards Fully Autonomous Driving: Systems and Algorithms, Intelligent Vehicles Symposium (IV), IEEE, June 2011.

Jones, L.A. & **Held, D.**, Characterization of Tactile Used in Vibrotactile Displays, Journal of Computing and Information Sciences in Engineering, 2008.

### **Conferences**

Lin, X., Huang, Z, Li, Y., Tenenbaum, J., **Held, D.**, Gan, C., DiffSkill: Skill Abstraction from Differentiable Physics for Deformable Object Manipulations with Tools, International Conference on Learning Representations (ICLR), 2022

Narasimhan, G., Zhang, K., Eisner, B., Lin, X., **Held, D.**, Transparent Liquid Segmentation for Robotic Pouring, International Conference of Robotics and Automation (ICRA), 2022

Mittal, H., Okorn, B., Jangid, A., **Held, D.**, Self-Supervised Point Cloud Completion via Inpainting, British Machine Vision Conference (BMVC), 2021 - **Oral presentation** (Selection rate 3.3%)

Dasari S, Wang J, Hong J, Bahl S, Lin Y, Wang A, Thankaraj A, Chahal K, Calli B, Gupta S, **Held D.**, Pinto L, Pathak D, Kumar, V, Gupta, A. RB2: Robotic Manipulation Benchmarking with a Twist. NeurIPS 2021 Datasets and Benchmarks Track, 2021

Wang J, Gang H, Ancha S, Chen YT, **Held D.** Semi-supervised 3D Object Detection via Temporal Graph Neural Networks. (2021) International Conference on 3D Vision (3DV)

Lin, X, Wang, Y., Huang, Z., **Held, D.**, Learning Visible Connectivity Dynamics for Cloth Smoothing, Conference on Robot Learning (CoRL), 2021

Weng, T., Bajracharya, S., Wang, Y., **Held, D.**, FabricFlowNet: Bimanual Cloth Manipulation with a Flow-based Policy, Conference on Robot Learning (CoRL), 2021

Sikchi, H., Zhou, W., **Held, D.**, Learning Off-policy for Online Planning, Conference on Robot Learning (CoRL), 2021 - **Oral presentation** (Selection rate 6.5%); **Best Paper Finalist**

Ancha, S., Pathak, G., Narasimhan, S., **Held, D.**, Active Safety Envelopes using Light Curtains with Probabilistic Guarantees, Robotics: Science and Systems (RSS), 2021

Okorn, B.\*, Gu, Q.\*, Hebert, M., **Held, D.**, ZePhyR: Zero-shot Pose Hypothesis Rating, International Conference of Robotics and Automation (ICRA), 2021

Raaj, Y., Ancha, S., Tamburo, R., **Held, D.**, Narasimhan, S., Exploiting & Refining Depth Distributions with Triangulation Light Curtains, Conference on Computer Vision and Pattern Recognition (CVPR), 2021

Hu, P., Huang, A., Dolan, J., **Held, D.**, Ramanan, D., Safe Local Motion Planning with Self-Supervised Freespace Forecasting, Conference on Computer Vision and Pattern Recognition (CVPR), 2021

Lin, X., Wang, Y., Okin, J., **Held, D.**, SoftGym: Benchmarking Deep Reinforcement Learning for Deformable Object Manipulation, Conference on Robot Learning (CoRL), 2020

Wang, Y., Narasimhan, G., Lin, X., Okorn, B., **Held, D.**, Visual Self-Supervised Reinforcement Learning with Object Reasoning, Conference on Robot Learning (CoRL), 2020

Zhou, W., Bajracharya, S., **Held, D.**, PLAS: Latent Action Space for Offline Reinforcement Learning; Conference on Robot Learning (CoRL), 2020 - **Plenary talk** (Selection rate 4.1%)

Ancha, S., Raaj, Y., Hu, P., Narasimhan, S., **Held, D.**, Active 3D Perception using Light Curtains, European Conference on Computer Vision (ECCV), 2020 - **Spotlight** (Selection rate 5.3%)

Qian\*, J., Weng\*, T., Zhang, L., Okorn, B., **Held, D.**, Cloth Region Segmentation for Robust Grasp Selection; International Conference on Intelligent Robots and Systems (IROS), 2020

Wang, J., Ancha, S., Chen, Y., **Held, D.**, Self-supervised Learning for 3D Data Association; International Conference on Intelligent Robots and Systems (IROS), 2020

Okorn, B., Xu, M., Hebert, M., **Held, D.**, Learning Orientation Distributions for Object Pose Estimation, International Conference on Intelligent Robots and Systems (IROS), 2020

Weng, X., Wang, J., **Held, D.**, Kitani, K., 3D Multi-Object Tracking: A Baseline and New Evaluation Metrics; International Conference on Intelligent Robots and Systems (IROS), 2020

Mittal, H., Okorn, B., **Held, D.**, Just Go with the Flow: Self-Supervised Scene Flow Estimation. Conference on Computer Vision and Pattern Recognition (CVPR), 2020 - **Oral** (Selection rate 5.7%)

Hu, P., Ziglar, J., **Held, D.**, Ramanan, D. What You See is What You Get: Exploiting Visibility for 3D Object Detection. Conference on Computer Vision and Pattern Recognition (CVPR), 2020 - **Oral** (Selection rate 5.7%)

Ancha, S., Lin, J., **Held, D.** Combining Deep Learning and Verification for Precise Object Instance Detection. Conference on Robot Learning (CoRL), 2019

Lin, X., Baweja, H., Kantor, G., **Held, D.**, Adaptive Auxiliary Task Weighting for Reinforcement Learning. Neural Information Processing Systems (NeurIPS), 2019

Lin, X., Guo, P., Florensa, C., **Held, D.**, Adaptive Variance for Changing Sparse-Reward Environments, *International Conference of Robotics and Automation (ICRA)*, 2019

Yuan, W., Khot, T., **Held, D.**, Mertz, C., Hebert, M., PCN: Point Completion Network, *International Conference on 3D Vision (3DV)*, 2018 - **Best Paper Honorable Mention**

Florensa, C., **Held, D.**, Geng, X., Abbeel, P., Automatic Goal Generation for Reinforcement Learning Agents, *International Conference on Machine Learning (ICML)*, 2018

Huang, S., **Held, D.**, Abbeel, P., Dragan, A. Enabling Robots to Communicate their Objectives, *Autonomous Robotics (AURO)*, 2018

Florensa, C., **Held, D.**, Wulfmeier, M. and Abbeel, P., Reverse Curriculum Generation for Reinforcement Learning, *Conference on Robot Learning (CoRL)*, 2017.

Clavera, I., **Held, D.**, Abbeel, P., Policy Transfer via Modularity, *International Conference on Intelligent Robots and Systems (IROS)*, 2017.

Achiam, J., **Held, D.**, Tamar, A. and Abbeel, P., Constrained Policy Optimization. *International Conference on Machine Learning (ICML)*, 2017.

Huang, S. H., **Held, D.**, Abbeel, P., & Dragan, A. D. Enabling Robots to Communicate their Objectives. *Robotics: Science and Systems (RSS)*, 2017.

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

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

**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. 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. A Probabilistic Framework for Car Detection in Images using Context and Scale. *International Conference of Robotics and Automation (ICRA)*, 2012.

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

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

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

## Research and Industry Experience

<b>U.C. Berkeley Robot Learning Lab</b>	2016 - 2017
Post-doctoral researcher. Developed deep reinforcement learning algorithms for object manipulation	
<b>Stanford Autonomous Driving Team</b>	2010 - 2016

Ph.D. Student. Developed perception algorithms for self-driving car.

**Google [x] Self-driving Car Team** 2013

Intern. Developed perception algorithms for Google's self-driving car.

**Weizmann Laboratory for Vision Research and Robotics** 2009 - 2010

Research Assistant. Developed novel method to analyze stiffness of simulated octopus arm.

**Evolgen Software** 2008-2009

Software developer. Developed enterprise software for configuration management.

**MIT Bioinstrumentation Lab** 2006 - 2007

Master's Thesis. Modeled the interaction of factors with skin for a vibrotactile display.

**Harvard Social Psychology Lab** 2005

Research Assistant. Tested the contrast effect with images.

**MIT Aerospace Controls Lab** 2004

Research Assistant. Analyzed digital magnetometer signals for controlling a UAV.

**Caltech Controls and Dynamical Systems** 2003

Research Assistant. Designed an outdoor testbed of 12 miniature hovercrafts.

**Patents** Robust Anytime Tracking Combining 3D Shape, Color, and Motion with Annealed Dynamic Histograms  
(Provisional Patent: 14/733,902)

**Awards** Best Paper Finalist, CoRL 2021  
Best Paper Honorable Mention, 3DV 2018  
**NSF CAREER Award 2021**  
Google Research Faculty Award 2017  
Best Vision Paper Finalist, ICRA 2013  
Best Master's Thesis of 2012 in Stanford's Computer Science Department

**Invited Talks** Georgia Tech 2022  
USC CS Colloquium 2022  
Stanford Vision and Learning Lab 2022  
UW Robotics Colloquium 2022  
UC Berkeley CITRIS People and Robots Seminar 2022  
Michigan Robotics 2022  
MIT Robotics Seminar 2021  
Northeastern Robotics Seminar 2021  
Cornell CS Colloquium 2021  
ICCV Workshop on Benchmarking Multi-Target Tracking 2021  
Brown Robotics Seminar 2021  
RSS Workshop: Deformable Object Simulation in Robotics 2021  
CVPR Workshop: 3D Deep Learning and Robotics 2021  
Naver Labs Europe 2021  
Technion Robotics Seminar 2021  
ICPR Workshop: Perception and Modeling for Manipulation of Objects 2021  
IPAM Workshop: Individual Vehicle Autonomy: Perception and Control 2020  
Aachen University, Aachen, Germany, 2019  
CVPR Workshop: Bringing Robots to the Computer Vision Community 2019  
Deep Learning Summit, Boston, MA, 2019  
Brown University, Providence, RI, 2018  
UT Austin 2018  
Symposium on Machine Learning in Science and Engineering 2018  
Carnegie Mellon University, RoboOrg Meta-Seminar 2017  
Carnegie Mellon University, Robotics Institute Seminar 2017  
Cornell University 2017  
Carnegie Mellon University 2017

University of British Columbia	2017
Microsoft Research, Cambridge, UK	2017
Hebrew University (Israel)	2017
University of Michigan	2017
Tel Aviv University (Israel)	2017
Princeton University	2017
Massachusetts Institute of Technology	2017
University of California, Los Angeles	2017
University of Southern California	2017
Toyota Technology Institute of Chicago	2017
University of California, San Diego	2017
Northeastern University	2017
Columbia University	2017
Weizmann Institute (Israel)	2017
University of Cambridge	2017
Spotlight Talk at NeurIPS Workshop on Reliable Machine Learning in the Wild	2016
Future Star Talks Series at RSS Workshop on Deep Learning for Autonomous Robots	2016
Northeastern College of Computer and Information Science Seminar	2016
Harvard School of Engineering and Applied Sciences Special Seminar	2016
Johns Hopkins Laboratory for Computational Sensing and Robotics Seminar	2016
University of Maryland Computer Vision Laboratory Seminar	2016
TTI Chicago Young Researcher Seminar Series	2016
MIT Robotics Seminar	2015
UC Berkeley	2015
Carnegie Mellon University VASC Seminar Talk	2015
University of Toronto AI Seminar	2015
University of Michigan AI Seminar	2015
The Future of Driverless Car Technology, UCLA VC Fund	2015
Google [x] Self-driving Car Team	2015
Stanford-Seoul National University Workshop on Automated Driving	2015

## Teaching

Graduate Introduction to Computer Vision (16-720A) - 2022  
Statistical Techniques in Robotics (16-831) - 2018-2021  
Special Seminar: Deep Reinforcement Learning for Robotics (16-881) - 2019-2021

## Mentoring

Current Post-docs: Daniel Seita

Current PhD students: Brian Okorn (co-advised with Martial Hebert)  
Xingyu Lin  
Siddarth Ancha (co-advised with Srinivasa Narasimhan)  
Thomas Weng  
Wenxuan Zhou  
Benjamin Eisner  
Yufei Wang (co-advised with Zackory Erickson)

Current MS students: Gaurav Pathak  
Zixuan Huang  
Chuer Pan  
Harry Zhang  
Sashank Tirumala  
Mansi Agarwal  
Fan yang  
Sarath Shetty  
Carl Qi

Current undergraduates: Edward Li

Current Capstone Mentor:  
Tanay Sharma  
Xiaochen Han  
Nitheesh Lakshminarayanan

Past MS students: Harshit Sikchi

Qiao Gu  
Sujoy Bajracharya  
Jianing (Aurora) Qian  
Gautham Narayan Narasimhan  
Yufei Wang  
Junyu (Jenny) Nan  
Mengyun (Olivia) Xu  
Edward Ahn  
Harjatin Baweja  
Pengsheng Guo  
Tiancheng Jin  
Ignasi Clavera  
Devin Guillory  
Yi Gu

Past undergraduates: Nomaan Qureshi  
Rahul Chakwate  
Kai Zhang  
Rashmi Anil  
Khush Agrawal  
Shubham Sahoo  
Rohan Chacko  
Patrick Liu  
Jake Olkin  
Yimin Tang  
Zhaoyuan (Andy) Fang  
Ziwen (Leo) Zhuang  
Yujie Lu  
Yifan Qiao  
Michael Zhang  
Fred Shentu  
Xinyang Geng  
Helen Jiang  
Derin Dutz  
Naor Brown  
Jacquelyn Kunkel  
Elizabeth Kim  
Katherine Ray

Past Capstone Mentor: Zhenli Zhang  
Arpit Jangid  
Ji Liu  
Yujia Chen  
Luxin Zhang  
Anshuman Majumdar  
Chang Gao  
Ziyan Wang  
Siddhant Jain  
Ankita Kalra  
Purna Sowmya Munukutla

Past Research Assistant: Himangi Mittal  
Jianren Wang  
Wen-Hsuan Chu  
Stephanie Milani  
Tiancheng Jin

Past MRSD teams: Cubi: Jorge Anton, Nithin Subbiah Meganathan, Laavanye Bahl,  
Changsheng Shen, Paulo Camasmie

Beyond Sight: Chien Chih Ho, Pengsheng Guo, Rohit Murthy, Vivek Gopal  
Ramaswamy, and Oliver Krengel

## Service

Associate Editor:

RA-L 2020-2022  
IROS 2018-2021  
ICRA 2017-2021  
ICRA Workshops 2021  
ICML 2019-2020  
NeurIPS 2019-2020

Co-organizer:

ICRA 2022: 2nd Workshop on Representing and Manipulating Deformable Objects  
RSS Workshop - Workshop on Visual Learning and Reasoning for Robotics, 2020-2021  
NeurIPS Workshop - Deep Learning for Action and Interaction, 2016  
ICRA Publications co-Chair (unofficial), 2016  
Stanford AI Lab Distinguished Speaker Series 2014-2015  
Bay Area Vision Meeting 2014  
ONR Workshop on Structured Learning for Scene Understanding 2014

Reviewer:

WAFR 2022  
Black in AI Innovation and Research Summer Research Grant, 2021  
CoRL 2019-2021  
RSS 2016-2018, 2020-2022  
ICRA Workshops 2021  
NeurIPS Workshop - Black in AI 2018-2021  
RSS Pioneers 2018-2020  
RA-L 2019-2020  
ICRA 2014-2016, 2018-2019  
Journal of Field Robotics, 2019  
ICML Workshop - Multi-Task and Lifelong Reinforcement Learning, 2019  
CVPR Workshop - Real-World Challenges and New Benchmarks for Deep Learning in Robotic Vision 2018  
CoRL 2017-2018  
CVPR VOCVALC - 2nd International workshop on Visual Odometry and Computer Vision Applications based Location Clues 2018  
TPAMI 2017-2018  
IROS 2013-2016  
NeurIPS Workshop - Acting and Interacting in the Real World: Challenges in Robot Learning, 2017  
NeurIPS Workshop - Hierarchical Reinforcement Learning, 2017  
CVPR Workshop - Deep Learning for Robotic Vision 2015, 2017  
IETE Journal of Research 2016  
T-RO 2015  
CVPR 2015  
CVPR Workshop - Computer Vision in Vehicle Technology, 2015  
ITS 2011-2014

Other:

AI4All Summer Program, 2018-2019, 2021  
AI Mentor-Matching Program, 2017-2021  
NSF Panel - 2019-2021  
Tartan Scholars - 2021-2022  
RI Manipulation Discussion Group - 2019-2022

## Training programs:

Mental Health First Aid Certification  
Bias Busters  
Floor Marshal Training  
Active Shooter Training  
Green Dot Overview Training  
Social Host Training

## Media Coverage

"New deep learning algorithms could improve robot sight," Tech Target, 2018  
"How computers with humanlike senses will change our lives," Wall Street Journal, 2021  
Italia Uno, 2021