

# SOMIK DHAR

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## EDUCATION

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**Master of Science, Electrical Engineering**  
New York University

*CGPA: 3.67/4.0*  
May 2024

**B.Tech(Honors) in Electrical Engineering**  
IEST, Shibpur

June 2021

## RESEARCH EXPERIENCE

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**Graduate Assistant with Dr. Chen Feng**  
*Ai4CE Lab, New York University*

Jan'23 - Present

- Proposed a spatiotemporal backbone to harness the sequential information for Visual Place Recognition(**VPR**)
- Evaluating different network configurations on benchmark VPR datasets to quantify accuracy gains compared to baseline approaches for Video VPR in **Pytorch**

**Research Intern with Dr. Pushpak Jagtap**  
*RBCCPs, Indian Institute of Science(IISc.), Bangalore*

Feb'22 - Jun'22

- Led the setup and calibration of PhaseSpace Motion Capture System and developed **ROS** support for integrating the system with Turtlebot3 robots
- Deployed Turtlebot3 robots with differential and mecanum drive configurations and utilized motion capture for accurate robot position tracking and real-time control adjustments
- Implemented a Control Lyapunov Function (CLF) based controller in Python to guide unicycle modeled robots to desired poses
- Implemented a barrier certificate-based collision avoidance algorithm for multi-agent systems using **ROS(Python)**.
- Achieved a 30cm safety radius in a 6m x 5m arena

## PROJECTS

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### **Vision Based Pose and Velocity Estimation with Outlier Rejection for Microaerial Vehicle**

- Developed and implemented a real-time vision-based state estimation system for quadrotors using MATLAB
- Estimated 6-DOF pose by detecting **AprilTags**, matching features, and computing planar homography with orthonormality constraints
- Computed optical flow to estimate velocity using KLT tracking and applying **RANSAC** outlier rejection
- Implemented Butterworth and Savitzky-Golay filtering to further smooth velocity estimates by reducing noise

### **State Estimation of Micro Aerial Vehicle using Kalman Filters**

- Developed Extended Kalman filter (**EKF**) and Unscented Kalman filter (**UKF**) for real-time state estimation of a quadrotor using MATLAB, fusing IMU, GPS and other sensor data
- Formulated 15-dimensional state vector and derived Jacobians for EKF implementation. Calculated sigma points for UKF to propagate state estimates
- Conducted in-depth analysis of EKF vs UKF - compared estimation accuracy and computational complexity to identify the most reliable, efficient filter for quadrotor platform

## TECHNICAL SKILLS

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**Programming Languages** Python, C/C++, MATLAB  
**Frameworks/Libraries** Pytorch, ROS, OpenCV