

# Sushmita Bhattacharya

Postdoctoral Fellow at Harvard University  
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## RESEARCH INTERESTS

Reinforcement Learning, Multi-robot Planning and Control.

## EDUCATION

**Harvard University** Cambridge, MA  
**Ph.D.** in Computer Science in the REACT Lab August 2024  
Awarded **2022 Apple Scholars in AI/ML PhD Fellowship** in Fundamentals of Machine Learning  
Thesis: “Sequential Decision-Making for Multi-Robot Systems with Real-World Uncertainty using Rollout-based Reinforcement Learning”  
Advisor: Dr. Stephanie Gil  
Transferred from Arizona State University with Dr. Stephanie Gil in July 2020 Tempe, AZ  
Awarded **Engineering Graduate Fellowship** (Spring 2020) for extraordinary academic achievements

**Indian Institute of Technology Bombay** Mumbai, India  
**M.Tech.** in Computer Science July 2015  
Advisor: Dr. N. L. Sarda

**Indian Institute of Engineering Science and Technology Shibpur** Howrah, India  
**B.E.** in Computer Science May 2011  
Advisor: Dr. Prasun Ghosal

## PROFESSIONAL EXPERIENCE

• Postdoctoral Fellow in Computer Science at Harvard University	September 2024 - Present
• Research Assistant at Harvard University	July 2020 - August 2024
• Research Intern at Apple Inc.	June 2022 - August 2022
• Research and Teaching Assistant at Arizona State University	August 2018 - June 2020
• Software Developer in Microsoft India Development Center	December 2016 - July 2018
• Data Scientist in Honeywell Technology Solution Labs	July 2015 - December 2016

## PUBLICATIONS

[1] “Reinforcement Learning-Based Framework for Whale Rendezvous via Autonomous Sensing Robots”  
Ninad Jadhav\*, **Sushmita Bhattacharya\***, Daniel Vogt, Shane Gero, Pernille Tonessen, Yaniv Aluma,  
Robert J. Wood, Stephanie Gil (\*equal contribution)  
Accepted in Science Robotics, 2024.

[2] “Multiagent Reinforcement Learning: Rollout and Policy Iteration for POMDP With Application to Multi-robot Problems”  
**Sushmita Bhattacharya**, Siva Kailas, Sahil Badyal, Stephanie Gil, Dimitri Bertsekas  
IEEE Transactions on Robotics, 2024

- [3] “Approximate Multiagent Reinforcement Learning for On-Demand Urban Mobility Problem on a Large Map”  
Daniel Garces, **Sushmita Bhattacharya**, Dimitri Bertsekas, Stephanie Gil  
International Conference on Robotics and Automation (ICRA), 2024
- [4] “Multiagent Reinforcement Learning for Autonomous Routing and Pickup Problem with Adaptation to Variable Demand”  
Daniel Garces, **Sushmita Bhattacharya**, Stephanie Gil, Dimitri Bertsekas  
International Conference on Robotics and Automation (ICRA), 2023
- [5] “Multiagent Rollout and Policy Iteration for POMDP with Application to Multi-Robot Repair Problems”  
**Sushmita Bhattacharya**, Siva Kailas, Sahil Badyal, Stephanie Gil, and Dimitri Bertsekas  
Conference on Robot Learning (CoRL), 2020
- [6] “Reinforcement Learning for POMDP: Partitioned Rollout and Policy Iteration With Application to Autonomous Sequential Repair Problems”  
**Sushmita Bhattacharya**, Sahil Badyal, Thomas Wheeler, Stephanie Gil, and Dimitri Bertsekas  
IEEE Robotics and Automation Letters (RA-L), 2020

## RESEARCH PROJECTS

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### Multi-robot Reinforcement Learning (RL) for biological data collection (Ongoing work)

- As a part of Project CETI, designed an RL framework for autonomous agents to rendezvous with whales under partial and noisy sensor observations with strict time constraints associated with whale dive patterns.
- Validated performance via field experiments in the Caribbean Ocean with whale biological data collected by marine biologists and sensor data collected from acoustic and radio signals.

### Multiagent RL for autonomous taxicab pickup problems in urban environments

- Derived an online optimization framework using Graph Neural Network-based offline policy approximation for coordinated taxi routing/pickup schedules with stochastic requests in downtown San Francisco.
- Proposed a Wasserstein distance-based switching framework that adapts to fluctuating demand distributions.
- Extended to a large urban map using map partition and a online hierarchical optimization framework that closely approximates a near-optimal policy where computational complexity grows sub-linearly in the number of taxis. Derived associated theoretical bounds on the number of taxis.

### RL for partially observable problems with computation and communication constraints

- Developed approximate policy iteration for long-term cooperative decision-making problems with multiple robots under imperfect communication. Our approach scales linearly in the number of agents even when the complexity of the available joint actions grows exponentially.
- Proposed partitioned approximate policy iteration for problems with partially observable states to address exploration-exploitation issues and to facilitate parallel computation.

## TEACHING EXPERIENCE

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### Teaching Assistant at Arizona State University Tempe, AZ

- Topics in Reinforcement Learning, Instructor: Dr. D. P. Bertsekas Spring 2020, Spring 2019
- Coordination of Multi-Robot Systems, Instructor: Dr. S Gil Fall 2019

- Introduction to Artificial Intelligence, Instructor: Dr. S Gil Spring 2019
  - Planning and Learning Methods in AI, Instructor: Dr. S Gil Fall 2018
- Teaching Assistant at Indian Institute of Technology Bombay Mumbai, India
- Embedded Systems Lab, Instructor: Dr. Kavi Arya Spring 2014
  - Database and Information Systems Lab, Instructor: Dr. N. L. Sarda Fall 2014

## TALKS AND PRESENTATIONS

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- **Sushmita Bhattacharya**, Daniel Garces, Dimitri Bertsekas, Stephanie Gil, “Approximate Multiagent Reinforcement Learning for On-Demand Urban Mobility Problem on a Large Map”  
International Conference on Robotics and Automation (ICRA), 2024.
- **Sushmita Bhattacharya** ”Sequential Decision-making with Reinforcement Learning”  
Invited talk at Apple Inc, February, 2023.
- **Sushmita Bhattacharya**, Siva Kailas, Sahil Badyal, Stephanie Gil, and Dimitri Bertsekas, “Multiagent Rollout and Policy Iteration for POMDP with Application to Multi-Robot Repair Problems”,  
Presentation at Conference on Robot Learning (CoRL), 2020.
- **Sushmita Bhattacharya**, Thomas Wheeler, Stephanie Gil, Dimitri Bertsekas, “Reinforcement Learning for POMDP: Rollout and Policy Iteration with Application to Sequential Repair”,  
Poster presentation at Learning for Dynamics and Control (L4DC), 2019

## SERVICES

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- Reviewer at the International Conference on Robotics and Automation (ICRA), 2020, 2023, 2024
- Reviewer at the International Conference on Intelligent Robots and Systems (IROS) 2023, 2024

## SELECTED COMPUTATIONAL SKILLS

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- Programming languages: Python, Matlab, C++
- Operating systems: Robot Operating System, Linux
- Learning tools: PyTorch, OpenAI Gym

## REFERENCES

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Available upon request