

Ajinkya Jain

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INTERESTS	Motion Planning, Robot Manipulation Planning and Control, Reinforcement Learning	
EDUCATION	Doctor of Philosophy , Mechanical Engineering, Advisor: Prof. Scott Niekum (2015 - 2020) <i>Specialization: Robotics, Dynamics Systems and Controls</i> The University of Texas at Austin	
	Master of Technology , Mechanical Engineering (2014 - 2015) <i>Specialization: Robotics</i> Indian Institute of Technology Kanpur	
	Bachelor of Technology , Mechanical Engineering (2010 - 2014) Indian Institute of Technology Kanpur	
RESEARCH EXPERIENCE	Graduate Research Assistant, Computer Science Jan'16 - present Advised By Prof. Scott Niekum, Department of Computer Science, UT Austin Project Title: <i>Leveraging Task Structure for Robot Manipulation Planning under Uncertainty</i> <ul style="list-style-type: none">• Developed POMDP Motion planner that leverages knowledge of motion constraints encountered during a manipulation task to plan under noisy feedback• Utilized trajectory optimization techniques for optimal motion planning of hybrid systems• Implemented for Contact-Rich toy airplane assembly task on a 7 DOF Kinova Jaco2 Arm Graduate Research Assistant, Mechanical Engineering, IIT Kanpur Feb'14 - June'15 Advised by Prof. Bishakh Bhattacharya, Dept. of Mechanical Engineering Thesis: <i>Two Design Challenges in Exoskeleton Systems: Optimal Gripper Design and Optimal Bipedal Gait Controller</i> [Github] [paper] <ul style="list-style-type: none">• Modeled Dynamics of Piezoelectric actuator using a novel minimalistic model• Optimized Piezoelectric actuator driven gripper design using genetic algorithm• Designed a Time-Varying Optimal Controller (LQR) for Bipedal locomotion of Exoskeletons Undergraduate Research Assistant, Aerospace Engineering, TAMU May'13 - July'13 Advised by Prof. Suman Chakravorty, Dept. of Aerospace Engineering Title: <i>Motion planning for MAVs using Feedback Information based RoadMaps</i> [GitHub] <ul style="list-style-type: none">• Implemented Motion Planning Library FIRM on robots including mobile manipulator Kuka youBot• Interfaced robotic simulator, V-Rep, with the library in MATLAB• Features: Robot Dynamics Models, Customizable work environment, Synchronized communication	
PRODUCT DEVELOPMENT EXPERIENCE	Team Austin Villa, Robocup@Home, SSPL March'17 - July'17 <i>Third Place Worldwide, Nagoya Japan</i> <ul style="list-style-type: none">• Developed Manipulation pipeline for Toyota Human Support Robot• Implemented fast tabletop perception based common household object grasping and manipulation Boeing IIT-K Autonomous Navigation System (Abhyast) Phase-III May'12 - Jan'13 <i>Funded by Boeing Corporation, US and Dean, R&D, IIT Kanpur</i> <ul style="list-style-type: none">• Built navigation planner for a jumping robot capable of navigating in cluttered environment Project: Humanoid Robot, Phase-I Sep'11 - April'12 <i>Funded by Dean, Resource Planning & Generation, IIT Kanpur</i> <ul style="list-style-type: none">• Designed navigation system for an omnidirectional movable robot featuring obstacle avoidance and path planning	
TECHNICAL SKILLS	Languages: C, C++, Python, MATLAB Softwares/Other Tools: Robot Operating System, Moveit, Drake Toolbox for Planning, Control and Analysis, AGILE Grasp, Autodesk Inventor, V-REP Simulator Hardware: Toyota Human Support Robot, Kinova Jaco-2 6-DOF and 7-DOF Arms, Microsoft Kinect SDK, Hokuyo 3D laser Scanner, Atmel AVR, Arduino, Bluetooth Modules, IR sensors, IC Engines	

ACADEMIC
PROJECTS

Learning Optimal Policy under Spatially-Varying Dynamics Aug'16-Dec'16
Reinforcement Learning: Theory and Practice, Course Project, UT Austin

- Developed learning agents executing optimal policy on domains with spatially-varying dynamics
- Stochastic dynamics modeled as POMDP; Implemented **SARSA** update rule with Eligibility traces

Stochastic Motion Planning for State-Dependent Dynamics Aug'16-Dec'16
Robot Learning from Demonstration and Interaction, Course Project, UT Austin

- Modeled state-dependent dynamics as hybrid dynamics; Motion planning under uncertainty as POMDP
- Implemented and Extended Belief-space LQR algorithm to Hybrid systems

Optimal Controller for Car Active Suspension Assembly Jan'17-May'17
Modern Control, Course Project, UT Austin

- Designed and Implemented a Reduced-order observer with an Optimal finite time tracker

A case study of Passivity-based control of 6-DOF arm Jan'16-May'16
Nonlinear Dynamics and Control, Course Project, UT Austin

- Designed and Implemented a Passivity-based feedback linearization controller for 6-DOF arm

Classification of Human Actions in Video Jan'14-Apr'14
Course Project, Computer Vision, IIT Kanpur

- Implemented multiclass SVM and SCHM for classifying Human Actions in Videos.
- Improved SCHM by focusing on characteristic histogram bins; *Accuracy increased by 20%*

A* algorithm : A motion planning algorithm for Soccer playing Robots July'13-Nov'13
Term Paper, Robot Motion Planning, IIT Kanpur

- Analysed applicability of A* Graph search algorithm as offensive strategy for Soccer playing robots
- Simulated a 2D Soccer game on MATLAB; Studied the impact of computational complexity of path planning algorithm and team formation and passing strategy, on the chances of winning.

RELEVANT
COURSES

Robotics: Introduction to Robotics, Robot Motion Planning, Robot Manipulators: Dynamics and Control, Robot Mechanism Design

Machine Learning: Reinforcement Learning, Learning from Demonstration and Interaction, Computer Vision and Image Processing

Controls: Optimal Control, Nonlinear Dynamics & Control, Modern Control, Automation & Control

Miscellaneous: Optimization Methods in Engineering, Theory of Mechanisms and Machines, Finite Element Methods, Programming and Numerical Analysis, Introduction to Cognitive Science

PUBLICATIONS

A. Jain and S. Niekum, Belief Space Planning under Approximate Hybrid Dynamics, Robotics: Science and Systems (R:SS) Workshop on POMDPs in Robotics, July 2017.

R. Datta, **A. Jain** & B. Bhattacharya, "A Piezoelectric Model based Multi-Objective Optimization of Robot Gripper Design", *Structural and Multidisciplinary Optimization, Springer 2015* [[paper](#)]

A. Jain, R. Datta & B. Bhattacharya, "Unified Minimalistic Modelling of Piezoelectric Stack Actuators for Engineering Applications", *Advances in Intelligent Systems and Computing, Springer 2014* [[paper](#)]

AWARDS AND
ACHIEVEMENTS

- Awarded **Certificate of Merit for Academic Excellence** for the terms 2011-12 and 2012-13
- Recipient of **Robotics Scholarship** by **Boeing Corporation** for Abhyast Phase-III project
- Selected for **TAMU-IITK Student Exchange Program at Texas A&M University**, 2013