VISHNU ROHIT ANNADANAM

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EDUCATION

Master of Science, Robotics | Northeastern University, Boston, MA | GPA – 3.8/4 **Dec 2024**

Coursework: Autonomous Field Robotics, Mobile Robotics, Computer Vision, Control Systems, Robotics Sensing & Navigation.

Bachelor of Engineering, Electronics & Telecommunication | University of Mumbai, India | GPA – 8.4/10 **Jun 2022**

Coursework: Neural Networks & Fuzzy Logic, Image Processing & Machine Vision, Discrete Time Signal Processing.

EXPERIENCE

Robotics Research Assistant [incl. Co-op] | Field Robotics Lab, Northeastern University, Boston, MA **Sep 2023 – Present**

- Led the design and development of a multi-UAV swarm system for dynamic mapping, with a dual RGB camera setup for stereo vision on each drone and ensuring precise time synchronization across all cameras and platforms.
- Developed a perception-based control algorithm with real-time camera feedback using Python and ROS2 to achieve formation flight with collision avoidance for tracking dynamic targets using Pixhawk 6X and ArduPilot.
- Calibrated camera intrinsic and extrinsic parameters for the stereo-camera rig before each mission to get accurate depth estimation for optimal 3D reconstruction and mapping.
- Generated 3D/4D representations and novel views of dynamic scenes using NeRFs and Gaussian Splatting, from optimized sparse point clouds produced by Structure from Motion (SfM) algorithms.
- Benchmarked state-of-the-art Visual SLAM algorithms such as NVIDIA ISAAC SLAM on the on-board Nvidia Jetson Orin Nano to evaluate real-time performance on edge devices.

Graduate Teaching Assistant – Robotics Sensing and Navigation | Northeastern University, Boston, MA **Sep 2023 – Dec 2024**

- Guided students on data acquisition using ROS/ROS2 and analysis techniques for IMU, GNSS, RTK GPS, Camera and LiDAR sensors.
- Led discussions on core robotics concepts such as localization, mapping, path planning, computer vision, optimization, etc. and their state-of-the-art algorithms.

Computer Vision & IoT Intern | EdVerb Pvt. Ltd, Mumbai, India **Jan 2022 – Jun 2022**

- Programmed the Arduino Uno and ESP-32 board and interfaced with multiple sensors to devise several cost-efficient computer vision and IoT-based solutions for automation.
- Designed and developed an automated parking management system using the ESP-32 Cam to implement automatic number plate detection and Optical Character Recognition (OCR) to register license plates.
- Deployed ultrasonic sensors for marking and determining slot availability at each parking space and continuously update the real-time database.

TECHNICAL SKILLS

Operating Systems & Software: ROS/ROS2 (Robot Operating System), Linux, Git, Docker, Gazebo, Raspberry Pi, Fusion 360.
Programming Languages & Libraries: Python, C++, MATLAB, OpenCV, PyTorch, CUDA, GTSAM, NumPy, Matplotlib.
Proficiencies: Robotics, Perception, SLAM, Deep Learning, System Design, Motion Planning, Machine Learning, CAD, 3D Printing.

PROJECTS

Semantic Segmentation of Road Cracks using Swin Transformer *(link)*

- Trained a surface crack segmentation model for autonomous road inspection using Swin Transformer + UPerNet architecture, utilizing PyTorch and MMSegmentation, with ADE20K pre-trained weights for improved transfer learning.
- Achieved ~78% mIoU on the test set at 80k iterations by employing a hybrid loss strategy combining Cross-Entropy loss and Lovasz-Softmax loss to optimize IoU on fine-grained crack patterns across a dataset of 11.2K images.

3D Point Cloud Reconstruction from 2D Images through Structure from Motion (SfM) *(link)*

- Developed a 3D reconstruction algorithm that performs Structure from Motion to generate a sparse point cloud from 2D images captured with a phone camera, using OpenCV for processing and GTSAM for optimization.
- Matched features between images using SIFT and RANSAC to estimate camera poses using essential matrix and Perspective-n-Point (PnP) pose computation, and triangulate their inlier feature points into 3D space.
- Optimized the point cloud by performing global Bundle Adjustment using GTSAM's factor graphs with LM algorithm to improve camera poses and 3D landmarks from the initial triangulation, achieving a 94.5% decrease in reprojection error.

GPS & IMU Sensor Fusion for Automotive Dead Reckoning

- Built and deployed custom Python-based ROS2 drivers for real-time sensor data acquisition from a GNSS receiver and IMU for vehicle localization and navigation.
- Analyzed IMU noise using Allan Variance, calibrated magnetometer for hard/soft iron distortions, corrected accelerometer bias for velocity estimation, and refined heading by fusing gyroscope & magnetometer data for dead reckoning.
- Performed GPS and IMU sensor fusion by implementing Extended Kalman Filtering (EKF) to get an improved estimate of vehicle's overall trajectory including GPS-denied environments.

PUBLICATIONS

- A System for Multi-View Mapping of Dynamic Scenes Using Time-Synchronized UAVs, submitted to ***IROS 2025***.