Richard Oliveira

My background can be broadly defined as that of a Mathematical Engineer, with a strong interest in developing data-driven mathematical models to describe complex systems in the fields of Machine Learning, Control Theory, Optimization and Robotics.

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Education

Master of Science (MSc.) in **Electrical Engineering, Signal and Image Processing**
University of California, San Diego, La Jolla, CA
September 2022 - June 2024

Bachelor of Science (BSc.) in **Electrical Engineering, Machine Learning and Controls**
University of California, San Diego, La Jolla, CA
September 2020 - June 2022

Research Experience

Graduate Student Researcher
University of California, San Diego, Electrical and Computer Engineering Dept.
Advisor: Prof. Massimo Franceschetti
September 2023 - August 2024

- Developed a symbolic generative model for music creation in the context of Jazz Improvisation.
- Contributed to the theory of Discrete Pearson-Rayleigh Random Walks by analyzing how walks of this kind behave in Discrete Space with Geometric and Poisson distributed step sizes.

Undergraduate Student Researcher
University of California, San Diego, Electrical and Computer Engineering Dept.
Advisor: Prof. Nick Antipa
September 2020 - June 2022

- Analysis and development of a Linear, Spacial - Invariant Imaging system (Diffuser Cam).
- Experimentally recovered a Point Spread Function of the Imaging system.
- Implemented in Python an accelerated version of Gradient Descent (ADMM), which was used for the minimization of a Loss in the context of solving an Inverse Problem (Scene Reconstruction).

Projects

Inverse Problems in NeuroMANCER, November 2024 - December 2024
The NeuroMANCER library enables the incorporation of physics-informed constraints into convex optimization problems. I utilized this library to solve an inverse problem using the MNIST dataset, specifically to evaluate its performance with non-smooth regularizers. When comparing the results with established libraries like CVXPY, I discovered that NeuroMANCER requires careful fine-tuning to effectively handle non-differentiable regularizers.

Deep Pose Estimation from 3D Point Clouds, March 2024 - June 2024
In this work, we develop a NN to predict relative poses between two sets of 3D point clouds from LiDAR scans and RGBD camera data, obtained from the EDEN Data Set. It aims to improve upon traditional point cloud registration methods, such as the Iterative Closest Point (ICP) algorithm by addressing two main challenges: sensitivity to initialization and the high computational cost of successive data alignment and optimization steps.

Visual-Inertial SLAM, January 2024 - March 2024
In this project, we present a way of solving the SLAM problem by using the Extended Kalman Filter (EKF). Initially, we simply use the *Prediction Step* of the EKF to track the position of the robot over time (Localization). Then, in order to estimate the location of landmark positions measured by a stereo camera mounted on the robot, we only use the *Update Step* of the EKF (Mapping). Lastly, we combine the *Prediction* and *Update Step* of the EKF such that we perform Localization and Mapping simultaneously, hence we perform Visual-Inertial SLAM.

Li-DAR-based SLAM, January 2024 - March 2024
In this project we present a way of approaching the SLAM problem for a Differential-Drive robot via the use of measurements coming from wheel encoders, IMU, LiDAR and a RGBD camera (Kinect). We make use of the Iterative Closest Point (ICP) algorithm to estimate the robot's pose over time while using LiDAR measurements and also use GTSAM which re-formulates the SLAM problem and optimizes the trajectory of our robot. We then build a occupancy grid of the environment, which addresses the Mapping part of SLAM, using an optimized trajectory obtained from ICP and LiDAR measurements, and GTSAM.

A Literature Review of the Theory and Applications of Convex Lifts, January 2023 - March 2023
This literature review offers a concise overview of the theory and applications related to lifts of convex sets. A lift of a convex set is a higher-dimensional convex set that can be linearly projected onto the original set. In many cases, lifting a convex set to a higher dimension simplifies its structure significantly. Lifts of this kind are particularly important in the field of optimization.

Teaching

ECE 227: Big Network Data - Graduate Teaching Assistant
University of California, San Diego, Electrical and Computer Engineering Dept.
March 2024 - June 2024

- A course on Graph Analysis, in which I developed course projects in the context of Robotics.
- Provided feedback and instructional help to students on the course projects during lecture hours.

ECE 35: Introduction to Analog Design - Undergraduate Teaching Assistant
University of California, San Diego, Electrical and Computer Engineering Dept.
September 2021 - December 2021

- Provided academic support to students during lecture hours.
- Developed instructional materials and attended lab sessions.
- Assisted in grading exams and held multiple weekly Office Hours during the quarter.

Employment History

Junior Data Scientist
Onikron LLC, Remote
September 2024 - Present

- Currently implementing and researching modern NLP models, such as Transformers and RNNs with PyTorch. Developed Lemmatization and Tokenization scripts for Data Pre-Processing, as well as Clustering for Unsupervised Learning.

Algorithms & Signal Processing Engineer
General Atomics A.S.I, San Diego, CA
June 2023 - August 2023

- Research modern NN architectures for the development of a Deep Learning model in the context of Computer Vision. Additionally, I have created a Data Visualization tool in Python, using PythonBokeh, for the analysis of heat maps. This tool enabled the team to perform appropriate Data Pre-Processing.

DataBase Engineer
Ciena, San Jose, CA
May 2021 - August 2021

- Extensive use of SQL queries, through the FLYBID database, which organized sensitive records within the company. Furthermore, special focus was placed on the creation of Data Dictionaries which would simplify Data mapping through the use of LucidChart.

Grants & Awards

Graduate Student Researcher (GSR) Grant, January 2024

Skills

- Programming Languages: C, C ++, MatLab, SQL, Python, PyTorch, TensorFlow, Assembly, Scikit-learn.
- Languages: Italian, English, Spanish.
