Chaitanya Sriram Gaddipati

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Education

Worcester Polytechnic Institute 2022 - 2024
Master of Science - Robotics Engineering *GPA: 4.0/4.0*

- **Coursework :** Robot Control, Deep Learning, Motion Planning, Autonomous Aerial Robotics, Machine Learning

Indian Institute of Technology Hyderabad 2018 - 2022
Bachelor of Technology - Mechanical Engineering (Major) *GPA: 9.29/10.0*

Skills

Programming Languages: Python, C, C++
Software: Linux, ROS2, Gazebo, Blender, NumPy, OpenCV, PyTorch, TensorFlow, Git, Docker, MATLAB, Eigen
Hardware: DJI Tello drone, NVIDIA Jetson, Franka Emika Panda Arm

Experience

Void Robotics Aug 2024 – Present
Robotics Software Engineer Intern *Marathon, Florida*

- Developing a localization system using Nav2 with GPS sensor on a custom robot for navigation with ROS2 in C++.
- Incorporating Extended Kalman Filter for sensor fusion of the wheel odometry, IMU data, and GPS data, and simulating the robot in Gazebo.

Comet Lab, WPI May 2023 – Jun 2024
Research Assistant *Worcester, MA*

- Designed and implemented a **Model Predictive Controller** with thermal diffusion **partial differential equation constraints** for optimal tissue surface temperature control in **robotic laser surgery** to minimize tissue damage.
- Conducted experiments on animal tissues to test the controller performance using a Franka Emika Panda robot arm mounted with a laser and a thermal imaging system.

Projects

Instant NeRF with Multiresolution Hash Encoding | PyTorch, CUDA Dec 2024

- Implemented instant-NGP's Neural Radiance Fields (NeRF) pipeline using PyTorch and CUDA, achieving average **PSNR of 27.5** and **SSIM of 0.943** on 3D scene reconstruction of the lego dataset.
- Created the multiresolution hash encoding for density MLP inputs and additional direction input encoding with spherical harmonics for color MLP.
- Utilized a multi-cascade occupancy grid to accelerate ray marching with efficient sampling. - **Github**

Probability based boundary detection | Python, NumPy Oct 2024

- Implemented a probability of boundary detection algorithm that utilizes the color and texture discontinuities along with intensity for better edge detection. - **Github**

Optical flow based gap detection for drone flight | Python, PyTorch, OpenCV Dec 2023

- Developed a sensori-motor framework for autonomous navigation through unknown gaps without 3D reconstruction and mapping, leveraging solely a **monocular camera** and onboard IMU sensing.
- Utilized the RAFT model which is a composition of CNN and RNN architectures for **dense optical flow estimation**, achieving a **99% IoU score** for the unknown-shaped gap detection.
- Performed post-processing with OpenCV(Python) for gap contour detection and center identification, integrated **visual servoing** methods to align the drone with gap centers for successful navigation. - **Github**

Sim2Real Learning for Autonomous Drone Racing | Python, PyTorch, OpenCV, sim-to-real Oct 2023

- Engineered a perception stack for DJI Tello EDU drone, enabling precise navigation through diverse drone racing gates.
- Created Blender based Python script to generate a robust synthetic dataset of 14100 image-mask pairs using **domain randomization**.
- Trained YOLOv8 neural network on generated dataset for real-time gate identification and **segmentation** in complex environments with latency of 30ms.
- Extracted corners with OpenCV and used **Perspective-n-Point(PnP)** for 3D pose estimation for navigation. - **Github**

3D RRT* Drone Motion Planning | Python, Numpy, SciPy Sep 2023

- Developed motion planning pipeline for DJI Tello drone using RRT* path planner and generated smooth **minimum snap trajectories** by solving unconstrained quadratic optimization problem with NumPy and SciPy.
- Fine tuned the cascaded velocity and position PID controllers to ensure precise tracking of the optimal 3D trajectories.
- Validated planner through Blender simulation and real drone testing. - **Github**

Quaternion based Attitude Estimation of IMU | Python, NumPy Aug 2023

- Implemented a Complimentary, **Madgwick**, and **Unscented Kalman filters** for attitude estimation of a 6-DoF IMU in Python and benchmarked it against ground truth data from Vicon motion capture system for accuracy. - **Github**

Path Planning for multiple autonomous agents | Python, NumPy Apr 2023

- Implemented **model predictive control** (MPC) as local path planner of multiple autonomous vehicles in a 2D environment and performed **dynamic collision avoidance** by utilizing acceleration velocity obstacle (AVO) and generalized velocity obstacle (GVO) methods. - **Github**

Robust Trajectory Tracking for UAV | ROS, Python, Gazebo Mar 2023

- Designed a robust **sliding mode control** for trajectory tracking in the presence of external disturbances. The quadrotor is simulated in Gazebo using ROS. - **Github**

SCARA Robot Simulation | C++, ROS, Gazebo, Docker Dec 2022

- Simulated a SCARA Robot manipulator in Gazebo with ROS and created forward and inverse kinematics nodes in C++.
- Additionally designed custom velocity and position controllers for path tracking. - **Github**

Publications

N. E. Pacheco, **C. S. Gaddipati**, S. Farzan and L. Fichera, **"Automatic Focus Adjustment for Single-Spot Tissue Temperature Control in Robotic Laser Surgery"**, in IEEE Transactions on Medical Robotics and Bionics, vol. 6, no. 4, pp. 1386-1390, Nov. 2024, doi: 10.1109/TMRB.2024.3464670.

N. P. Babu M, P. Kumar Duba, **G. C. Sriram** and P. Rajalakshmi, **"Autonomous Bio-Inspired Micro Aerial Vehicle (MAV)"**, 2022 IEEE IAS Global Conference on Emerging Technologies (GlobConET), Arad, Romania, 2022, pp. 661-666, doi: 10.1109/GlobConET53749.2022.9872352.