

# Ajinkya Jain

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INTERESTS	Robot Learning, Robot Manipulation, Robot Motion Planning and Controls, Reinforcement Learning	
EDUCATION	<b>Doctor of Philosophy</b> , Mechanical Engineering, Advisor: Prof. Scott Niekum (2015 - Present) <i>Specialization: Robotics, Dynamics Systems and Controls</i> The University of Texas at Austin	
	<b>Master of Technology</b> , Mechanical Engineering (2014 - 2015) <i>Specialization: Robotics</i> Indian Institute of Technology Kanpur	
	<b>Bachelor of Technology</b> , Mechanical Engineering (2010 - 2014) Indian Institute of Technology Kanpur	
RESEARCH EXPERIENCE	<b>Graduate Research Assistant, Computer Science, UT Austin</b> Jan'16 - present Advised By Prof. Scott Niekum, Department of Computer Science, UT Austin Project Title: <i>Learning and Leveraging Dynamics for Robot Motion Planning Under Uncertainty</i> <ul style="list-style-type: none"><li>• Developed a POMDP Motion planner that leverages knowledge of task dynamics to improve performance on manipulation tasks involving noisy feedback and nonlinear dynamics</li><li>• Developed an algorithm for learning planning-compatible hybrid kinematics models for articulated objects from human demonstrations</li><li>• Proposed a novel deep network architecture for learning articulation models for objects directly from raw depth images across articulation types using screw theory</li></ul>	
	<b>Graduate Research Assistant, Mechanical Engineering, IIT Kanpur</b> 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"><li>• Modeled Dynamics of Piezoelectric actuator using a novel minimalistic model</li><li>• Optimized Piezoelectric actuator driven gripper design using genetic algorithm</li><li>• Designed a Time-Varying Optimal Controller (LQR) for Bipedal locomotion of Exoskeletons</li></ul>	
	<b>Undergraduate Research Assistant, Aerospace Engineering, TAMU</b> 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"><li>• Implemented Motion Planning Library FIRM on robots including mobile manipulator Kuka youBot</li><li>• Interfaced robotic simulator, V-Rep, with the library in MATLAB</li><li>• Features: Robot Dynamics Models, Customizable work environment, Synchronized communication</li></ul>	
PUBLICATIONS	<b>A. Jain</b> , R. Lioutikov, and S. Niekum, ScrewNet: Category-Independent Articulation Model Estimation From Depth Images Using Screw Theory, <i>under submission</i> , July 2020	
	<b>A. Jain</b> and S. Niekum, Learning Hybrid Object Kinematics for Efficient Hierarchical Planning Under Uncertainty, <i>IEEE/RSJ International Conference on Intelligent Robots &amp; Systems (IROS)</i> , 2020 [paper]	
	<b>A. Jain</b> and S. Niekum, Efficient Hierarchical Robot Motion Planning Under Uncertainty and Hybrid Dynamics, <i>Conference on Robot Learning (CoRL)</i> , 2018. [paper]	
	<b>A. Jain</b> and S. Niekum, Belief Space Planning under Approximate Hybrid Dynamics, <i>Workshop on POMDPs in Robotics, Robotics: Science and Systems (R:SS)</i> , 2017	
	R. Datta, <b>A. Jain</b> & B. Bhattacharya, "A Piezoelectric Model based Multi-Objective Optimization of Robot Gripper Design", <i>Structural and Multidisciplinary Optimization, Springer 2015</i> [paper]	
	<b>A. Jain</b> , R. Datta & B. Bhattacharya, "Unified Minimalistic Modelling of Piezoelectric Stack Actuators for Engineering Applications", <i>Advances in Intelligent Systems and Computing, Springer 2014</i> [paper]	

POSTERS	<ul style="list-style-type: none"> <li>• Efficient Robot Motion Planning Under Uncertainty, <i>UT Robotics Consortium</i>, 2019</li> <li>• Robot Motion Planning Under Uncertainty for Tasks Involving Contacts, <i>UT GAIN'19 Symposium</i></li> <li>• Belief Space Planning for Robot Manipulation with Hybrid Dynamics, <i>UT Robotics Consortium</i>, 2018</li> </ul>
INTERNSHIPS	<p><b>AI Researcher, Samsung AI Research Center-Robotics, New York</b> May'19 - Aug'19  Project Title: <i>Zero Shot Learning to Grasp using Single RGB-D image</i></p> <ul style="list-style-type: none"> <li>• Objective: Optimal grasp selection for an object in the scene without human supervision</li> <li>• Developed a data-efficient end-to-end autonomous learning system for object-category level grasping</li> </ul> <p><b>Robotician, Vicarious</b> May'18 - Aug'18  Project Title: <i>Task Agnostic High Precision Assembly using Visual Servoing</i></p> <ul style="list-style-type: none"> <li>• Implemented state-of-the-art visual servoing algorithms to do high precision (<math>\leq 2mm</math>) assembly tasks</li> <li>• Ensured Fast convergence (<math>\leq 20 s</math>) to target features with High repeatability (<math>\geq 90\%</math> success)</li> <li>• Developed interfaces to ensure a Task and Platform-agnostic implementation</li> </ul>
PRODUCT DEVELOPMENT EXPERIENCE	<p><b>Team Austin Villa, Robocup@Home, SSPL</b> March'17 - July'17  <i>Third Place Worldwide, Nagoya Japan</i></p> <ul style="list-style-type: none"> <li>• Developed Manipulation pipeline for Toyota Human Support Robot</li> <li>• Implemented fast tabletop perception based common household object grasping and manipulation</li> </ul> <p><b>Boeing IIT-K Autonomous Navigation System (Abhyast) Phase-III</b> May'12 - Jan'13  <i>Funded by Boeing Corporation, US and Dean, R&amp;D, IIT Kanpur</i></p> <ul style="list-style-type: none"> <li>• Built navigation planner for a jumping robot capable of navigating in cluttered environment</li> </ul> <p><b>Project: Humanoid Robot, Phase-I</b>  <i>Funded by Dean, Resource Planning &amp; Generation, IIT Kanpur</i> Sep'11 - April'12</p> <ul style="list-style-type: none"> <li>• Designed navigation system for an omnidirectional movable robot featuring obstacle avoidance and path planning</li> </ul>
TECHNICAL SKILLS	<p><b>Languages:</b> C, C++, Python, MATLAB</p> <p><b>Softwares/Other Tools:</b> ROS, Moveit, Drake Toolbox, Autodesk Inventor, V-REP Simulator</p> <p><b>Hardware:</b> 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</p>
AWARDS AND ACHIEVEMENTS	<ul style="list-style-type: none"> <li>• Awarded <b>UT AI-lab travel grant</b> for attending conferences in 2017 and 2018</li> <li>• Awarded <b>Certificate of Merit for Academic Excellence</b> at IITKanpur for 2011-12 and 2012-13</li> <li>• Recipient of <b>Robotics Scholarship</b> by <b>Boeing Corporation</b> for Abhyast Phase-III project</li> <li>• Selected for <b>TAMU-IITK Student Exchange Program at Texas A&amp;M University</b>, 2013</li> </ul>
ACADEMIC PROJECTS	<p><b>Learning Optimal Policy under Spatially-Varying Dynamics</b> Aug'16-Dec'16  <i>Reinforcement Learning: Theory and Practice, Course Project, UT Austin</i></p> <ul style="list-style-type: none"> <li>• Developed learning agents executing optimal policy on domains with spatially-varying dynamics</li> <li>• Stochastic dynamics modeled as POMDP; Implemented <b>SARSA</b> update rule with Eligibility traces</li> </ul> <p><b>Stochastic Motion Planning for State-Dependent Dynamics</b> Aug'16-Dec'16  <i>Robot Learning from Demonstration and Interaction, Course Project, UT Austin</i></p> <ul style="list-style-type: none"> <li>• Modeled state-dependent dynamics as hybrid dynamics; Motion planning under uncertainty as POMDP</li> <li>• Implemented and Extended Belief-space LQR algorithm to Hybrid systems</li> </ul> <p><b>Analysis of Optimal Control Schemes for Car Active Suspension Assembly</b> Jan'17-May'17  <i>Modern Control, Course Project, UT Austin</i></p> <ul style="list-style-type: none"> <li>• Designed and Implemented a Reduced-order observer with an Optimal finite time tracker</li> </ul>

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