

Muhammad Fadli Alim Arsani

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EDUCATION

University of California San Diego

San Diego, CA

B.S. Electrical Engineering - Machine Learning & Control

September 2020 - June 2024

- **Graduate-level courses:** Robotics Sensing and Estimation, Robotics Planning and Learning, Computer Vision, Convex Optimization
- **Undergraduate-level courses:** Statistical Learning, Machine Learning Algorithms, Deep Learning, C++, Python For Data Analysis, Linear and Non-Linear Optimization, Controls Theory, Data Structures and algorithms, C Programming, Computer Engineering (ARMv8), Circuits Theory

TECHNICAL SKILLS

Programming Language: C++, Python, C

Concepts/Libraries/Tools: ROS2, Point Cloud Library (PCL), PyTorch, JAX, OpenCV, Eigen, Linux, Boost, SLAM, Parallel Programming, Image Processing, Object Detection & Recognition, State Estimation, Mapping, Localization, Planning, Behavior Trees, Digital Signal Processing (DSP), ESP32, Raspberry Pi, Jetson Nano

WORK EXPERIENCE

Perception Software Engineer Intern (Autonomous Driving)

Pittsburgh, PA

Moss Robotics Inc.

July 2023 – September 2023

- Overcome limitations of single-scan **LiDAR** data by implementing a **point cloud accumulator** module.
- Enhanced **trees/plants tracking and detection** by implementing a **fast real-time data association** algorithm.
- Improved **tree detection** and **row-following** accuracy with **deep learning (YOLO)** and **parallel line fitting**.
- **Optimized** real-time performance with **multithreading** and using **ROS2 Components** and **Behavior Trees**.
- Automated **trees/pots counting** through **tree block identification** by introducing a **graph-based** approach.
- Developed all the software **entirely in C++**.

Research Software Engineer

San Diego, CA

Existential Robotics Lab, Contextual Robotics Institute (CRI) UC San Diego

September 2022 – Current

- Built implementations & visualizations of **mobile robot algorithms** for **localization, mapping, & controls**.
- Implemented various robotics algorithms like **Particle Filter, SLAM, A* search, etc.**
- Programmed a **navigation environment** in **PyBullet** real-time physics simulation engine.

Research & Software Engineer Intern

San Diego, CA

Autonomy Lab, Contextual Robotics Institute (CRI) UC San Diego

March 2022 – September 2022

- Deployed **Reinforcement Learning policy** on **Unitree A1** robot enabling it to navigate challenging terrains.
- Worked with a **depth camera (Intel RealSense D435)** and other sensors on the robot.
- Collected **real-world data** to bridge the gap between **Sim2Real** and uncertainties in the real world.
- Utilized **GPU clusters** and other MLOps tools like **Kubernetes** and **WANDB** to train the models.

PROJECTS

LiDAR-based SLAM: Pose Graph Optimization with ICP

Winter 2024

LiDAR, SLAM, Python, Occupancy Mapping, Iterative Closest Point, IMU, Localization, GTSAM

- Built **LiDAR-based (full) SLAM** system for **differential-drive robot**, integrating data from multiple **sensors**.
- Implemented **ICP** (from scratch) for **point-cloud registration**, enhancing **pose estimations** between scans.
- Created a **2D occupancy grid map** and **texture mapping** from **RGBD images**, improving map representation.
- Optimized trajectory through **pose graph optimization** with **loop closure** constraints using **GTSAM**.

Robust Orientation Tracking for Panoramic Stitching with Projected Gradient Descent

Fall 2023

Python, JAX, IMU, Gradient Descent, Kalman Filters, Robotics, Sensor Fusion, Quaternion

- Implemented Projected Gradient Descent (PGD) for **3D orientation tracking** of a rotating body.
- Demonstrated the algorithm's precision with **panoramic image stitching**.
- Implemented **7-state EKF**, achieving accurate response to rapid movement changes and **real-time** adaptability.
- Performed **comparative analysis** between the PGD & EKF approaches, highlighting potential future work.