Mayank Deshpande

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Education

University of Maryland, College Park **Aug. 2023 – Present**
M.Eng. Robotics, GPA: 3.97/4 *College Park, MD*

Ramdeobaba College of Engineering and Management **Aug. 2019 – May 2023**
B.E. Mechanical Engineering, GPA: 9/10 *Nagpur, IN*

Technical Skills

Languages: C++, C, Python, MATLAB
Development Platforms: Linux/RTOS environments, Embedded robotics, Gazebo, AirSim, CARLA, CarSim, MoveIt, SUMO
Libraries/Frameworks: ROS, PyTorch, OpenCV, TensorFlow, Arduino, gtest, Qt, SolidWorks
Embedded & Architecture:ARM platforms, CUDA, GPU computing, controllers, interrupts, buses
Tools: Kubernetes, Docker, Git, Confluence, bash, GitHub Actions, GPU Programming

Experience

Intuitive Surgical Inc. **May 2024 – Dec 2024**
System Software Engineer Co-op *Sunnyvale, CA*
- Developed an end-to-end testing pipeline in MATLAB for the Ion Endoluminal robot, integrating real-time data logging and time-series analysis to proactively detect equipment failures. Achieved 85% automation and reduced single-use test time by 20%.
- Developed an optical-flow–based verification method to compare user commands with real-time video from catheter, addressing low-texture lung simulations by training a custom RAFT model and improving flow accuracy by 35% over classical approaches.

GAMMA AI Lab, UMD **Jan 2024 – May 2024**
Research Assistant *College Park, MD*
- Developed a GCN based model for pedestrian trajectory prediction that inputted the robot's planned path as future, achieving a 12% improvement in real-time performance and maintaining sub-2ms inference time, leveling state-of-the-art ADE/FDE benchmarks.
- Validated the model on a Husky robot navigating crowded environments, confirming simulation outcomes through successful real-life experiments and demonstrating robust, low-latency trajectory forecasting.

CodelatticeLabs Pvt. Ltd. **May 2022 – July 2023**
Robotics Software Engineer *Bengaluru, IN*
- Designed a submap-fusion approach to reduce localization latency for delivery robots and developed C++ firmware on Esp32 (NodeMCU) to enable real-time IoT weight data transmission, ensuring efficient resource utilization.
- Simulated and implemented multi-agent coordination algorithms and trajectory tracking methods for constrained robots, leveraging reinforcement learning for intelligent intersection management.

Projects

Adaptive RL-MPC for Autonomous Lane-Changing | *Python, SUMO, RL, MPC* **November 2024**
- Engineered a real-time RL-MPC pipeline for autonomous lane-changing, integrating SAC/PPO/TD3 with model predictive control to dynamically adjust risk weights. Achieved 30% higher success rates, 25% lower collision rates, and 20% faster lane changes in SUMO simulations, while optimizing concurrency for stable performance under varying traffic conditions.

Temporal Coherence Evaluation in Video-Language Models | *Python, Pytorch, CLIP, Hugging Face* **November 2024**
- Developed a framework to evaluate temporal coherence in multimodal foundation models for video understanding tasks, introducing metrics like CLIPGain for temporal consistency in video captioning and leveraging BERTScore for semantic analysis in video QA. The project was tested on benchmarks such as TOMATO and MSR-VTT, providing nuanced insights into temporal reasoning.

Visual-Encoding-Particle-Filter | *C++, Python, ROS2, DL* **May 2024**
- Developed a vision-based localization and visual odometry method for drones using a particle filter with CNN, VecKM, and Histogram of Features encoders, achieving fast convergence and real-time localization in ROS, validated in a Gazebo PX4 SITL environment.

3D Reconstruction using Structure from Motion | *Python, openCV, eigen* **March 2024**
- Developed a Structure from Motion (SfM) system using SIFT, matching, and bundle adjustment for 3D reconstruction, achieving accurate results validated with synthetic and real-world datasets.

MultiRobot Search and Rescue | *C++, ROS2, git, gtest* **December 2023**
- Utilized nav2_utils for collaborative navigation, implemented ACO for dynamic goal assignment (10% faster), and integrated YOLOv5 for real-time human detection (95% accuracy), achieving 90% code coverage through comprehensive unit testing.

LQR and LQG controller for two pendulum crane | *MATLAB* **October 2023**
- Modeled and controlled a two-pendulum crane system using LQR and LQG techniques in MATLAB

Right Invariant Extended Kalman Filter for object based SLAM | *Python* **September 2023**
- Translated the theoretical RIEKF algorithm for object-based SLAM into Python, showcasing in-depth knowledge of RIEKF principles and their advantages over standard EKF in a detailed report on Yang Song et al.'s 2022 paper.

Publications

Behavioral Analysis of ROS motion planners integrated with Robotics Middleware Framework (RMF) |
Published: 2022 | IEEE
This paper evaluates the integration of the Robotics Middleware Framework (RMF) with Free Fleet, analyzing the performance of different path planning algorithms in multi-robot scenarios to enhance autonomous mobile robot fleet management.