

Tejas Agarwal

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EDUCATION

University of Pennsylvania Philadelphia, United States
Masters of Science in Engineering - Electrical Engineering (conc. Robotics) - 3.88/4.0 Aug '21 - May '23
Advanced Drone Robotics Motion Planning for cars Planning for Robot arms Design & Control of UAVs
Estimation in Robotics Dynamic Nonlinear Control Trajectory Optimization Embedded & Applied Machine Learning

RELEVANT EXPERIENCE

- **Safe Autonomous Systems Lab, UPenn** United States
Course Developer & Teaching Assistant June '22 - May '23
 - Designed & Deployed ML applications such as Keyword Spotting, Person & Gesture detection on a 1MB unicycle robot
 - Delivered Python and C++ based tutorials on Tensorflow lite for model quantization, maintained Git and [Website]
- **Sung Robotics Lab, GRASP Lab** United States
Graduate Research Assistant Jan '22 - May '23
 - Enabled control, planning and communication in ROS (C++) for a Hybrid Aerial Vehicle softwinged robot
 - Developed aggressive flight maneuvers in PX4, worked on spline trajectory generation, contributed to more than 150 flights, analyzed data in Matlab. The system showed 20% improvement in energy efficiency from conventional UAVs
- **Mitacs Globalink Research, Intro Lab, 3IT Institute (UdeS)** Canada
Research Scholar May '19 - Aug '19
 - Developed a fault detection interface to parse robot's TF data in real time via web sockets to an iOS AR environment
 - Created an application to view errors in production line robots using a smartphone by overlaying statistics in AR
- **Helicopter Lab, IIT Kanpur** India
Research Intern May '18 - July '18
 - Developed a ROS package to simulate and control multiple UAV vehicles in a swarm. Flight tested leader-follower policy
 - Enabled co-operative control for the autonomous drone simulation in gazebo, designed entire deployment network, did sensor calibrations such as RTK GPS, integrated communication by setting up zigbee protocol for the Pixhawk 2 swarm
- **UAS-DTU, Delhi** India
Avionics Engineer Aug '17 - Aug '18
 - Worked on the electronics, communication, and control for 3 fixed wing UAVs, one octacopter and multiple quadcopters
 - Designed the subsystems & worked on the integration of embedded systems (pi & PX4) with the control surfaces, ran calibration and power tests on motors and sensors and ran analysis on data. 2nd worldwide for the AUVSI 2018 journal
 - Worked extensively on the autopilot firmware and conducted more than 30 flight tests throughout the year

PROJECTS

- **Motion Planning and control algorithms for an autonomous racing vehicle [Link]**
Integration and development of multiple algorithms for head to head racing on a closed circuit - Pure Pursuit, RRT^* , sampling based planning for obstacle avoidance using clothoids, sensor fusion for localization using LIDAR and IMU, SLAM using ROS2 gmapping. Secured first position in 2 of 3 races.
- **7 DOF robotic arm manipulation for block stacking maneuvers [Link]**
Led the development of the fastest pick and place software stack with RRT^* & Potential field planner, Dynamic block propagation, Smart Switch and Adversarial attack. Scored highest points in the competition's 10 year history.
- **Convex optimization based multi agent path planning [Link]**
Developed dynamic and static collision free paths for centralized swarms using sequential convex programming.
- **VIO based autonomous Indoor quadrotor navigation [Link]**
Implemented Geometric nonlinear controller, global path planners like A^* , optimized trajectory generation using Minimum snap, complementary filter, RANSAC and VIO for a quadrotor. Tested in simulation and in an indoor obstacle course on the Crazyflie 2.0 drone. Stood among top 10 in Planning & obstacle course time.
- **High Speed Autonomous Drifting using Reinforcement Learning [Link]**
Trained a soft actor critic control policy to closely follow a given raceline composed of coordinates, heading and slip angle.
- **State Estimation and Learning based control for robots [Link]**
Implemented UKF for estimating drone orientation using IMU and vicon, SLAM using Particle Filter for a mobile robot.
- **Building & Motion Planning for multiple cars**
Built the autonomous F1tenth car, soldered power boards, and wrote a ROS package to control a fleet of F1tenth cars using LIDAR & to test a Low latency network scheduler.

SKILLS SUMMARY

Languages Python, C++, JAVA, Swift, L^AT_EX
Software MATLAB, Simulink, Blender, Premiere, PX4, Mission Planner, Ardupilot, OpenCV, Photoshop, GIT, Drake
Platforms Linux, MacOS, Windows, Arduino, RTOS, RaspberryPi, Jetson TX2, ROS, ROS2
Techniques Quad design, System integration, Simulation Modelling, ML, Vision robotics, Sensor Processing
Soft Skills Leadership and teamwork (University events and clubs), Public speaking (Debates/MUNs),
Online courses Control of Mobile Robotics, Image & Video Processing, Practical Deep Learning, Cryptography