

# MUSTAFA MUKADAM

308F College of Computing Building, 801 Atlantic Drive, Atlanta, GA 30332  
mmukadam3@gatech.edu | www.mustafamukadam.com | github.com/mhmukadam

## RESEARCH INTERESTS

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Robotics, Motion Planning, Machine Learning, Learning from Demonstration, Manipulation, Controls, Estimation

## EDUCATION

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**PhD, Robotics**, Georgia Institute of Technology, USA Aug '14–Present  
Advisor: Dr. Byron Boots

**MS, Aerospace Engineering**, University of Illinois at Urbana-Champaign, USA Aug '12–May '14

**BE, Mechanical Engineering**, Sardar Patel College of Engr., Mumbai University, India Aug '08–May '12

## RESEARCH/WORK EXPERIENCE

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**Georgia Tech, Robot Learning Lab**, PI: Dr. Byron Boots GA, USA  
**Graduate Research Assistant** Jan '15–Present

- Conducting fundamental theoretical and applied research in robotics
- Developed state-of-the-art algorithms in planning, LfD, control, estimation and their intersections



**NVIDIA, Seattle Robotics Lab**, Supervisor: Dr. Dieter Fox WA, USA  
**Robotics Research Intern** May '18–Aug '18

- Real-time reactive motion generation



**Amazon Robotics**, Supervisor: Dr. Joey Durham MA, USA  
**Research Scientist Intern** Aug '17–Dec '17

- Estimation and prediction of pedestrian motion



**Honda Research Institute**, Supervisor: Dr. Alireza Nakhaei CA, USA  
**Research Intern** May '17–Aug '17

- Autonomous lane changing for self driving cars with deep reinforcement learning



**Georgia Tech, Mobile Robot Lab**, PI: Dr. Ronald Arkin GA, USA  
**Graduate Research Assistant** Aug '14–Dec '14

- Multi-agent robotic systems inspired from elk herding behavior



**UIUC, Advanced Controls Research Lab**, PI: Dr. Naira Hovakimyan IL, USA  
**Graduate Research Associate** May '14–July '14

- Way point navigation and obstacle avoidance for multi-robot control



**UIUC, Robotics and neuro-Mechanical Systems Lab**, PI: Dr. Timothy Bretl IL, USA  
**Graduate Student Research** Jan '13–May '14

- Manipulation planning for deformable linear objects

## SKILLS

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**Language:** C++, Python, Embedded C, MATLAB, Java, LaTeX

**Software:** ROS, GTSAM, Tensorflow, CUDA, OpenMPI, OpenRAVE, OMPL, CATIA

**Robots:** WAM (Barrett), JACO/JACO2 (Kinova), Vector (Stanley Innovation), Kiva Drives (Amazon)

**Hardware:** Optitrack, ARM9, Raspberry PI, MSP430, TMS320, Arduino

## TEACHING

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-  **UIUC, TESSAL**, Supervisor: Dr. Bonnie Ferri GA, USA  
**Teaching Assistant**, Electrical and Computer Engineering Fall 2015, Summer 2015, Spring 2015
- Conducted in class labs based on embedded processors for fundamental ECE courses
  - Trained TAs of respective courses on the labs
-  **UIUC, ECE Senior Design**, Supervisors: Dr. Scott Carney, Dr. Jonathan Makela IL, USA  
**Teaching Assistant**, Electrical and Computer Engineering Spring 2014, Fall 2013, Spring 2013
- Gave lectures to a class of 150+ students and mentored 8-9 projects (group of 2-3 students) each semester
  - Provided mentorship that led students in winning the 'Instructor's Award' (best project)
-  **UIUC, NetMath**, Supervisor: Bruce Carpenter IL, USA  
 Mentor for Calculus I and II, Department of Mathematics Fall 2012
- Taught distance learning students online via Mathematica

## EXTRA-CIRRICULAR PROJECTS

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- NASA Robotic Mining Competition** 2012-2013  
 Autonomous Systems Team leader (team size ~ 10 students), UIUC
- Robocon (International Robotic Contest)** 2011-2012  
 Team leader (team size ~ 40 students), Sardar Patel College of Engr.
- Robocon (International Robotic Contest)** 2010-2011  
 Team leader (team size ~ 40 students), Sardar Patel College of Engr.

## HONORS AND AWARDS

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- NeurIPS Travel Award** 2018
- Husqvarna Research Platform Award, ICRA 2016** 2016
- ECE Graduate Fellowship, Georgia Tech** 2014-2015
- List of Teachers Ranked as Excellent by their Students (*outstanding*)**, ECE Senior Design, UIUC Spring '14
- List of Teachers Ranked as Excellent by their Students**, ECE Senior Design, UIUC Fall '13

## PROFESSIONAL AND OUTREACH ACTIVITIES

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- Organizer** for Workshop on *Imitation Learning and its Challenges in Robotics* at NeurIPS 2018  
<https://sites.google.com/view/nips18-ilor>
- Organizer** for Workshop on *Learning and Inference in Robotics* at RSS 2018  
<https://sites.google.com/view/rss2018lair>
- Reviewer** for Conferences: RSS, ICRA, IROS, AAMAS, ICAPS
- Reviewer** for Journals: IJRR, T-ASE, RA-L
- VP of Academics, RoboGrads** - Graduate Student Organization, Georgia Tech 2017-2018
- VP of Robotics PhD, RoboGrads** - Graduate Student Organization, Georgia Tech 2016-2017
- Student Member**, IEEE and Robotics & Automation Society 2014-Present
- Founder, President**, Sardar Patel Automation and Robotics Club (SPARK), Sardar Patel College of Engr. 2011-2012
- FIRST outreach**, Mentoring for First Robotics Challenge (FRC), Judging for First Lego League (FLL)
- RoboGrads outreach**, Georgia Tech, conducting lab tours for high/middle school students

## PUBLICATIONS

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### Preprint

- [1] Multi-Objective Policy Generation for Multi-Robot Systems Using Riemannian Motion Policies  
A. Li, **M. Mukadam**, M. Egerstedt, B. Boots  
arXiv:1902.05177, 2019

### Conference & Journal

- [13] Joint Inference of Physics-Based Tracking and Force Estimation in Planar Pushing  
A. Lambert, B. Sundaralingam, **M. Mukadam**, N. Ratliff, B. Boots, D. Fox  
Proceedings of IEEE Conference on Robotics and Automation (ICRA), 2019
- [12] RMPflow: A Computational Graph for Automatic Motion Policy Generation  
C. Cheng, **M. Mukadam**, J. Issac, S. Birchfield, D. Fox, B. Boots, N. Ratliff  
Proceedings of International Workshop on the Algorithmic Foundations of Robotics (WAFR), 2018
- [11] Learning Generalizable Robot Skills from Demonstrations in Cluttered Environments  
M. A. Rana, **M. Mukadam**, S. R. Ahmadzadeh, S. Chernova, B. Boots  
Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018
- [10] STEAP: Simultaneous Trajectory Estimation and Planning  
**M. Mukadam\***, J. Dong\*, F. Dellaert, B. Boots  
Autonomous Robots (AuRo), 2018  
(Invited submission from RSS 2017)
- [9] Continuous-Time Gaussian Process Motion Planning via Probabilistic Inference  
**M. Mukadam\***, J. Dong\*, X. Yan, F. Dellaert, B. Boots  
International Journal of Robotics Research (IJRR), 2018
- [8] Sparse Gaussian Processes on Matrix Lie Groups: A Unified Framework for Optimizing Continuous-Time Trajectories  
J. Dong, **M. Mukadam**, B. Boots, F. Dellaert  
Proceedings of IEEE Conference on Robotics and Automation (ICRA), 2018
- [7] Towards Robust Skill Generalization: Unifying Learning from Demonstration and Motion Planning  
M. A. Rana, **M. Mukadam**, S. R. Ahmadzadeh, S. Chernova, B. Boots  
Proceedings of Conference on Robot Learning (CoRL), 2017  
(Selected for plenary presentation: 8% acceptance rate)
- [6] Simultaneous Trajectory Estimation and Planning via Probabilistic Inference  
**M. Mukadam**, J. Dong, F. Dellaert, B. Boots  
Proceedings of Robotics: Science and Systems (RSS), 2017
- [5] Approximately Optimal Continuous-Time Motion Planning and Control via Probabilistic Inference  
**M. Mukadam**, C. Cheng, X. Yan, B. Boots  
Proceedings of IEEE Conference on Robotics and Automation (ICRA), 2017
- [4] Motion Planning with Graph-Based Trajectories and Gaussian Process Inference  
E. Huang, **M. Mukadam**, Z. Liu, B. Boots  
Proceedings of IEEE Conference on Robotics and Automation (ICRA), 2017
- [3] Motion Planning as Probabilistic Inference using Gaussian Processes and Factor Graphs  
J. Dong, **M. Mukadam**, F. Dellaert, B. Boots  
Proceedings of Robotics: Science and Systems (RSS), 2016
- [2] Gaussian Process Motion Planning  
**M. Mukadam**, X. Yan, B. Boots  
Proceedings of IEEE Conference on Robotics and Automation (ICRA), 2016
- [1] Quasi-Static Manipulation of a Planar Elastic Rod using Multiple Robotic Grippers  
**M. Mukadam**, A. Borum, T. Bretl  
Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2014

**Refereed Workshop**

- [5] Robot Skill Learning from Demonstrations in Cluttered Environments  
M. A. Rana, **M. Mukadam**, S. R. Ahmadzadeh, S. Chernova, B. Boots  
RSS Workshop on Learning and Inference in Robotics: Integrating Structure, Priors and Models, 2018
- [4] Tactical Decision Making for Lane Changing with Deep Reinforcement Learning  
**M. Mukadam**, A. Cosgun, A. Nakhaei, K. Fujimura  
NIPS Workshop on Machine Learning for Intelligent Transportation Systems, 2017
- [3] STEAP: Towards Online Estimation and Replanning  
**M. Mukadam**, J. Dong, X. Yan, F. Dellaert, B. Boots  
RSS Workshop on POMDPs in Robotics, 2017
- [2] Towards Robust Skill Generalization: Unifying LfD and Motion Planning  
M. A. Rana, **M. Mukadam**, S. R. Ahmadzadeh, S. Chernova, B. Boots  
RSS Workshop on Data-Driven Robotic Manipulation, 2017
- [1] Skill Generalization via Inference-Based Planning  
M. A. Rana, **M. Mukadam**, S. R. Ahmadzadeh, S. Chernova, B. Boots  
RSS Workshop on Mathematical Models, Algorithms, and Human-Robot Interaction, 2017