

# JARED MORGAN

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## EDUCATION

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### Worcester Polytechnic Institute

B.S. in Robotics Engineering

M.S. in Robotics Engineering

Overall GPA: 3.94

May 2025

October 2025

## EXPERIENCE

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### Hayward Industries, Inc.

Robotics Engineer Intern

May 2024 – August 2024

North Kingstown, RI

- Developed an ethernet communication and UR5 robot arm control system to automate the loading, testing, and sorting of 6 PCB test stations.
- Created UI using tkinter for factory workers to safely control and monitor system state.
- Designed and machined PCB-holding grippers to permit mechanical error from the UR5.
- Designed holding stations for PCB testers to maximize repeatability of placement.

## PUBLICATIONS

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**Jared Morgan and Mahdi Agheli. Trajectory Optimization through Mixed-Integer Optimization of Contact Dynamics for Switching End Effector Locomotion. Submitted to 2026 IEEE International Conference on Robotics and Automation (ICRA), 2026.**

- Used Gurobi mixed-integer optimization to model and optimize system and contact dynamics of a quadruped robot across end effector and terrain types. Validated trajectories on the Unitree Go1 robot quadruped using Linux interface.
- Designed a whole-body controller to execute trajectories with passive wheels and feet.
- Implemented an extended Kalman filter for wheeled-legged robots to capture system dynamics during state estimation.
- Interfaced with Pinocchio and ROS in C++ to translate trajectories into joint torques through a whole-body controller.

**Jared Morgan, Owen Sullivan, Guanri Li, and Mahdi Agheli . PACE: Perception-aware Contact Estimation and Slip Detection through Dynamic Map Analysis. Submitted to 2026 IEEE International Conference on Robotics and Automation (ICRA), 2026.**

- Employed Kalman filtering using a system dynamics observer to detect end effector contact with a surface through joint readings, terrain information, and force sensors. Allowed for a more accurate detection of contact for stair climbing.
- Created a map analysis paradigm for determining the impact of slips and adjusting the attention of sensor inputs.
- Developed state estimation with probabilistic slip detection in C++ using an extended Kalman filter using integrated IMU readings, change in footstep location, visual inertial odometry, and joint velocities.

## PROJECTS

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### Drone Reinforcement Learning

March 2025 - May 2025

- Developed environments in Python for training aircraft navigation around static obstacles and through dynamic crowded sectors with other aircraft using Bluesky air traffic simulator.
- Validated environment and reward functions by training DDPG and PPO algorithms in Pytorch to guide the aircraft through the environments while maintaining altitude, speed, and distance from other aircrafts.

### Gesture Recognition LSTMs

March 2024 - May 2024

- Created and trained LeNet, ResNet, and transformer-based LSTM architectures in Pytorch for gesture recognition. Forward-passed historical outputs and attentions to better analyze sections of realtime video.
- Compared network accuracy and framerate for the best option for a robot-control task.

### **Large Object Approximation for Robot Swarms**

March 2024 - May 2024

- Developed a control and communication protocol for robot swarms to surround and calculate the center of large objects.

### **Quadrotor Control to Intercept UAVs**

September 2023 - December 2023

- Led a group of 4 students in designing a LQR with integral action control system for a quadrotor to intercept and relocate resisting UAVs capable of exerting 4N of force and 0.4 N-m of torque.
- Simulated and evaluated controller performance in MATLAB under varying flight patterns and speeds up to 30 m/s.

### **Maze Navigation for Robotic Exploration**

October 2023 - December 2023

- Wrote python classes in ROS that utilized graph search and a weighted cautionary gradient kernels to develop a motion plan for a robot through a maze using LiDAR. Deployed on hardware using Linux and the pure pursuit algorithm.
- Used SLAM techniques and Kalman filtering for localization. Cell-based sensing, A\* navigation, and image processing techniques quickly selected the safest path and reduced collisions by 90%.

### **Website Development for a Theater Venue**

October 2023 - December 2023

- Led a team of 4 to program and host a webapp using AWS, JavaScript, and HTML to manage shows for theater venues.
- Developed 15 backend lambda functions integrated with database schemas, Rest-based API, and frontend user interfaces that allowed for an easily operated website for both ticket purchasers and venue managers.

### **Robot Manipulator Object Sorting using Computer Vision**

January 2023 - March 2023

- Collaborated with a team of 3 students to use MATLAB, Linux, and CV to locate and sort objects by color and shape.
- Generated trajectories that avoided singularities and smoothly took the arm around the reachable workspace.
- Clustered point clouds to approximate primitive 3D shapes for complex objects such as mugs in ROS for improved grip.

### **Recursive Neural Network for Natural Language Generation**

January 2022

- Employed TensorFlow and NumPy to train an LSTM with 1024RNN units using Tokenization for natural language generation on a dataset of over 600 student-sourced submissions to replicate student speech for WPI's hackathon.
- Added a CockroachDB database of over 1000 web scraped images to connect generated text in a format consistent with a popular Instagram page on campus. Listed as Hackathon Winner for its category.

### **OpenCV App Development for Phone Camera Calibration**

March 2021 - May 2021

- Programmed an app in Android Studio to calibrate phone cameras to new environments with OpenCV for FIRST teams learning OpenCV. Downloaded on over 500 devices.

### **Genetic Algorithm for Maze Navigation**

Jan 2021 - March 2021

- Visualized a genetic algorithm written in Java for 500 holonomic robots to navigate a maze while maximizing speed.

## **TECHNICAL STRENGTHS**

### **Computer Languages**

C++, Java, Python, MATLAB, C, Javascript, HTML

### **Software**

Git, Linux, ROS, Drake, OpenCV, Pytorch, Tensorflow, Gurobi, Pinocchio

### **Techniques**

Kalman Filter, WBC, MPC, SLAM