

REVANT MAHAJAN

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Research Objective

To pursue a research-oriented graduate degree with a focus on the intersection of generalized learning, planning, and control applied to humanoids and mobile manipulators.

Education

Worcester Polytechnic Institute (WPI), Worcester, MA, USA August 2017 to May 2021
Bachelor of Science, **Double Major: Robotics Engineering and Computer Science**
GPA: **3.95/4.0**

Professional Experience

Software Development Engineer II, Path Planning, **Amazon Robotics** Sept 2021 - Oct 2024

- Mitigated vertical scaling to support Amazon's expansion by leading development of a **cellularized native AWS** path planning service. Spearheaded the design and development of API, multi-threaded caching solution, asynchronous event processing framework, and client SDK.
- **Service owner for Tier-1 path planning service** for a fleet of 750K+ robots. Enhanced availability and performance by defining and executing operational roadmaps to optimize search latency, supporting new robot types, setting up proactive alarming and search analysis metrics.
- Improved team's code quality and testing standards by being one of the **top three code contributor** and reviewer out of a team of 12.
- Mentored an intern to demonstrate a **40% reduction** in the travel time estimation latency by using precomputed heuristics representative of actual costs.
- **Redesigned and improved human access path planning** usage by re-modeling the graph representation and cost structure to better reflect access impact on surrounding robots.
- **Decreased mean resolution time** by authoring technical guides on triaging the robotic software stack. Amazon technical support integrated these into their runbook for faster and more streamlined troubleshooting.

Software Development Engineer Intern, Path Planning, **Amazon Robotics** May 2020 - August 2020

- Demonstrated a low **single digit% decrease in congestion** on robotics floors by modifying A* to find n-cheapest paths and utilizing heuristics to optimize traffic flow.
- Delivered a robust **experimentation framework to production**, enabling the evaluation of custom path planning strategies against live simulations.

Software Development Engineer Intern, Platform Bringup, **Dell EMC** May 2019 - August 2019

- **Automated faulty hardware detection** for PowerStorage products by creating debugging scripts.
 - Performed testing, triaging, and defect management on 15+ devices using internal tools and logs.
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Teaching Experience

Student Assistant, Multiple Undergraduate Robotics Courses, WPI March 2019 - May 2021

- **Spearheaded workshops for 400+ students** to teach C++ and object-oriented Programming and review topics like linkages, CAD, sensor filtering, sensor fusion, and sensor communication.
 - **Supported 15+ teams every quarter** to successfully finish homework assignments, labs, and final projects by debugging hardware and software bugs.
 - **Assisted professors in revamping the labs and final projects** to accommodate COVID-19 virtual class by testing with Zoomu and Romi robotic kits for virtual instructions.
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Project Experience

Multi-Modal Locomotion Robot, Senior Capstone, WPI

August 2020 - May 2021

- Awarded “**Honorable Mention for Provost’s Major Qualifying Project**”:
<https://wpi-mmrl.github.io/>.
- Developed a quadrupedal robot capable of bipedal transition by enhancing an existing open-source quadruped, **reducing costs by ~\$500** using off-the-shelf hardware.
- Derived the forward and inverse kinematics to implement a PID-based low-level controller.
- Designed a higher-level controller with Raspberry Pi to work with both robot and simulation.
- Implemented a **walking gait on the robot** and **bipedal transitioning motion** in the simulation.
- Trained the robot using **reinforcement learning** for quadrupedal standing in simulation.

Endogenous Fault Detection, Swarm Robotics, WPI

January 2020 - May 2021

- Designed an experiment to evaluate distributed fault detection in a robot swarm.
- **Achieved a 100% detection rate for actuator-induced faults** by a self-fault identification algorithm based on loss of proximity to neighbors within a swarm.
- **Validated the algorithm's robustness across** varying swarm size, field of view, and proximity thresholds of the ultrasonic sensor to ensure consistent identification of faults.

Materials Analysis Platform, Independent Study, WPI

August 2020 - December 2020

- Awarded the “**Data Science Excellence Award**” out of 8 teams.
- Led a team of 4 to identify Army Research Lab’s requirements to streamline data collection, aggregation, and analysis.
- Developed a **web application using FastAPI and Flask** to ingest data from Excel (researcher’s choice) and store it in SQL databases.
- Simplified data analysis for researchers by creating **tooling for data visualization and statistical analysis on the web application**.

Generalized RL Manipulator, Reinforcement Learning, WPI

August 2020 - December 2020

- Achieved **close to the state-of-the-art** benchmarks of 100% for OpenAI’s FetchPush and 90% for OpenAI’s FetchPickAndPlace by training a generalized model.
- Trained a **multi-critic single actor agent** using Deep Deterministic Policy Gradient + Hindsight Experience Replay to generalize over multiple tasks.
- Developed and implemented an **interlaced training methodology** on top of an open-source implementation for training the generalized actor.

Environment Mapping Robot, Unified Robotics: Navigation, WPI

March 2019 - April 2019

- **Mapped 100% of an unknown maze** by working in a team of 3 using SLAM and obstacle avoidance on a differential drive robot equipped with IMU and Lidar.
- Planned paths to the unmapped frontier by developing an **exploratory algorithm using A***.

Robotic Arm Manipulator, Unified Robotics: Manipulation, WPI

January 2019 - March 2019

- Achieved a **100% success rate for sorting objects** using a 3-degree-of-freedom serial robotic manipulator: <https://www.youtube.com/watch?v=WFollGf8Wlo>.
 - Identified and localized objects of interest with a **100% success rate** in creating start and goal trajectory points.
 - Derived and implemented the forward and inverse kinematics of the arm and the trajectory plan for the task space.
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Awards and Honors

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| 1. Honorable Mention for Best Senior in the Robotics Department, WPI | May 2021 |
| 2. Honorable Mention for Provost's Major Qualifying Project, WPI | May 2021 |
| 3. Data Science Excellence Award, WPI | December 2020 |
| 4. Third Place for Innovation Encounter, LTU | October 2018 |
| 5. Charles O. Thompson Scholar, WPI | December 2018 |
| 6. Dean's List, WPI | August 2017 - May 2018, January 2019 - May 2019, January 2020 - December 2020 |
| 7. Presidential Scholar, WPI | August 2017 |
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Relevant Coursework

Robotics: Deep Learning for Advanced Robotic Perception (Grad), Swarm Intelligence (Grad), Control Engineering, Embedded Computing, Unified Robotics Courses: Actuation, Sensing, Manipulation, Navigation, Social Implications of Robotics, Walking Robots on Hardware (Independent Study)

Computer Science: Artificial Intelligence (Grad), Reinforcement Learning (Grad), Material Science Project (Independent Grad Study), Machine Learning, Advanced Analysis of Algorithms

Technical Skills

Software: Java, AWS, C++, Python, ROS, Tensorflow, Keras, MATLAB, Verilog

Hardware: Microcontrollers (Arduino, ESP-32), Oscilloscope, Function Generator

Robotics: Search Algorithms, Control (PID), Kinematics, Sensor Filter and Fusion, Kalman Filters

Reports and Papers

1. A. Euredjian, A. Gupta, R. Mahajan, D. Muzila, "Multi-Modal Locomotion Robot," Worcester Polytechnic Institute, 2021, <https://digital.wpi.edu/pdfviewer/h128nh66c>
2. A. Euredjian, R. Mahajan, H. Saperstein, "Endogenous Fault Detection for Circle Following Behavior," Worcester Polytechnic Institute, 2020, <https://tinyurl.com/3ftw2aew>
3. P. Argyrakis, R. Mahajan, "Multi-environment Reinforcement Learning Agent For Robotic Tasks," Worcester Polytechnic Institute, 2020, <https://tinyurl.com/2a4nbm8j>
4. R. Mahajan, "Should Robots Be Taxed?," Worcester Polytechnic Institute, 2020, <https://tinyurl.com/mpkjj5t2>
5. R. Mahajan, "Challenges With Integration of Co-Bots Into Society?," Worcester Polytechnic Institute, 2020, <https://tinyurl.com/yc3yys2b>
6. P. Jawahar, S. Koenke, R. Mahajan, "Deepfake Detection and Classification," Worcester Polytechnic Institute, 2019, <https://tinyurl.com/4ybvc84w>