Hrushikesh Budhale

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EDUCATION

M Eng Robotics, University of Maryland, College Park, MD (3.8/4.0 expected) **Aug 2021 - Present**
Relevant Coursework: Planning, Perception, Robot Learning, Control System, DL Frameworks

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

TECHNICAL SKILLS

Languages & Tools: C++, Python, Git, Docker, ROS1, ROS2, Pytorch, Unix, Javascript
Software: Gazebo, R-Viz, Carla sim, Coppelia sim **Controls:** MPC, LQG, LQR, PID, Stanley, Pure Pursuit
Planning: A*, RRT*, PRM, Dijkstra, Sampling based **Localization:** ORB SLAM, KF, EKF, PF, Bayesian Filters

EXPERIENCE

Nuro CA, USA
Software Engineer Intern *(Controls & Planning Team)* *May 2022 - Aug 2022*
- Nuro is one of the leading autonomous vehicle companies focused on last mile goods delivery.
- Designed a new framework architecture to validate the vehicle's actuator performance.
- System built with hardware agnostic APIs at its core, allowed it to scale and support different types of actuators and multiple comm. buses in parallel.

Maryland Robotics Center MD, USA
Graduate Research Assistant *(Planning and Behavior)* *Dec 2021 - May 2022*
- Developed behavior tree and behavior plugins for the autonomous package delivery robots.
- Development / integration of custom RL based Local planner and controller plugins.
- Developed ROS2 package of the robot for training in the simulator.
- Designed a training environment with intelligent pedestrians to mimic the real world scenario in a crowded building.

Flytbase Inc. Pune, India
Robotics Engineer *(Localization and Path Planning)* *January 2020 - August 2021*
- Developed Visual odometry for monocular camera. Package developed using Geometric projection, predictive filter and DL based approach, achieved ~20 cm in localisation accuracy in a GPS denied environment across an 80mx40m field.
- Developed hierarchy based rapid Path Planner for the fleet of drones. Implemented (LaneNet DL) detection pipeline for drone localization.
- 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 fixed monocular 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. Effective use of simulation software (Coppelia Sim) to emulate the real scene.

PROJECTS

Structure From Motion | Vision & Tracking *2022*
- Developed opencv pipeline for generating 3D point cloud from images of a scene.

Planning Experiments | Path Planning *2022*
- Simple path planner app to plan paths in configuration space using multiple planning algorithms.
- Implemented Fast Planner to solve 16 tile puzzles under 4 sec.

Gantry Crane Control | Control & Filtering *2021*
- Designed LQG and LQR control of a gantry crane. Analyzed 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.
- Autonomously navigating using Movebase and Hector SLAM, Moveit for manipulator trajectory planning. Complete C++ stack with GitHub Continuous Integration and gtests. Link

Monocular Human Position Estimator | Vision & Tracking *2021*
- Detection and tracking humans using a pre-trained HOG descriptor and SVM detector in OpenCV.
- Unit tests using gtests and maintained using Travis CI and lcov, Coveralls. Link

Pose Estimation in Structured Environment | Perception & Localization *2020*
- Developed pose estimation package working on DL inference.
- Pose prediction/correction using DTW and projective geometry
- Efficient vectorized implementation using Numpy. Link

LEADERSHIP/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*