Rajiv Bharadwaj

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Education

ETH Zurich, *Master of Science in Robotics, Systems, and Control* Sep 2024 – Present

- **Interests:** Reinforcement Learning for Controls, Optimization Methods, Vision Algorithms, Simulation, Aerial Robots
- **Courses**: Model Predictive Control, Computational Models of Motion, Convex Optimization, Robot Dynamics, Motion Planning, Vision Algorithms, Probabilistic AI

University of Michigan, Ann Arbor, *BSc. in Engineering - Computer Engineering; Music Minor* Sep 2018 - May 2022
summa cum laude GPA: 3.9/4.0

- **Honors:** Dean's List for 7 semesters, James B. Angell Scholar 2020, 2021
- **Clubs and Societies:** Men's Glee Club, Michigan Student AI Lab, UM Autonomous Robotic Vehicle, Michigan Sahana

Work Experience

Amazon *Seattle, WA, USA*
Software Development Engineer - II *Oct '22 - Sep '24*

- Designed and implemented fully managed systems, processing **50+ million records/day** and improving **job efficiency by 90%** using *Spark, Alster Deequ, and AWS Lambda*.
- Mentored a summer intern, resulting in **improved backend system reliability**. Oversaw **project ideation, strategic planning, and performance evaluation** to ensure an impactful outcome.
- Led operational excellence initiatives to enhance best practices and **reduce technical debt**.
- Served as *Subject Matter Expert* for **Apache Spark-based ETL jobs**, guiding system design and coding practices.

Software Development Engineer Intern *May '21 – Aug '21*

- Migrated legacy ETL jobs to a new **Apache Spark framework**, improving long-term operational stability.

Analog Garage - Analog Devices Inc. *Boston, MA, USA*
Systems & Applications Engineering Intern *May '20 - Sep '20*

- Designed and implemented **NoSQL-based ML data storage** and an add/retrieve *API in Python*.

University of Michigan IT Services *Ann Arbor, MI, USA*
Application Development Intern *May '19 - May '21*

- Delivered web and backend tools supporting **university-wide networking infrastructure** using *Python, Django, and PostgreSQL*.

Research

Multi-task Reinforcement Learning for Multi-Contact Plans *May '25 - Sep '25*
Semester Thesis, Robotic Systems Lab - Prof. Dr Marco Hutter

- Designed and trained multi-task learning policies in *Isaac Lab* simulation environments using *PPO* and *student-teacher distillation*.
- Defined research directions and evaluation metrics based on a literature review on multi-task reinforcement learning.
- Implemented new *Isaac Lab* features for multi-task policy training, with potential for public release.
- Authored and presented thesis to faculty, demonstrating **multi-task distillation as a promising direction for multi-contact plans**.

Technologies: Isaac Lab, PyTorch, RSL RL

Wire Harnessing using Reachability-based Trajectory Design *Jan '22 - Jul '22*
Undergraduate Research Assistant, ROAHM Lab - Prof. Dr. Ram Vasudevan

- Implemented an *RRT planner* in *Robosuite* for *Kinova Gen3* high-level planning.
- Developed a *Recursive Newton-Euler low-level controller* to evaluate performance of a novel robust controller.
- Conducted system identification to bridge the **sim-to-real gap** for robotic tasks.

Technologies: Robosuite, MuJoCo, ROS 1, Python

Projects

Project CRATER - Mars Rover Project, ETH Zurich *Oct '25 - Present*
Systems Architect *[website]*

- Leading overall **system architecture and cross-team integrations**, collaborating with subteam leads.
- Driving *requirements gathering*, *interface definition*, and *design review processes* to **ensure coherent system design**.

Technologies: Full-stack Robotic System Architecture

Camera-based RL Drone Control *Sep '25*
For Vision Based Drone Flight, ETH Zurich *[video][report]*

– Trained a reinforcement learning control policy for a drone to follow another drone using *PPO*.
– Designed reward functions based on tracking, bounding box estimation, smoothness, and safety constraints to achieve reliable camera-based tracking.
– Utilized a *ROS C++ / Python software stack* for training, simulation, and deployment.

Technologies: Python, C++, PyTorch, ROS 2, PPO

Imitation Learning using a Tendon-Actuated Hand *Fall '24*
For Real World Robotics, ETH Zurich *[report]*

– Spearheaded high-level **ROS 2 software architecture** for a tendon-actuated hand, including hardware communication, joint kinematics, teleoperation, and data collection. Awarded "**Most Intuitive Software Design**".
– Modeled a custom rolling-contact joint hand in *MuJoCo* to verify software before hardware deployment.
– Developed a UI with **fail-safes and visualization tools**, increasing data collection rate by **15x** and reducing hardware accidents.
– Trained an *Action Chunking Transformer* to grasp and sort objects by color, achieving **accurate grasps** despite color-based sorting limitations.

Technologies: Python, MuJoCo, ROS 2, Action Chunking Transformer

Vision Odometry Pipeline *Fall '24*
For Vision Algorithms for Mobile Robotics, ETH Zurich *[report][code]*

– Implemented a **monocular visual odometry pipeline** using 2D $\leftrightarrow$ 3D correspondences to estimate camera pose.
– Populated the pipeline with **high-quality** 2D keypoints and 3D landmarks to ensure stable operation.
– Achieved **locally accurate pose estimation**, noting scale ambiguity inherent to purely camera-based methods.

Technologies: Python, OpenCV, NumPy, Visual Odometry

Robotics Summer School *Summer '25*
RobotX Initiative, ETH Zurich *[website]*

– Participated in a 50-student Robotics Summer School, deploying autonomous software on wheeled robots for search-and-rescue missions.
– Completed hands-on tutorials on key robot modules: state estimation, SLAM, exploratory path planning, motion planning, and object detection.

Technologies: Python, SLAM, State Estimation, ROS 2

SKILLS

Programming:	C++, Python, Java, Scala, MATLAB, Typescript, Javascript, Lua, C
Robotics Tools:	Robot Operating System, NVIDIA Isaac Lab, MuJoCo, OpenCV, PyTorch, NumPy, Linux
Other Technical:	AWS, Git, Slurm, STM32, Arduino, Raspberry Pi, Autodesk Eagle, OnShape CAD
Languages:	English (native), German (conversational - B1), Hindi (native), Tamil (native), Gujarati (conversational)