

# ANIMESH GARG

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## RESEARCH INTERESTS

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I develop algorithmic methods to enable efficient robot learning for long-term sequential tasks through **Generalizable Autonomy**. The principal focus of my research is to understand representations and algorithms to enable the efficiency and generality of learning for interaction in autonomous agents. My research spans Robotics, Reinforcement Learning, Computer Vision and Optimal Control. I work on applications of intelligent manipulation in surgical, personal and warehouse robotics.

## EDUCATION

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**University of California, Berkeley** 2016  
Ph.D., Operations Research, Minor in Artificial Intelligence & Machine Learning  
*Committee: Ken Goldberg (Chair), Alper Atamtürk, Pieter Abbeel, Laurent El Ghaoui*  
M.S., Computer Science

**Georgia Institute of Technology, Atlanta** 2011  
M.S., Industrial Engineering

**Netaji Subhas Institute of Technology, University of Delhi, India** 2010  
B.E., Manufacturing Processes & Automation Engineering

## HONORS AND AWARDS

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**2018** Stanford-Coulter Translational Research Award (\$100K)

**2015** Best Video Award at Hamlyn Surgical Robotics Challenge 2015  
Best Medical Robotics Paper Finalist at IEEE ICRA 2015  
Best Workshop Paper Award at IEEE ICRA 2015  
Invited Speaker at the IEEE ICRA 2015 Ph.D. Forum  
UC Berkeley Ira Abraham Fellowship

**2014** UC Regents Fellowship (Summer)

**2013** NSF Travel Support for IEEE CASE 2013  
S. Tashiera Fellowship, UC Berkeley (Summer)

**2012** Best Application Paper Award at IEEE CASE 2012  
UC Berkeley International Office Tuition Award

**2012–2013** Earl C. Anthony Tuition Fellowship, UC Berkeley

**2010** Erasmus Mundus Fellowship (full tuition and stipend at TU Munich)

**2007 – 2010** University of Delhi Academic Merit Scholarship Award (full tuition waiver)

**2004 – 2010** State Bank of India Meritorious Student Scholarship (stipend)

## SELECTED INVITED TALKS & DEMOS

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- **Deep Reinforcement Learning for Medical Applications**  
MICCAI 2018 Tutorial in Deep RL *Sept 2018*
  - **Generalizable Robot Learning: Manipulation and Mobility**  
Re:Work Deep Learning for Robotics *June 2018*  
CVPR Fine-Grained Instructional Video understanding Workshop *June 2018*
- Animesh Garg* 1/8

- NVIDIA GTC 2018 *Mar 2018*  
Toyota Research Institute Symposium (Stanford-MIT-Michigan) *Dec 2017*
- **Towards Generalizable Imitation in Robotics**  
University of Toronto (CS), University of Michigan (CS), NYU (CS-Courant),  
USC (EE), Univ. of British Columbia (EE), University of Sydney (ACFR) *Mar-Apr 2018*  
Google AI, MSR, FAIR, Nvidia Research *May-June 2018*  
Stanford Robotics Seminar Series *Jan 2018*  
MIT (AA), CalTech (MCE), UNC (CS) *Nov-Dec 2017*
  - **Closing the Visuo-Motor Loop with Deep Reinforcement Learning**  
Stanford CS 331B, AA 274, CS 327A Guest Lecturer *Oct'16-Mar'17*  
SAIL-Toyota AI Center Annual Review *Sept 2016*
  - **Algorithmic Automation in Medical Robotics,**  
MIT (ME), UC San Diego (ECE), Stanford (CS) *Mar-Apr 2016*  
Uber Marketplace Optimization, Amazon Research, Baidu Research, Drive.ai *Jan-Apr 2016*
  - **Unsupervised Task Segmentation For Learning from Demonstrations,**  
BEARS Research Symposium (short talk), Berkeley, CA *Feb 2016*  
Algorithms for Human Robot Interaction Workshop, Berkeley, CA *Nov 2015*
  - **Algorithms for 3D Printed Implants for Brachytherapy in Intracavitary Tumors,**  
INFORMS 2015 Conference, Philadelphia, PA *Nov 2015*
  - **UC Berkeley IEOR 24** Intro to IEOR (Seminar) Guest Lecture: OR in Healthcare *Sept 2015*
  - **Learning by Observation for Surgical Subtasks,**  
BEARS Research Symposium (short talk), Berkeley, CA *Feb 2015*
  - **Custom 3D printed Implants for High Dose Rate Brachytherapy,**  
Poster & Demo at Stanford Berkeley Robotics Symposium, *Oct 2014*  
BEARS Research Symposium (short talk), Berkeley, CA *Feb 2014*
  - **UC Berkeley IEOR 24** Intro to IEOR (Seminar) Guest Lecture: Linear Programming *Sept 2011*
  - **A Robotic System for Needle Steering,** IEEE IROS 2011 Demonstrations *Sept 2011*

## TEACHING AND MENTORING

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### Stanford University

- CS 332: *Advanced Survey of Reinforcement Learning* *F17*

Co-Instructor with Emma Brunskill

### University of California, Berkeley

- IEOR 131: *Simulation of Industrial Engineering Systems* *Sp16*

Lecture on simulation and mentor design project.

- IEOR 170: *Industrial Design and Human Factors* *Sp15*

Lectured, designed and graded assignments, mentored design project.

- IEOR 115: *Industrial and Commercial Data Systems* *F14, F13, Sp13, F11*

Lectured on Database implementation in SQL and MS Access, mentored projects and graded exams.

- IEOR 191: *Technology Entrepreneurship* *F12*

Organized lectures, office hours, mentored projects and graded homeworks.

### Georgia Institute of Technology

- CS 3451: *Computer Graphics* – Grading of Assignments and Exams *Sp11*

## Student Advising

UC Berkeley

*Undergraduate:* Heimdall Siao (2011-12), Nikitha Singh (2013-14), Zach Mulder (2013-14), Adithya Murali (2014-15), Sidharth Sen (2014-16), Yiming Jen (2015-16), Brijen Thananjeya (2015-16)

*M.Eng:* Anwaar El-Zireeni (2013-14), Jennifer Wong (2013-14), Rashmi Ramtani (2013-14).

## EXPERIENCE

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### Nvidia AI Research

August, 2018 - Present

*Senior Research Scientist*

*Santa Clara, CA*

Machine learning algorithms for robot manipulation in applications for personal and industrial robotics.

### Stanford AI Lab

August, 2016 - Present

*Postdoctoral Researcher*

*Stanford, CA*

I work on deep reinforcement learning for closing visuo-motor loop for personal and healthcare robotics.

### Automation Lab, UC Berkeley

August, 2011 - August, 2016

*Graduate Student Researcher*

*Berkeley, CA*

My research focuses on medical robotics applications of optimization and machine learning. I work on treatment planning and delivery techniques in Brachytherapy for Cancer Treatment using Robots and 3D-Printed Implants. I also study learning from experts for long-term autonomy in surgical robotics.

### Georgia Institute of Technology

August, 2010 - July, 2011

*Graduate Student Researcher*

*Atlanta, GA*

I worked with Mike Stilman and Henrik Christensen on problems of identifying unseen erroneous states and on localization with noisy visual information. I also worked with Jim Rehg and Santanu Dey on video segmentation using mixed integer programming formulations.

### National Thermal Power Corporation

Summer, 2009

*Engineering Intern*

*New Delhi, India*

Assisted in the Control and Instrumentation dept. of the thermal power plant.

### JK Tyre Pvt India Ltd.

Winter, 2007

*Engineering Intern*

*Banmore, India*

Programming PLCs for automatic Mixing of composites in rubber in tyre manufacturing.

## SERVICE & OUTREACH

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### • Service, Workshop and Tutorials Organization

- *IEEE Int'l Conf on Robotics and Automation (ICRA)* – Associate Editor 2018
- RSS 2018: *Causal Learning in Robotics*
- ICML 2018: *Machine Learning in Robotics*
- MICCAI 2018: *Deep Reinforcement Learning for Medical Applications*
- NASA Proposal Review in Medical Robotics 2017
- ICRA 2017: *C4 Surgical Robots: Compliant, Continuum, Cognitive, and Collaborative*
- 3DV 2016: *Understanding 3D and Visuo-Motor Learning*
- Student Committee Member for UC Berkeley EECS and IEOR faculty Searches 2015.

### • Reviewing

**Journals:** *International Journal of Robotics Research (IJRR)* – 2016-18; *Robotics & Automation Letters (RA-L)* – 2018; *Computer Vision & Image Understanding (CVIU)* – 2017; *IEEE Transactions on Automation*

*Science and Engineering (T-ASE)* – 2015-16; *Springer Journal on Australasian Physical Engineering Sciences in Medicine* – 2014.

### Conferences

· **Robotics:** *IEEE Int'l Conf on Robotics and Automation (ICRA)* – 2014-19; *IEEE Int'l Conf. on Intelligent Robots and Systems (IROS)* – 2015-18; *IEEE Int'l Conf on Automation Science and Engineering (CASE)* – 2013-16;

· **Computer Vision:** *IEEE Conf on Computer Vision and Pattern Recognition (CVPR)* – 2018-19; *European Conf on Computer Vision (ECCV)* – 2018;

· **Machine Learning:** *Internal Conference on Learning Representations (ICLR)* – 2019; *Neural Information Processing Systems (NeurIPS)* – 2018; *Conference on Robot Learning (CoRL)* – 2017-18; *Conference on Artificial Intelligence (AAAI)* – 2017-18.

### Outreach

· Tutorial and Demo on Intro to Learning in Robotics at AI4ALL at Stanford. *Summer 2018*

· Organized Lab Tour for Society of Women Engineers to encourage STEM in High-School Girls. *Nov 2015*

· Organized *Berkeley Automation Sciences Lab Open House*, Cal Day *2013–15.*

Research showcase for the community and prospective college students to be exposed to the college environment and STEM as a potential career.

· *2009–2010: NSIT Alumni Association* ([www.nsitalumni.org](http://www.nsitalumni.org))

Co-Founded an online alumni network and started bi-annual publication *Reminisce*

· *2009–2010: NSIT Recruitment Placement Team*

Recruitment Liaison for the undergraduate batch of 2010.

## REFERENCES

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Please contact me for timely delivery of reference letters.

<b>Ken Goldberg</b>	Professor, IEOR and EECS at UC Berkeley Professor, Radiation Oncology at UC San Francisco Email: <a href="mailto:goldberg@berkeley.edu">goldberg@berkeley.edu</a>
<b>Fei-Fei Li</b>	Director Stanford AI Lab Professor, CS at Stanford Email: <a href="mailto:feifeili@cs.stanford.edu">feifeili@cs.stanford.edu</a>
<b>Silvio Savarese</b>	Professor, CS at Stanford Email: <a href="mailto:ssilvio@stanford.edu">ssilvio@stanford.edu</a>
<b>Dieter Fox</b>	Professor, CS at University of Washington Email: <a href="mailto:fox@cs.washington.edu">fox@cs.washington.edu</a>
<b>Marco Pavone</b>	Professor, Aero Astro, EE, ICME at Stanford Email: <a href="mailto:pavone@stanford.edu">pavone@stanford.edu</a>
<b>Oussama Khatib</b>	Professor of Computer Science at Stanford University Email: <a href="mailto:ok@cs.stanford.edu">ok@cs.stanford.edu</a>
<b>Pieter Abbeel</b>	Professor, EECS at UC Berkeley Email: <a href="mailto:pabbeel@cs.berkeley.edu">pabbeel@cs.berkeley.edu</a>

## PEER REVIEWED PUBLICATIONS

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### Theses

- [T2] Optimization and Design for Automation of Brachytherapy Delivery and Learning Robot-Assisted Surgical Subtasks. Ph.D. Thesis, University of California, Berkeley, 2016.
- [T1] Autonomous Palpation for Tumor Localization: Design of a Palpation Probe and Gaussian Process Adaptive Sampling. Masters' Thesis, University of California, Berkeley, 2016.

### Journal Publications

- [J5] K. Fang, Y. Zhu, **A. Garg**, V. Mehta, A. Kurenkov, L. Fei-Fei, S. Savarese. Learning Task-Oriented Grasping for Tool Manipulation with Simulated Self-Supervision. *under review Int'l Journal of Robotics Research, 2018.*
- [J4] S. Krishnan, **A. Garg**, R. Liaw, B. Thananjeyan, L. Miller, F. T. Pokorny, K. Goldberg. SWIRL: A Sequential Windowed Inverse Reinforcement Learning Algorithm for Robot Tasks With Delayed Rewards, *Int'l Journal of Robotics Research, 2018.*
- [J3] S. Krishnan\*, **A. Garg\***, S. Patil, C. Lea, G. Hager, P. Abbeel, K. Goldberg. (\* equal contribution) Transition State Clustering: Unsupervised Surgical Trajectory Segmentation For Robot Learning, *Int'l Journal of Robotics Research, 2017.*
- [J2] K. Mellis, T. Siau, A. Sudhyadhom, R. Sethi, I-C. Hsu, J. Pouliot, **A. Garg**, K. Goldberg, J. A. Cunha. Material Evaluation of PC-ISO for Customized, 3D Printed, Gynecologic 192Ir HDR Brachytherapy Applicators. *Journal of Applied Clinical Medical Physics (JACMP) 2014.*
- [J1] **A. Garg**, T. Siau, D. Berenson, A. Cunha, I-C. Hsu, J. Pouliot, D. Stoianovici, and K. Goldberg. Open-Loop Robot-Guided Insertion of Optimized Skew-Line Needle Arrangements for High Dose Rate Brachytherapy. *IEEE Transactions on Automation Science and Engineering, 2013.*

### Conference Publications and Preprints

- [C30] D.-A. Huang, S. Nair, D. Xu, Y. Zhu, **A. Garg**, L. Fei-Fei, S. Savarese, J. C. Niebles. Neural Task Graphs: Generalizing to Unseen Tasks from a Single Video Demonstration, under review at *IEEE Conf. on Computer Vision & Pattern Recognition (CVPR), 2019.*
- [C29] M.A. Lee\*, Y. Zhu\*, K. Srinivasan, P. Shah, S. Savarese, L. Fei-Fei, **A. Garg**, J. Bohg (\* equal contribution). Making Sense of Vision and Touch: Self-Supervised Learning of Multimodal Representations for Contact-Rich Tasks, under review at *IEEE Int'l Conference on Robotics and Automation (ICRA) 2019, arXiv 1810.10191.*
- [C28] M. Danielczuk, A. Kurenkov, A. Balakrishna, M. Matl, R. Martín-Martín, **A. Garg**, S. Savarese, K. Goldberg. Mechanical Search: Multi-Step Retrieval of a Target Object Occluded by Clutter, under review at *IEEE Int'l Conference on Robotics and Automation (ICRA) 2019.*
- [C27] A. Mandlekar, Y. Zhu, **A. Garg**, J. Booher, M. Spero, A. Tung, J. Gao, J. Emmons, A. Gupta, E. Orbay, S. Savarese, L. Fei-Fei. ROBOTURK: A Crowdsourcing Platform for Robotic Skill Learning through Imitation, *Conference on Robot Learning (CoRL) 2018.*
- [C26] K. Fang, Y. Zhu, **A. Garg**, V. Mehta, A. Kurenkov, L. Fei-Fei, S. Savarese. Learning Task-Oriented Grasping for Tool Manipulation with Simulated Self-Supervision. *Robotics Systems and Science (R:SS), 2018.*
- [C25] D.-A. Huang, S. Buch, L. Dery, **A. Garg**, L. Fei-Fei, J. C. Niebles. Finding "It": Weakly-Supervised Reference-Aware Visual Grounding in Instructional Video, *IEEE Conf. on Computer Vision & Pattern Recognition (CVPR), 2018.* (oral)

- [C24] D. Xu\*, S. Nair\*, Y. Zhu, J. Gao, **A. Garg**, L. Fei-Fei, S. Savarese (\* equal contribution). Neural Task Programming: Learning to Generalize Across Hierarchical Tasks, *IEEE Int'l Conference on Robotics and Automation (ICRA) 2018*, *arXiv 1710.01813*.
- [C23] A. Kurenkov\*, J. Ji\*, **A. Garg**, V. Mehta, J. Gwak, C. Choy, S. Savarese (\* equal contribution). DeformNet: Free-Form Deformation Network for 3D Shape Reconstruction from a Single Image. (*IEEE Winter Conf. on Applications of Computer Vision (WACV) 2018*), *arXiv 1708.04672*.
- [C22] J. Harrison\*, **A. Garg\***, B. Ivanovic, Y. Zhu, S. Savarese, L. Fei-Fei, M. Pavone (\* equal contribution). AdaPT: Zero-Shot Adaptive Policy Transfer for Stochastic Dynamical Systems, *Int'l Symposium on Robotics Research (ISRR) 2017*. *arXiv 1707.04674*
- [C21] J. Gwak, C. Choy, **A. Garg**, M.Chandraker, S. Savarese. Weakly supervised 3D Reconstruction with Adversarial Constraint, *Int'l Conf. on 3D Vision (3DV) 2017*.
- [C20] A. Mandlekar\*, Y. Zhu\*, **A. Garg\***, L. Fei-Fei, S. Savarese (\* equal contribution), Adversarially Robust Policy Learning through Active Construction of Physically-Plausible Perturbations, *Int'l Conf. on Intelligent Robots and Systems (IROS), 2017*.
- [C19] B. Thananjeyan, **A. Garg**, S. Krishnan, C. Chen, L. Miller, K. Goldberg. Multilateral Surgical Pattern Cutting in 2D Orthotropic Gauze with Deep Reinforcement Learning Policies for Tensioning. *IEEE Int'l Conference on Robotics and Automation (ICRA) 2017*.
- [C18] R. Liaw, S. Krishnan, **A. Garg**, D. Crankshaw, J. E. Gonzalez , K. Goldberg. Composing Meta-Policies for Autonomous Driving Using Hierarchical Deep Reinforcement Learning, *preprint, 2017*. *arXiv 1711.01503*
- [C17] S. Krishnan, **A. Garg**, R. Liaw, B. Thananjeyan, L. Miller, F. T. Pokorny, K. Goldberg. SWIRL: A Sequential Windowed Inverse Reinforcement Learning Algorithm for Robot Tasks With Delayed Rewards. *Workshop on Algorithmic Foundations in Robotics (WAFR), 2016*.
- [C16] **A. Garg**, S. Sen, R. Kapadia, Y. Jen, S. McKinley, L. Miller, K. Goldberg. A Tumor Localization using Automated Palpation with Gaussian Process Adaptive Sampling. *IEEE Int'l Conference on Automation Science and Engineering (CASE), 2016*.
- [C15] S. McKinley, **A. Garg**, S. Sen, D. V. Gealy, J. P. McKinley, Y. Jen, M. Guo, D. Boyd, K. Goldberg. An Interchangeable Surgical Instrument System with Application to Supervised Automation of Multilateral Tumor Resection. *IEEE Int'l Conference on Automation Science and Engineering (CASE), 2016*.
- [C14] A. Murali\*, **A. Garg\***, S. Krishnan\*, F. T. Pokorny, P. Abbeel, T. Darrell, K. Goldberg (\* denotes equal contribution). TSC-DL: Unsupervised Trajectory Segmentation of Multi-Modal Surgical Demonstrations with Deep Learning *IEEE Int'l Conference on Robotics and Automation (ICRA) 2016*
- [C13] S. Sen\*, **A. Garg\***, D. V. Gealy, S. McKinley, Y. Jen, K. Goldberg (\* denotes equal contribution). Autonomous Multiple-Throw Multilateral Surgical Suturing with a Mechanical Needle Guide and Optimization based Needle Planning. *IEEE Int'l Conference on Robotics and Automation (ICRA) 2016*
- [C12] S. Krishnan\*, **A. Garg\***, S. Patil, C. Lea, G. Hager, P. Abbeel, K. Goldberg.(\* equal contribution) Transition State Clustering: Unsupervised Surgical Trajectory Segmentation For Robot Learning. *International Symposium on Robotics Research (ISRR), 2015*.
- [C11] S. McKinley, **A. Garg**, S. Sen, R. Kapadia, A. Murali, K. Nichols, S. Lim, S. Patil, P. Abbeel, A. M. Okamura, K. Goldberg. A Disposable Haptic Palpation Probe for Locating Subcutaneous Blood Vessels in Robot-Assisted Minimally Invasive Surgery. *IEEE Int'l Conference on Automation Science and Engineering (CASE), 2015*.



- [C10] A. Murali, S. Sen, B. Kehoe, **A. Garg**, S. McFarland, S. Patil, W. D. Boyd, S. Lim, P. Abbeel, K. Goldberg. Learning by Observation for Surgical Subtasks: Multilateral Cutting of 3D Viscoelastic and 2D Orthotropic Tissue Phantoms. *IEEE Int'l Conference on Robotics and Automation (ICRA) 2015*. **Best Medical Robotics Paper Finalist**
- [C9] **A. Garg**, T. Siau, G. Yang, S. Patil, J. A. M. Cunha, I-C. Hsu, J. Pouliot, A. Atamtürk, K. Goldberg. Exact Reachability Analysis for Planning Skew-Line Needle Arrangements for Automated Brachytherapy. *IEEE Int'l Conference on Automation Science and Engineering (CASE), 2014*.
- [C8] T. Siau, J. A. M. Cunha, **A. Garg**, K. Goldberg, I-C. Hsu, and J. Pouliot. Customized Needle Guides for Inserting Non-Parallel Needle Arrangements in Prostate HDR Brachytherapy: A Phantom Study. *Brachytherapy 13 (2014): S126-S126*.
- [C7] **A. Garg**, S. Patil, T. Siau, J. A. M. Cunha, I-C. Hsu, P. Abbeel, J. Pouliot, and K. Goldberg. An Algorithm for Computing Customized 3D Printed Implants with Curvature Constrained Channels for Enhancing Intracavitary Brachytherapy Radiation Delivery. *IEEE Int'l Conference on Automation Science and Engineering (CASE), 2013*.
- [C6] **A. Garg**, T. Siau, D. Berenson, A. Cunha, I-C. Hsu, J. Pouliot, D. Stoianovici, and K. Goldberg. Initial Experiments toward Automated Robotic Implantation of Skew-Line Needle Arrangements for HDR Brachytherapy. *IEEE Int'l Conference on Automation Science and Engineering (CASE), 2012*. **Best Applications Paper**
- [C5] JAM Cunha, T. Siau, **A. Garg**, N. Zhang, K. Goldberg, D. Stoianovici, M. Roach III, I-C. Hsu, J. Pouliot. Robotic Brachytherapy Demonstration: Implant of HDR Brachytherapy Needle Configuration Computer-Optimized to Avoid Critical Structures Near the Bulb of the Penis. *Medical Physics, vol. 39, p.3931, 2012*.
- [C4] JAM Cunha, **A. Garg**, T. Siau, N. Zhang, Y. Zuo, K. Goldberg, D. Stoianovici, M. Roach, J. Pouliot. Robot-Guided delivery of Brachytherapy needles along Non-Parallel paths to avoid Penile Bulb puncture. *J. of Radiotherapy and Oncology, vol.103,p.S45-S46, May 2012*.
- [C3] S. Thakkar, **A. Garg**, A. Midha, P. Gaur. Low-cost Teleoperation of Remotely Located Actuators Based on Dual Tone Multi-frequency Data Transfer. *Advanced Materials Research 403 (2012): 3884-3891*. (Also in *IEEE Intl Conf. of Cybernetics, Robotics and Controls, 2011*)
- [C2] **A. Garg**, A. Toor, S. Thakkar, S. Goel, S. Maheshwari, S. Chand. The Autotrix: Design and Implementation of an Autonomous Urban Driving System. *Advanced Materials Research 403 (2012): 4727-4734*. (Also in *IEEE Intl Conf. of Cybernetics, Robotics and Controls, 2011*.)
- [C1] **A. Garg**, A. Toor, S. Thakkar, S. Goel, S. Maheshwari, S. Chand. Object Identification and Mapping using Monocular Vision in an Autonomous Urban Driving System. *Intl Conf. of Machine Vision, 2010*.

### Peer-Reviewed Non-archival Publications

- [W11] D. Xu, Y. Zhu, **A. Garg**, J. Gao, L. Fei-Fei, S. Savarese. Neural Task Programming: Learning to Generalize Across Hierarchical Tasks. *Conference on Robot Learning (CoRL) 2017*.
- [W10] A. Kurenkov\*, V. Mehta\*, J. Ji, **A. Garg**, S. Savarese (\* equal contribution). Towards Grasp Transfer using Shape Deformation. *Conference on Robot Learning (CoRL) 2017*.
- [W9] A. Mandlekar\*, Y. Zhu\*, **A. Garg\***, L. Fei-Fei, S. Savarese (\* equal contribution), Adversarially Robust Policy Learning through Active Construction of Physically-Plausible Perturbations *Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM), 2017*.

- [W8] S. Krishnan, **A. Garg**, R. Liaw, L. Miller, F. T. Pokorny, and K. Goldberg. HIRL: Hierarchical Inverse Reinforcement Learning for Long-Horizon Tasks with Delayed Rewards. *R:SS 2016 Workshop on Bootstrapping Manipulation Skills*.
- [W7] **A. Garg\***, S. Krishnan\*, A. Murali, F. T. Pokorny, P. Abbeel, T. Darrell, K. Goldberg (\* denotes equal contribution). On Visual Feature Representations for Transition State Learning in Robotic Task Demonstrations. *NIPS 2015 Workshop on Feature Extraction*.
- [W6] S. McKinley, **A. Garg**, S. Lim, S. Patil, K. Goldberg. Automated Delivery Instrument for Stem Cell Treatment using the da Vinci Robotic Surgical System. *13th Annual Meeting of the International Society for Stem Cell Research. Stockholm, Sweden. June 2015*.
- [W5] S. McKinley, S. Sen, **A. Garg**, Y. Jen, D. Gealy, W. D. Boyd, P. Abbeel, K. Goldberg. Autonomous Tumor Localization and Extraction. *Surgical Robot Challenge, Hamlyn Symposium, 2015*. **Best Video Award**.
- [W4] **A. Garg**, K. Goldberg. Learning, Optimization Design for Healthcare Systems. *Ph.D. Forum at ICRA 2015*.
- [W3] S. McKinley, **A. Garg**, S. Sen, R. Kapadia, A. Murali, K. Nichols, S. Lim, S. Patil, P. Abbeel, A. M. Okamura, K. Goldberg. Preliminary Report on the Design of a Palpation Probe for Robot-Assisted Minimally Invasive Surgery. *ICRA 2015 Workshop: Shared Frameworks for Medical Robotics Research* **Best Poster/Demo Award**.
- [W2] A. Murali\*, S. Sen\*, B. Kehoe, **A. Garg**, S. McFarland, S. Patil, W. D. Boyd, S. Lim, P. Abbeel, K. Goldberg>(\* denotes equal contribution). Multilateral Cutting on the da Vinci Research Kit (dVRK): Surgical Subtask Automation using Learning by Observation. *ICRA 2015 Workshop: Shared Frameworks for Medical Robotics Research*.
- [W1] A. Majewicz, J. Swensen, T. Wedlick, K. Reed, R. Alterovitz, V. Kallem, W. Park, **A. Garg**, G. Chirikjian, K. Goldberg, N. Cowan, and A. Okamura. A Robotic System for Needle Steering. *IEEE IROS 2011 Demonstrations*.

### Patents

- [P3] Precision Injector/Extractor for Robot-Assisted Minimally Invasive Surgery. Susan M.L. Lim, S. McKinley, **A. Garg**, S. Patil, and K. Goldberg. International Patent Application No. PCT/US2016/039026.
- [P2] Single-use Palpation Probe For Robotic Minimally-invasive Surgery. S. McKinley, K. Goldberg, **A. Garg**, S. Patil, K. Nichols, A. Okamura, D. Boyd. *Provisional Patent*
- [P1] Patient-Specific Temporary Implants For Accurately Guiding Local Means of Tumor Control Along Patient-Specific Internal Channels to Treat Cancers. J. Pouliot, K. Goldberg, I-C. Hsu, JAM Cunha, **A. Garg**, S. Patil, P. Abbeel, T. Siau. *U.S. Provisional. PCT International Application No.: PCT/US2014/048488 filed July 28, 2014*.