Sumukh Porwal

Worcester, MA • sporwal@wpi.edu • (774) 253-0580 • linkedin.com/in/sumukhporwal • sumukh18.github.io

EDUCATION

Worcester Polytechnic Institute (WPI) | Worcester, MA
Master of Science in Robotics Engineering | **GPA:** 4.0/4.0 — August 2024 - May 2026
Coursework: Computer Vision, Motion Planning, Reinforcement Learning, Robot Control, Robot Dynamics

Indian Institute of Technology Tirupati (IIT Tirupati) | Tirupati, India
Bachelor of Technology in Mechanical Engineering | **GPA:** 8.69/10.0 — July 2020 - June 2024
Coursework: Machine Learning, Modeling & Control of Mobile Robots & Manipulators, Attitude Estimation & Control

TECHNICAL SKILLS

Operating System: Windows, Linux
Programming Languages & Tools: Python, C, C++, MATLAB, Bash, LaTeX, Git, Docker, Singularity
Frameworks & Libraries: ROS 1 & 2, PyTorch, TensorFlow, Keras, OpenCV, OMPL, Acados, Taichi, CasADi
Embedded Systems: Jetson Orix NX, Raspberry Pi, Raspberry Pi Pico, Arduino
Simulation & ROS Tools: Gazebo, RViz, MoveIt, Nav Stack, rqt

WORK EXPERIENCE

Aerial-Robot Control and Perception Lab, WPI — *Worcester, MA*
Graduate Researcher — January 2025 – Present
- Developing a GPU-accelerated simulation with differentiable physics to train neural network control policies for high-speed aerial navigation of a quadrotor using depth image as the sole input.
- Targeting real-time navigation at speeds up to 20 m/, leveraging backpropagation through differentiable physics.

SeiAnmai Technology Pvt. Ltd. — *Delhi, India*
Robotics Intern — May 2023 – July 2023
- Led a team to develop an autonomous robot with 95% navigation accuracy, integrating ROS 2 and micro-ROS.
- Designed an ArUco marker detection system, achieving docking precision within 1 cm.
- Enhanced real-time telepresence by implementing internet-based teleoperation within 100 ms latency.
- Optimized performance by refining control algorithms and leveraging Docker for seamless micro-ROS deployment.

PROJECTS

Reactive Collision Avoidance for Safe Agile Navigation
Worcester Polytechnic Institute — February 2025 – Present
- Developed a reactive collision avoidance framework integrating perception, planning, and control using nonlinear model predictive control (NMPC) with adaptive control barrier functions (CBFs) for a quadrotor.
- Designed a neural network-based refinement of noisy RGB-D data and a heuristic optimization strategy to enhance real-time obstacle avoidance for agile quadrotors in diverse environments.

Structure from Motion (SfM) and Neural Radiance Field (NeRF)
Worcester Polytechnic Institute — February 2025 – March 2025
- Developed a SfM pipeline for 3D reconstruction using feature matching, motion recovery, and bundle adjustment to estimate camera positions and 3D points.
- Implemented NeRF to synthesize novel views by optimizing a deep neural network to model scene geometry and appearance from sparse input images.

Learning-Based Collision & Clearance Estimator for Manipulators
Worcester Polytechnic Institute — November 2024 – December 2024
- Implemented a neural network-based heuristic achieving a 50% reduction in collision-checking time compared to geometric methods like the Gilbert–Johnson–Keerthi algorithm.
- Designed a clearance adjustment algorithm, improving planning efficiency by 35% in cluttered environments.

Deep Reinforcement Learning for TurtleBot3 Navigation
Worcester Polytechnic Institute — October 2024 – December 2024
- Implemented DDPG, PPO, TD3, & DQN algorithms achieving obstacle avoidance with 88% accuracy in simulations.
- Built a ROS 2 & Gazebo environment using LiDAR for precise distance sensing and decision-making.
- Conducted performance benchmarking, revealing a 15% improvement in path efficiency for PPO over others.

Perception-aware Model Predictive Control on Quadrotor
Worcester Polytechnic Institute — September 2024 – December 2024
- Integrated YOLACT architecture, achieving 95% accuracy in real-time detection and tracking targets.
- Developed a NMPC using Acados, enabling trajectory tracking with sub-1% error in constrained environments.

Semantic Image Segmentation for Autonomous Vehicles
Indian Institute of Technology Tirupati — May 2024 – August 2024
- Achieved 90% segmentation accuracy using U-Net CNN on CARLA self-driving datasets for navigation tasks.
- Delivered precise object detection by training on 100,000+ labeled samples, enhancing autonomous driving safety.