# Priyam Parashar

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## Education

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| 2016-Present | PH.D. RESEARCHER in Computer Science | **UC, San Diego** |
| | ADVISOR: Dr. Henrik I. Christensen, Dr. Ashok K. Goel | Expected: Q3 2021 |
| 2015-2016 | PH.D. RESEARCHER in Robotics | **IRIM, Georgia Institute of Technology** |
| | ADVISOR: Dr. Henrik I. Christensen, Dr. Ashok K. Goel | |
| 2015 | M.Sc. in Robotics | **Robotics Institute, CMU** |
| | ADVISOR: Dr. Reid Simmons | CGPA: 3.90/4.00 |
| 2013 | B.Tech. in Elec. and Comm. | **International Institute of Information Technology, Hyderabad** |
| | ADVISOR: Dr. K. Madhava Krishna | CGPA: 8.55/10.00 |

## Academic Research Experience

**2015-Present** — COGNITIVE ROBOTICS LAB - UC SAN DIEGO, CA [1], [2], [4]
- Ph.D. thesis on plan execution monitoring based on past observations and subsequent repair in novel configurations using model-based reasoning and guided learning with application on manipulators
- Initiated an assembly planning and plan repair project which expanded to a team of 3 more Masters students
- Led the design, modeling, and implementation of a technical product based on assembly planning project. Served as the primary point-of-contact for overseas sponsor and technical mentor for sister-team
- Implemented robot application platforms for 2 separate competitions and exhibitions as part of a team of Ph.D. students
- Mentored 2 Undergraduates, 2 Masters and 1 Ph.D. student in their research agenda

**2013-2014** — ROBOTICS INSTITUTE - CMU - PITTSBURGH, PA [3]
- Modelled and designed an algorithmic pipeline in MATLAB for analyzing indoor navigational traffic patterns, classifying between high and low traffic modes given time of day and other features, and predict the expected travel-time for informing route planner
- Managed collaboration between two research labs to acquire longitudinal robot data for initial analysis
- Communicated key insights and data requirements for the algorithm to sponsors, i.e. Vecna Robotics
- Implemented the prediction system in C++ during internship with sponsors, wrote a conference paper as first author and defended research thesis

## Professional Experience

**Summer 2017** — HONDA RESEARCH INSTITUTE - US - SAN JOSE, CA [6]   Dr. Akansel Cosgun, Dr. Alireza Nakhaei
- Scoped the open-ended problem of driving safely near occluded pedestrians in suburban setting to learning minimum and maximum velocity and trajectory constraints from safe driving behaviors
- Designed a solution based on Learning from Keyframes framework
- Designed the data collection experiment and implemented driving simulator in Gazebo including hardware integration as well as inter-model interactions for studying contextual behaviors
- Implemented a driving simulator in Gazebo with PS driving rig to collect data which was segregated into safe and unsafe driving behaviors based on collisions
- Evaluated the component on novel situations with promising qualitative results and authored a workshop paper
- HRI-US patented the solution as a novel invention

**Summer 2014** — VECNA ROBOTICS - CAMBRIDGE, MA   Dr. Frederik Heger
- Designed the MATLAB prototype as a C++ pipeline which read in logged data, trained the prediction component, and returned expected travel-time for given route-IDs
- Applied Gaussian Mean-shift, Decision Trees and Random forests for the prediction to provide estimates based on prior data
- Tuned the data analysis pipeline for QC Bot specific purpose based on data monitoring of in-house runs

## Projects

**Q4 2019 - Q4 2020** — WORLD ROBOT SUMMIT - ASSEMBLY CHALLENGE 2020 WITH RPDC ROBOTICS
- Served as technical team lead for 2-3 MS students to participate in World Robot Summit's Assembly Challenge 2020 (later postponed)
- Resulted in a dual-arm product assembly system and was chosen as one of the 16 teams for the final
- Collected product requirements based on official rule-book and communications with successful teams from past competitions
- Performed a range of duties from designing hardware setup to ROS architecture design, serving as sprint master and managing communications with our sponsors
- Modelled assembly as a search-based planning problem with domain-knowledge represented as constraints
- Designed and implemented the high-level planner in Python for generating a sequence of assembly actions and the translator for converting into a Behavior Tree in C++
- Resources: [arxiv-1], [arxiv-2], [video]

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| 2015-2017 | **TASK PLAN REPAIR USING DOMAIN-KNOWLEDGE GUIDED REINFORCEMENT LEARNING** |

- Modelled task plan repair problem as a local reinforcement learning problem with the goal of manipulating novel environment to achieve a previously known state
- Tabular Q-learning was guided using reward shaping represented as a linear combination of distance from future sub-goals from known plan and comparison between occupancy grid of current state with previously known states
- Designed and implemented experiments in Minecraft using Microsoft's Malmo platform for RL event-handling and in Gazebo using C++ API for second set of experiments
- Evaluated the guided Q-learner to be significantly more data efficient than the unguided Q-learner, e.g. first successful episode for guided learner was ~100 versus ~700 for the unguided

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| Q1 2017<br>- Q3 2017 | **RoboCup @ Home Competition** |

- Project involved autonomous execution of person detection, person following, and grocery handling
- Served as a member of team of 5 students to implement the platform and provide on-field support
- Designed the robot behavior scripts using FSM implemented in ROS and Python integrating perception outputs with planner inputs
- Coordinated with the team to integrate person tracker, navigation for person following and speech detection into the scripts
- Covered by UC San Diego news release

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| 2018-2019 | **A TAXONOMY FOR CHARACTERIZING MODES OF INTERACTIONS IN GOAL-DRIVEN, HUMAN-ROBOT TEAMS** |

- Conducted critical literature review to identify gaps in current characterization of human-robot interaction patterns in goal-driven heterogeneous teams
- Designed an upper ontology of important HRI characteristics and connected disparate prior taxonomy literature together

## Awards and Honors

- Paper [2] won the Visionary Paper award at AAMAS 2017
- Received Georgia Robotics Fellowship for Women and Underrepresented Minorities
- Recognized on IIIT-H's Dean's List of Academic Excellence: Monsoon-2010, Monsoon-2011, Monsoon-2009, and Spring-2012
- Work on [1] and [2] featured in news articles [article-1], [article-2]

## Skills

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| Languages | Python, C++, MATLAB, LaTeX |
| Tools | Linux, ROS, Gazebo, Git, Agile Methodology |

## Publications

[1] **Parashar, Priyam**, Ashok K. Goel, Bradley Sheneman, and Henrik I. Christensen. "Towards life-long adaptive agents: using metareasoning for combining knowledge-based planning with situated learning."
*The Knowledge Engineering Review 33* (2018): e24

[2] **Priyam Parashar**, Bradley Sheneman, Ashok K. Goel "Adaptive Agents in Minecraft: A Hybrid Paradigm for Combining Domain Knowledge with Reinforcement Learning."
In: *International Conference on Autonomous Agents and Multiagent Systems* (pp.86-100). Springer, 2017

[3] **Parashar, Priyam**, Robert Fisher, Reid Simmons, Manuela Veloso, and Joydeep Biswas. "Learning context-based outcomes for mobile robots in unstructured indoor environments."
In *IEEE 14th International Conference on Machine Learning and Applications*, pp. 703-706. IEEE, 2015

[4] Goel, Ashok K., Tesca Fitzgerald, and **Priyam Parashar**. "Analogy and metareasoning: Cognitive strategies for robot learning."
In *Human-Machine Shared Contexts*, pp. 23-44. Academic Press, 2020

[5] **Parashar, Priyam**, Lindsay M. Sanneman, Julie A. Shah, and Henrik I. Christensen. "A Taxonomy for Characterizing Modes of Interactions in Goal-driven, Human-robot Teams."
In IROS, pp. 2213-2220. 2019.

## Patent

[6] **Parashar, Priyam**, Kikuo Fujimura, Alireza Nakhaei Sarvedani, and Akansel Cosgun. "Keyframe based autonomous vehicle operation."
U.S. Patent 10,739,774, issued August 11, 2020.

## Other Experience

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| Mentoring | Served as teaching assistant for: 'Pattern recognition' (CSE291-SP17 UCSD), 'Introduction to Robotics and Perception' (CSE3630-SP16 GT); 'Electronics Workshop II' (SP12) and 'Embedded Hardware Design' (FA11) at IIITH |
| Leadership &<br>Volunteering | Founding member of Women in Robotics at UC San Diego |
| | Active member of RoboGrads @ UC San Diego Outreach committee |
| | Participated in project showcase at Contextual Robotics Insitute/San Diego Robotics Forum @ UC San Diego 2017, 2018, 2019 |
| | Reviewed papers for conferences like IROS, ICRA, and AAAI; and for journals like T-RO, IJRR and RA-Letters |