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

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 **tree/plant 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++**, ensuring high performance and maintainability.
- **Doubled perception stack's efficiency**, **enhanced detection by 100%**, **made inventory counting 2x faster**.

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.

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