Mayank Sharma

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Domain skills: Control Systems, Computer Vision, Localization, Calibration, SLAM, Artificial Intelligence(AI), Machine Learning, Deep Learning, Robotics

Education

University of Maryland, College Park **Aug 2022 - May 2024**

Master of Engineering in Robotics

Courses: Foundations of Deep Learning, Perception, Planning and Controls for Robotics

NMIMS University, India **Aug 2018 - May 2022**

Bachelor of Technology in Mechatronics

Courses: Digital Signals and Image Processing, Microcontroller and Microprocessors

Skills

Programming Languages: Python, C++, MATLAB, C
Libraries and Tools: PyTorch, OpenCV, TensorFlow, ROS1, ROS2, Git, CI/CD, SolidWorks, NI Lab View
Deep Learning Architectures: ResNet18, VGG16, RCNN, CNN, HomographNet, SfMLearner, SegFormer, NeRF

Work Experience

Perception & Robotics Group(PRG), University of Maryland, College Park **Sept 2022 - May 2023**

Graduate Research Assistant

- Created an **RCNN**-based object detection system, incorporating selective search, region proposal techniques, and multi-class support and demonstrated image classification capability on the ImageNet dataset.
- Researched and implemented **DeepFit** technique for fitting surface on event point cloud dataset.

Lighter than Air Systems Lab, Indian Institute of Technology, Bombay **July 2021 - Aug 2022**

Robotics Intern

- Built battery swapping mechanisms and integrated them with the UAV docking mechanism resulting in **45%** less time to charge than most techniques.
- Developed firmware for a robust and modular arresting mechanism to lock the UAV in six degrees of freedom ***[Paper]***.

NMIMS University, India **May 2021 - July 2021**

Control Systems Intern

- Researched nonlinear BLDC motor speed control methods and implemented a speed control algorithm based on sliding mode reaching law **(SMRL)** on MATLAB Simulink.

Projects

- **Cyber Shopper**: Executed pick-and-place operations for grocery items utilizing a mobile robot featuring a UR5 arm in ROS2 Gazebo and employed inverse kinematics to ensure precision in robotic manipulation.
- **Outfit Recommendation System**: Enhanced the dataset pipeline with background augmentation and introduced an attention mechanism in the architecture, achieving a **2**% increase in Area Under the Curve (**AUC**) over the baseline, thereby improving the system's robustness to noise in outfit images.
- **Implicit Neural Respresentations**: Implemented image compression with INR and improved image reconstruction by using positional encoding, achieving a **29 PSNR** *Github*.
- **SLIC and Image Segmentation**: Executed image segmentation using superpixels generated with SLIC and k-means, resulting in **85%** accuracy with ResNet18 *Github*.
- **Real time Semantic Segmentation**: Trained SegFormer model on the Cityscapes dataset, and performed evaluation testing on hardware producing real-time semantic segmentation, achieved **45%** mIOU *Github*.
- **Robot Path Planning**: Applied BFS, DFS, Dijkstra, RRT, RRT*, and A* for holonomic and non-holonomic robots.
- **Delivery Bot**: Developed an autonomous robot utilizing RRT* for path planning, adept at avoiding static obstacles to efficiently deliver food from the kitchen to customers in a restaurant *Github*.
- **Structure from Motion**: Applied Structure from Motion (SfM) to reconstruct a high-fidelity 3D point cloud, employing advanced techniques such as RANSAC-based outlier rejection, PnP estimation, and Bundle Adjustment for optimal accuracy.
- **Panorama Stitching**: Implemented panorama stitching algorithm using traditional (Homography estimation using feature points) and deep learning (HomographyNet: Supervised and unsupervised) methods.
- **Optimal Control of Manipulator**: Applied an optimal control approach to address robust control challenges in manipulators *Github*.
- **Biomimicry Robotic Snake**: Attained snake-like robot motion by utilizing SolidWorks for CAD modeling, structural stability validation, and integrating motor angles through Python in Proteus *Github*.

Publications

- Khojasteh Z. Mirza, Mayank Sharma, Saurabh V. Bagare, Dhwanil Shukla and Rajkumar S. Pant. **A Study on Autonomous Mechanisms for Swapping of Batteries on Unmanned Aerial Vehicles**, AIAA 2023-1142. AIAA SCITECH 2023 Forum. January 2023.

- Saurabh V. Bagare, Khojasteh Mirza, Mayank Sharma, Dhwanil Shukla and Rajkumar Pant. **Design of Mobile Docking Mechanism for Unmanned Aerial Vehicles capable of Vertical Take-off and Landing**, AIAA 2022-4063. AIAA AVIATION 2022 Forum. June 2022.

Leadership Experience

Team Technotix, NMIMS University **Sept 2021 - Jul 2022**

Student Mentor

- Mentored a team of 150 students for ABU Robocon 2022, leading the design, fabrication, and coding of robots focused on stacking blocks for competition. Successfully guided the team to qualify for the National Finals.

Team Technotix, NMIMS University **Sept 2020 - Aug 2021**

Team Co-leader

- Led a diverse team of 70 individuals for ABU Robocon 2021, overseeing departments such as Manufacturing, Designing, and Simulation. Achieved a national ranking of **11** through effective team management and collaboration.