MIHEER DIWAN

✉ Email in LinkedIn ⓞ Github 🌐 Portfolio

EDUCATION

Worcester Polytechnic Institute
Master of Science in Robotics Engineering *Worcester, MA*

Mukesh Patel School of Technology Management & Engineering, NMIMS University
Bachelor of Technology in Mechatronics Engineering (Minor: Robotics & IoT) *Mumbai, India*

SKILLS

Robotics : Perception, Localization, Deep Learning, ADAS, Aerial Robotics, State Estimation, Sensor Fusion, Calibration
Software : Python, C++, ROS, ROS 2, Gazebo, OpenCV, PyTorch, TensorFlow, CUDA, TensorRT, NumPy, SciPy, Pandas, PCL, Open3D, scikit-learn, Matplotlib, MATLAB/ Simulink, Docker, Linux, Git, LaTeX, SolidWorks, Blender
Hardware : DJI Tello EDU, Jetson Orin Nano, Arduino, Raspberry Pi, Yaskawa Motoman MH5, Rapid Prototyping
Architectures : YOLO, CNN, R-CNN, VGG16, ResNet18, DenseNet, LSTM, TCN, HomographNet, Transformers, NeRF

EXPERIENCE

Perception and Autonomous Robotics (PeAR) Group | *Graduate Researcher* **Aug 2023 – Dec 2023**

Quadrotor Navigation in Uncharted Terrains | *Python, C++, ROS, PyTorch, OpenCV*
- Developed a Generative, Procedural environment for quadrotor simulation and learning using Blender software.
- Employed RRT* algorithm and Minimum Snap Trajectory generation to navigate a dense, simulated forest.
- Designed a Model Predictive Controlfor precise trajectory tracking and traversal of optimal trajectories.

Sim-2-Real Mini Drone Racing | *Python, PyTorch, OpenCV, Blender, Data Generation, Jetson Orin Nano* | *Github*
- Trained a custom neural network using synthetic data and domain randomization to autonomously segment windows in the real world with an accuracy of 92 % and determined the 3D pose with Perspective-n-Point(PnP).
- Leveraged Optical Flow and Spatial Pyramid Network (SPyNet) to navigate arbitrarily shaped gaps in walls.
- Deployed the algorithm on DJI TelloEDU with Jetson Orin Nano and achieved latency of 10ms using TensorRT.

Embedded Computing Lab | *Graduate Researcher* **May 2023 – Aug 2023**

Drivable Region and Obstacle Segmentation for LiDAR pointclouds | *PyTorch, OpenCV, PCL*
- Developed voxel-based obstacle segmentation algorithm for autonomous vehicles on the KITTI Stereo 2015 dataset.
- Employed RANSAC plane fitting to segment roads in KITTI point clouds and refined drivable regions with ICP.
- Estimated absolute depth from disparity maps and reconstructed 3D traffic scene using stereophotogrammetry.

Monocular Camera Perception Stack for Autonomous Vehicles | *Python, PyTorch, OpenCV, Blender* | *Github*
- Used YOLOv8 for Object Detection and Instance Segmentation of vehicles, traffic signs, and pedestrians.
- Trained Cross Layer Refinement Network (CLRNet) on TUSimple dataset with a 97.8 % accuracy to detect lanes.
- Processed per-pixel relative depth using Intel's MiDaS depth model and created a visualization in Blender.

Control Systems Intern | *Technical Internship Project, NMIMS* **June 2021 – Dec 2021**
- Conducted comprehensive research, exploring and analyzing multiple non-linear methods for BLDC motor speed control.
- Constructed a closed-loop model for sensorless control of BLDC motors using Back-EMF and zero-crossing detection.

PROJECTS

Vision-Based Localization | *Python, Matplotlib* | *Github*
- Performed robust quadrotor pose estimation in 3D space by using Quadrotor Dynamics and Extended Kalman Filter.
- Improved prediction accuracy by using a vision-based observation model to get pose-estimates from AprilTags.

SCARA Robot Simulator | *ROS2, C++* | *Github*
- Simulated a SCARA robot manipulator in ROS 2 and Gazebo, and developed forward and inverse kinematics nodes.
- Designed custom position and velocity controllers for achieving smooth linear motion in Cartesian space.

Structure from Motion (SfM) | *Python, OpenCV, Matplotlib* | *Github*
- Extracted and matched monocular camera image features using SIFT descriptors and RANSAC algorithm.
- Calculated the Fundamental matrix and the Essential matrix based on Epipolar geometry constraints and leveraged camera triangulation to determine camera poses ensuring adherence to Cheirality Condition.
- Performed 3D scene reconstruction by refining camera poses using Bundle Adjustment and the Visibility matrix.

Sensor Fusion with Multiple Filters | *Python, Matplotlib* | *Github*
- Estimated 3D quaternion pose of a 6-DoF IMU using Complementary, Madgwick and Unscented Kalman Filter.
- Synchronised and evaluated the computed attitude against Vicon ground truth using Spherical linear interpolation.