Hrushikesh Budhale

My Website | hruhnb@gmail.com | LinkedIn | Github | *University of Maryland, College Park*

EDUCATION

M Eng Robotics, University of Maryland, College Park, MD **(3.87 / 4.0)** *Aug 2021 - Dec 2022*
Relevant Coursework: Robot Learning, Planning, DL Frameworks, Control of Robotic System, Perception

B Tech Electronics, Walchand College of Engineering, India **(8.2 / 10)** *Aug 2015 - May 2019*

TECHNICAL SKILLS

Languages & Tools: C++, Python, CUDA, Git, Docker, ROS1, ROS2, Pytorch
Software: OpeAI gym, Gazebo, R-Viz, Issac sim, Carla sim, Coppelia sim
RL/IL Algorithms: Actor-critic, PPO2, Deep Q Learning, Monte Carlo Tree search
Planning & Prediction: A*, RRT*, PRM, Dijkstra, orb slam, Kalman filter, particle filter, bayesian Filter
Controls: MPC, LQG, LQR, PID, Stanley, Pure Pursuit

PROJECTS

Learning planner parameters for autonomous vehicle (RL) *2022*
- Independent study project for dynamically adjusting the local planner's parameters for optimally following the path generated by the global planner.
- Agent was trained using Actor-Critic method to adjust linear and angular velocity limits of the trajectory planner based on surrounding obstacles. Along with training and reward shaping, work also involves development of a ros based training environment and tests on real F1Tenth car. Report

Learning Navigation in sim (RL) *2022*
- Trainied mobile robot agents to reach destinations in non convex obstacle environments like homes.
- Agent was trained using DDQN and learned emergent behavior of exploring the space while avoiding obstacles.
- Sim was developed from ground up in pygame and the agent's network was trained using pytorch. Video

Predictive maneuvering (RL) *2021*
- Development / integration of PPO2 based Local planner and controller plugins for vehicle that forecasts human direction of motion and adjusts its path for minimum intervention. *(Work is now part of a university startup)*
- Developed ROS2 package of the robot for training using OpenAI gym based environment.

Gantry Crane Control (Control & Filtering) *2021*
- Designed LQG and LQR control of a gantry crane. Stabilized system by analyzing its controllability and observability
- Implemented Kalman filter to account for gaussian noise in the sensor measurements. Link

Home organizing robot (slam & ros) *2021*
- Mobile manipulator for indoor search and manipulation of objects.
- Autonomous navigation using Movebase and Hector SLAM. Manipulator trajectory planning using Moveit. Complete stack in C++ with GitHub CI and GTests. Link

Pose Estimation in Structured Environment (Perception & Localization) *2020*
- Developed pose estimation pipeline on occupancy output, enabling localization in a GPS denied environment.
- Pose prediction using DTW, state space and projective geometry with vectorized implementation for runtime. Link

EXPERIENCE

Quidient MD, USA
Software Development Engineer *(Perception)* *Feb 2023 - preset*
- Work on development of solver for scene reconstruction of highly specular objects using light polarization.
- Developed alignment pipeline for camera poses and environment entities achieving a reprojection error of < 0.8 pixel.

Nuro CA, USA
Software Engineer Intern *(Planning & Controls Team)* *May 2022 - Aug 2022*
- Developed a proposed concept of an automated framework to validate actuator and controller performance of AV.
- Framework designed with hardware agnostic modules at core, allowed it to scale, resulting in significant reduction in development time per SW release, unblocking the team for critical public road deployment milestones.

Maryland Robotics Center MD, USA
Graduate Research Assistant *(Planning and Localization)* *Dec 2021 - May 2022*
- Developed behavior tree and behavior plugins for the autonomous package delivery robots.
- Designed a training environment with intelligent pedestrians to mimic the real world scenario of a crowded building.

Flytbase Inc. Pune, India

Robotics Engineer *(Localization and Path Planning)* *January 2020 - August 2021*

- Implemented hierarchy based rapid Path Planner for fleet of drones. Part of the core team Involved in development of the entire navigation stack.
- Developed flyzone optimization module based on google OR-tools.

CS Dept., Indian Institute of Technology Mumbai, India

Research Intern *(Path Planning)* *June 2018 - August 2018*

- Implemented robust controller for stability of drone while tracking from stationary camera.
- Path planning for MAVs using RRT* planner and trajectory following, capable of avoiding moving obstacles. Tests showed robust performance allowing drone to fly through 40cm diameter hoops.

ACADEMIC/VOLUNTEER EXPERIENCE

Volunteered in a campaign to teach school kids in nearby villages about computers.	*2019*
Mentor: Chief coordinator of the college event in the Robotics committee.	*2019*
Leadership: Led college team in National level Robotics competition 'Robocon'.	*2018*
Leadership: Team leader of Semi-finalist Team in National level robotics competition.	*2017*