Prakrit Tyagi

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Education

Carnegie Mellon University May 2024
Master of Science in Mechanical Engineering (GPA: 4.00 / 4.00) *Pittsburgh, PA*

- **Relevant Coursework:** Simultaneous localization & mapping (SLAM), Optimal Control, Machine learning, Path Planning & Decision Making, Computer Vision (CV), Robot Dynamics & Analysis

Delhi Technological University May 2021
Bachelor of Technology in Mechanical Engineering (GPA: 8.75 / 10.00) *Delhi, India*

Technical Skills

Languages/Frameworks: C/C++, Python, Julia, Pytorch, ROS1 & 2, RViz, Git, Linux CLI, PX4 Autopilot
Softwares: MATLAB, Simulink, Docker, Solidworks, ROS Nav2, ROS Slam Toolbox, Eigen C++, CasADI
Robotic Simulation: Gazebo (Garden) and Classic, Webots, URDF, SDF
Embedded Systems: Nvidia Jetson, Raspberry Pi, Arduino, Adafruit feather

Research Experience

Rex Lab, Robotics Institute CMU | *PI: Prof Zachary Manchester* May 2023 – July 2023
Graduate Research Assistant *Pittsburgh, PA*

- Developed a novel linear quadratic regulator (LQR) for quadrotor control that integrates delay compensation techniques to address time delays in visual feedback, directly influencing the drone's motors.
- Demonstrated through extensive simulations that the LQR with delay compensation significantly improves trajectory tracking stability and performance, especially when feedback delays exceed 40 milliseconds.

Moon Lab, IISER | *PI: Prof P. B. Sujit* Oct 2021 – June 2022
Research Associate *Bhopal, India*

- Designed, developed and implemented a MPC based control formulation for a fixed wing UAV to track a ground vehicle, using CasADI and Ipopt solve.
- Programmed an Arduino for motor control of a tuk-tuk (rickshaw) for a autonomous campus rickshaw project.
- Created an indoor testing facility for quadcopter flying with nets and lighthouse positioning system. Setting up crazyflie and controlling the drones by crazyflie-lib-python.

Selected Projects

lifelong multi-agent path finding in large-scale warehouses | *PI: Prof Maxim Likhachev*

- Developed a lifelong variant of the Conflict-Based Search Algorithm (CBS) for Multi-Agent Pathfinding (MAPF) to enhance throughput in dynamic warehouse environments.
- Demonstrated the algorithm's adaptability, achieving 3,666 task completions in 72.722 seconds in a 33x57 cell map with 20 agents, and 3,416 task completions in 70.821 seconds in a 32x32 cell map with 25 agents.
- Showcased the algorithm's adaptability and efficiency in both small and large-scale environments, with organized warehouse layouts enabling more straightforward and efficient pathfinding.

Viewpoint-Conditioned Legible Motion Planning with Imitation and Reinforcement Learning | *PI: Prof Inseung Kang*

- Developed a universal planning architecture leveraging reinforcement learning and imitation learning to achieve legible behaviors in robotic motion planning, enhancing efficiency and trust in human-robot collaboration.
- Introduced a novel model that adapts robot actions based on human perspectives, improving the clarity of robotic intentions by 15% over expert human demonstrations.
- Validated the system with the xArm6 robot in both simulated and real-world settings, demonstrating significant improvements in goal-reaching tasks.

Optimal Control Strategies for Racing | *PI: Prof Zachary Manchester*

- Developed and implemented a framework using closed natural cubic splines and DIRCOL-based trajectory optimization to minimize lap times on F1 circuits, improving performance by balancing distance and speed.
- Achieved smoother and faster lap times through optimized trajectories, demonstrating superior performance over traditional quadratic programming methods.