

# Gautam Salhotra

[me@gautamsalhotra.com](mailto:me@gautamsalhotra.com)  
[www.gautamsalhotra.com](http://www.gautamsalhotra.com)

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## Skills

Inductive Biases in Learning, Optimization, Robotic Manipulation & Locomotion, Control Theory  
*Programming:* Python, C++, Julia, bash, ROS, git, PyTorch, Tensorflow, MATLAB

## Education

**Graduate Student, PhD Computer Science, Robotics** ('18 – Present)

University of Southern California. **Advisor:** Dr. Gaurav Sukhatme

Research Focus: Learning & optimization, robotic manipulation & locomotion

**MS, Computer Science, Perception and Robotics** ('18)

College of Computing, Georgia Institute of Technology. GPA: 4/4

**MS, Mechanical Engineering, Dynamic Systems and Control** ('12)

Applied Research Laboratories (ARL), The University of Texas at Austin. GPA: 4/4

**BTech + MTech (Dual Degree), Mechanical Engineering** ('10)

Indian Institute of Technology Bombay (IIT Bombay), India. GPA: 8.59/10

## Publications

- **Gautam Salhotra**, Shashank Hegde, Sumeet Batra, Peter Englert, Gaurav S. Sukhatme. *Guided Learning of Robust Hurdling Policies with Curricular Trajectory Optimization*, Under Review ([website](#))
- **Gautam Salhotra\***, Chris Denniston\*, David A. Caron and Gaurav S. Sukhatme. *Adaptive Sampling using POMDPs with Domain-Specific Considerations*, ICRA 2021 ([pdf](#))
- Sung-Kyun Kim\*, Amanda Bouman\*, **Gautam Salhotra**, David Fan, Kyohei Otsu, Joel Burdick, Ali-akbar Agha Mohammadi, *PLGRIM: Hierarchical Value Learning for Large-scale Exploration in Unknown Environments*, ICAPS 2021 ([pdf](#))
- Jun Yamada, Youngwoon Lee, **Gautam Salhotra**, Max Pflueger, Karl Pertsch, Peter Englert, Gaurav S. Sukhatme, and Joseph J. Lim. *Motion Planner Augmented Action Spaces for Reinforcement Learning*, CoRL 2020 ([pdf](#))
- NASA JPL team CoSTAR, *NeBula: Quest for Robotic Autonomy in Challenging Environments; TEAM CoSTAR at the DARPA Subterranean Challenge*, Journal of Field Robotics, special issue on the DARPA SubT Challenge ([pdf](#))
- Justin Clough J., Patricia Chaffey, **Gautam Salhotra**, Colin Cess, Rey Pocius, Mary Bonaparte-Saller, Katie Mills, *Building Early Elementary Teacher Confidence in Teaching Computer Science Through a Low-Cost, Scalable Research-Practitioner Collaboration in Under-Resourced Latinx Los Angeles*, 2020 American Society for Engineering Education (ASEE) Annual Conference & Exposition ([pdf](#))
- Charles Kim, Alexandria Guo, **Gautam Salhotra**, Sara Sprinkhuizen, Keerthi Shetty, David Kong, *Sonifying Data from the Human Microbiota: Biota Beats*, MIT Computer Music Journal 44.1 (2020): 51-70 ([pdf](#))
- **Gautam Salhotra**, Vivek Bajpai, Ramesh Singh, *Finite Element Modeling of Orthogonal Cutting of Pyrolytic Carbon*, ASME 2011 International Manufacturing Science and Engineering Conf., Corvallis, OR
- Vivek Bajpai, **Gautam Salhotra**, Ramesh Singh, *Micromachining Characterization of Anisotropic Pyrolytic Carbon*, Inst. Of Mech Engr Journal of Engineering Manufacture, 225:9 (2011)
- Vivek Bajpai, **Gautam Salhotra**, Ramesh Singh, *Orthogonal Micro-grooving of Anisotropic Pyrolytic Carbon*, 2010 International Conf. On MicroManufacturing (ICOMM), Madison, WI

## Workshop Publications

- **Gautam Salhotra**, Peter Englert, Gaurav S. Sukhatme, *Curricular Policy Search for robust quadruped jumping*. ICRA 2021 workshop on Recent advances in MPC and RL for legged robots ([pdf](#))
- Pradeep Kadubandi, **Gautam Salhotra**, Peter Englert, Gaurav S. Sukhatme, *Motion Planner Guided Visuomotor Policy Learning*, ICRA 2021 workshop on Machine Learning for Motion Planning
- Jun Yamada, **Gautam Salhotra**, Youngwoon Lee, Max Pflueger, Karl Pertsch, Peter Englert, Gaurav S Sukhatme, Joseph J Lim, *Motion planner augmented action spaces for reinforcement learning*, RSS 2020 Workshop on Action Representations for Learning in Continuous Control, Corvallis OR

## Professional Experience

### Graduate Researcher, Robotics & Embedded Systems Lab, RESL (Aug '18 – Present)

- Task and motion planning, reinforcement learning with strong inductive biases, robot manipulation & locomotion, and adaptive sampling.

### Robotics Research Intern, Bosch Research (Summer '19)

- Developed ROS package to deploy a learned reinforcement learning algorithm on a robot.
- Created custom environments to test RL algorithms for solving manipulation tasks.
- Implemented classical control method for robotic peg insertion task.

### Senior Software Controls Engineer, Symbotic ('16 – '18)

- Implement object manipulation algorithms to pick to place cases in automated storage and retrieval systems (using C++, python, bash)
- Work on low-level controllers for actuator performance and stall detection

### Robotics & Technical Writing at MathWorks ('12 – '15)

- Member, MathWorks ETRobocon team 2013 & 2014 (see Projects)
- Implemented occupancy grid mapping prototype for robotics toolbox (see Projects)
- Technical writing: Wrote user examples for features in Simulink software

### Research Assistant, Applied Research Labs, Austin TX ('11- '12)

- Modeling dynamic response of a chiller in an in-house thermal management tool
- Compared PID and LQR control implementations for dynamic heat loads (C++, MATLAB)

### Graduate Researcher, Machine Tools Lab, IIT Bombay, India ('09 - '10)

- Modeled the anisotropic nature of Pyrolytic Graphite, using Abaqus™. Final model was as a laminate of multiple sheets, and the mechanical properties simulated were verified by experimentation.

### Engineering Intern, Siemens Transportation Systems (Summer '08)

- Designed a wheel for a new Light Rail Vehicle model
- Modified door design to minimize the rust on door ports by reducing weld contact area

### Undergraduate Research in Fluid dynamics, IIT Bombay, India (Summer '07)

- Modeled and studied the subsonic flow of fluids in a pipe, using ANSYS Fluent

## Teaching Experience

### Teaching Assistant, Univ of Southern California

- Produced and TA'ed master's level course: Introduction to Robotics, CS 545 (Fall '19)
- TA for CS 545, CS 591, CS 104

### Teaching Assistant, IIT Bombay ('09 - '10)

Manufacturing Processes II (Fall '09), Metrology Lab, (Spring '10)

## Other Projects

### Optimization for robot task and motion planning (Spring '20)

- Created an optimization framework to solve task and motion planning problems across kinematic switches in execution-space and symbolic search in task-space.

### **Multi-task learning through embeddings for robotic arms** (Fall '18)

- Training an agent to learn multiple manipulation tasks using trajectory embeddings (abstractions) and taking expert demonstrations as input trajectories.

### **Path Planning in Atlanta** (Spring '16)

- Implemented [path-planning in Atlanta USA](#), using bi-directional A\* and tri-directional UCS

### **Robot Localization: Particle Filter and AMCL** on custom robot (Jul & Nov '15)

- Jul '15: Implemented [particle filter localization and AMCL](#) on a custom-built robot in a maze  
Implemented clustering to detect multi-modal distributions. ([video](#))
- Nov '15: Formulated path-planner as MDP in BURLAP, solved with Q-Learning

### **Computer Vision: Tracking using Particle Filters** (Mar '15)

- Implemented an object tracking algorithm using particle filters to track a [face](#) and a [hand](#)

### **Occupancy Grid Mapping** (Jan – May '15)

- Developed a prototype for probabilistic occupancy grids with range-sensor data ([demo](#))

### **Computer Vision & Controls, ET Robocon, MathWorks** (Summer '13, Summer '14)

- 2013: Implemented a control algorithm for Lego MINDSTORMS NXT to cross ramps and a moving platform while balancing and line following ([blogpost](#))
- 2014: Detected and tracked multiple robots in real-time. Tracked Sphero robots by color (HSV filtering), and Zumbots by using a SIFT detector and a KLT point tracker

### **Reinforcement Learning: Teaching AI agents soccer** (Apr '16)

- Utilized Q-learning to teach two Foe-Q agents a simplified version of soccer ([video](#))

### **Inverse Reinforcement Learning (IRL) applied to sensorimotor learning** (Jan - Apr '18)

- Applied IRL to enable an AI agent to test human sensorimotor skills ([video](#))

### **Dynamic simulation and control of a 6-axis Stanford arm** (May '12)

- Developed feedforward and PID controller to manipulate an unknown payload

### **Simulation and control of an inverted pendulum** on a moving platform (Apr '11)

- Implemented a Kalman filter algorithm for estimation and an LQR optimal controller

### **Simulation of a dunking bird** (May '12)

- Coupled the mechanical, thermal, and fluid domains using bond graph theory

### **Magnetic levitation of a sphere** (Apr '11)

- Designed a lead-lag compensator for levitation of a sphere using an electromagnet

### **Brakes Team Leader, IIT Bombay Formula SAE Team** ('07 – '09)

- Designed, fabricated, and tested the braking system and frontal-impact attenuator for 2 cars (FSAE Michigan & Formula Student Silverstone UK)

### **Talks/Presentations**

- Introduction to Task and Motion Planning, invited lecture to CS 545 at USC (Nov '19)
- Introduction to Reinforcement Learning, Bosch Research LLC (Jun '19)

- Simulation and Control of a Marine Chiller, Electric Ship Research and Development Consortium Workshop, Austin TX (Jun '12)
- Micromachining Characterization of Pyrolytic Graphite (thesis), IIT Bombay (Jun '10)
- Regenerative Braking Strategies, IIT Bombay, India (Apr '08)
- Nitrous Boost in cars, IIT Bombay technical presentation (Jan '06)

## Key Graduate Courses

### Robotics & related CS

Reinforcement Learning, Deep Learning, Computer Vision, Artificial Intelligence, Human-Computer Interaction, Geometry (Kinematics) of Mechanisms & Robots, Advanced Dynamics of Robotic Systems

### System Modelling & Control Theory

Modeling of Multi-Energy Physical Systems, Finite Element Method, Modern (Optimal) Control, Stochastic Systems Estimation & Control

## Service

### Professional Service

- ICRA 2021 chair for session on "Field Robotics: Control" (May '21)
- Reviewed grant proposals for the US Department of Energy, office of SBIR/STTR (Mar '21)
- Volunteer panelist on advising first year CS PhD students on internships (Nov '19)
- Advising undergrad REU students on graduate research and grad student life (Jul '21)

### Volunteering

- Administrative volunteer in RESL lab as a student host for speakers, lab coordinators, etc.
- Volunteer at [StreetBio](#), a community bio-lab in Cambridge MA (Feb '17 – Apr '19)
- Community Farming Volunteer, Stearns Farm, Framingham MA (May '15)
- Cleanup of Lake Cochituate and nearby trails, Natick MA (Jun '13, Jun '14)

### University Service

- Volunteer at [USC VAST](#) K-12 outreach, to teach robotics & programming (Dec '18 - Present)
- Volunteer at USC Robotics Open House (outreach to school children) (Apr '19, Apr '21)
- Volunteer for Girls Empowerment Day: Encouraging high school girls to pursue robotics as a career option, USC (Dec '19)
- Editor, Politics, Nazar student magazine, University of Texas ('11 - '12)
- Head, IIT Bombay Chapter of PiTech, Pan IIT Technical Magazine ('09 - '10)
- Institute Student Mentor for Freshmen ('09 - '10)
- Student Journalist, InslghT student newspaper, IIT Bombay ('06 - '10)

### Department & Hostel (Dorm) Service

- Chief Editor, Mechanical Engineering Department Magazine, MEME ('09 - '10)
- Head, Mech. Engg. Dept. Academic Mentorship Programme ('09 - '10)
- Cultural Activities Councillor ('07 - '08)
- Founder and Chief Editor, Hostel 3 magazine - 3BUNE ('07 - '09)
- Debating Activities Secretary, Hostel 3, IIT Bombay ('06 - '07)

## Awards & Honors

- Amazon Research Award 2018
- DAAD WISE Scholarship 2008 (by German Academic Exchange Service) for internships in Germany ('08)

- Indian Institute of Technology Joint Entrance Exam (JEE): 858<sup>th</sup> out of 400,000 students nationwide ('05)
- Certificate of Excellence in Mathematics in Grade XII, State Govt. of Maharashtra, India ('04)
- Maharashtra High School Scholarship (HSS) recipient, State Govt. of Maharashtra, India. Ranked 29<sup>th</sup> in the state ('99)

### **Extra-Curricular Activities**

- Parliamentary debates, adventure sports (climbing, kayaking, etc.), photography, environmental conservation
- Member, [Biota Beats](#) project at the intersection of arts & life sciences ('17 – '20)
- Winner, UTexas Graduate Student Photography Showcase (Apr '12)
- Institute Cultural Colour, IIT Bombay ('08 - '09)  
Given to 6 in 6000 students, for excellence in cultural activities that year
- Hostel/Dorm Awards for Organizational & Cultural activities, IIT Bombay ('06 - '07)