

CONTACT

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SKILLS

Python

MATLAB

C++

ROS

PyTorch

TensorFlow

OpenCV

Unity3D

LabVIEW

SQL

Git

EXPERTISE

Computer Vision Machine Learning

Deep Learning State Estimation

Reinforcement Learning 3D Vision

Mixed Reality SLAM Control

IVAN ALBERICO

ACADEMIC EXPERIENCE

Vision-Based Navigation for Mid-Air Helicopter Delivery on Mars

Mar - Sep 23

Aerial Mobility Lab (347T), NASA JPL

The goal of the thesis was to investigate and address challenges in the revolutionary Mid-Air Helicopter Delivery (MAHD) mission concept for Mars exploration. Focusing on the navigation aspect, the study extensively analyzed the existing range-visual-inertial odometry (xVIO) framework under Mars-like conditions, revealing limitations in high-altitude and non-planar terrains. To overcome these challenges, an innovative extension to xVIO was proposed, that embeds altimeter measurements in the pipeline without any type of ground planarity assumptions. The thesis showcases a robust evaluation of the novel method in a simulated Mars environment, emphasizing its potential benefits for adaptable and efficient navigation systems in the context of Mars exploration.

Monocular markerless 6D pose estimation of ANYmal

Mar - Jun 22

Robotics Systems Lab, ETH Zürich

The goal of the project is to design a localization system that estimates the pose of ANYmal in the space without relying on external sources like depth cameras or QR codes placed in the surrounding environment, but on video streams only. The proposed method deploys state-of-the-art 6D pose estimation networks to estimate the pose of the robot only from RGB frames.

Semester Project

Sep 21 - Jan 22

Robotics and Perception Group (RPG), ETH Zürich

Title: "Learning to Generate Events using Spiking Neural Networks"

Semester Project at the Robotics and Perception Group (RPG). The goal of the project is to design a learning-based model that converts any existing video dataset recorded with conventional cameras to synthetic event data using Spiking Neural Networks.

Planning and Decision Making for Autonomous Robots course project

Nov 21 - Jan 22

ETH Zürich

The goal of the project was to control a spacecraft to safely reach a goal region, in an environment full of static and dynamic obstacles. The final solution was based on the implementation of an RRT* algorithm for the path planning module and an MPC controller for path tracking.

Instinctive Robot Control via Hololens2

Sep - Dec 21

Mixed Reality Lab, ETH Zürich

The goal of the project is to develop an intuitive mixed reality interface on a Microsoft Hololens 2, with which the user is able to remotely control a robotic arm and perform basic assembly tasks using hand and eye tracking. The project requires the use of C#/Unity/MRTK for interfacing with the HL2, ROS for telecommunicating with the physical robot and Python/OpenCV for estimating objects' poses (using ArUco markers) in the physical environment and mapping them to the MR environment of the user.

Robotics Summer School **RobotX, ETH Zürich**

July 2021

The ETH Robotics Summer School offered lectures and hands-on tutorials to program robotic platforms to perform autonomous tasks in real environments. The topics covered were: trajectory optimization, state estimation, SLAM with multiple sensor modalities, obstacle avoidance, path planning, artefacts detection and tracking. Participation to the program was highly competitive, with less than 7% of acceptance ratio. My team ranked second in the final competition held on the last day.

End-2-end self-supervised monocular SLAM **3D Vision course project, ETH Zürich**

Feb - June 21

Group project aimed at implementing an online self-supervised SLAM pipeline for real-time dense reconstruction. The goal of the project was to combine together Grad-SLAM framework with unsupervised depth prediction network, with an on-line adaptation to address the domain shift issue. The project was supervised by Google Research Interns.

Deep Learning for Autonomous Driving projects **ETH Zürich**

Feb - June 21

The course provided a solid foundation of perception, localization, path planning and control of autonomous driving vehicles, combining programming, machine learning and computer vision concepts. The projects involved training complex neural networks and applying them on real-world, multimodal driving datasets. The assigned projects were the following:

- Sensor calibration and synchronization to obtain multimodal driving data.
- Multi-task learning on semantic segmentation and depth estimation with deep neural networks.
- 3D object detection and tracking in LiDAR point clouds.

Recursive Estimation course projects **ETH Zürich**

Apr - June 21

The project consisted in the design of state estimation techniques for the tracking of robots in different environments. The project was coded on Matlab.

- Implementation of a Hybrid Extended Kalman Filter (Hybrid EKF) for tracking the position and orientation of the boat driving in a big windy lake.
- Implementation of a Particle Filter (PF) that tracks a mobile robot, which is moving in a closed room with a partially known contour.

Skater Blob game on Unity3D **Virtual Reality I course project, ETH Zürich**

Feb - June 21

The project consists in the implementation of a skateboarding game using Unity3D and Blender. The game contains different levels with increasing difficulty and the whole level design is implemented in C# with Unity interface. All the assets and animations were modeled on Blender.

LunarLander-v2 OpenAI Gym with Deep Reinforcement Learning **ETH Zürich**

Nov - Dec 20

The aim of the project was to implement a Deep Reinforcement Learning algorithm that was able to learn a control policy for a lander (spaceship), by practicing on a simulator. The solution was based on the implementation of Actor-Critic methods with policy gradients.

Admittance controller on an Haptic Paddle **pHRI course project, ETH Zürich**

Nov - Dec 20

The project aimed at implementing an admittance controller with inner position/velocity loop on an haptic device, with the aid of a servo-amplifier and tachometer for motor control. The project was developed on LabVIEW and Matlab.

Probabilistic Artificial Intelligence course projects **ETH Zürich**

Sep - Dec 20

The projects concerned the implementation of core modeling techniques and algorithms thought in class, from statistics, optimization, planning, and control in probabilistic scenarios.

- Gaussian Process Regression for ground-water pollution prediction.
- Predicting uncertainty with Bayesian Neural Nets on MNIST dataset.
- Hyperparameter tuning with constrained Bayesian optimization.

Advanced Machine Learning course projects **ETH Zürich**

Sep - Dec 20

The projects required solving challenging tasks regarding classification, clustering and regression. The projects assigned throughout the semester were the following:

- Brain age prediction using MRI features.
- Disease classification from image features.
- Heart rhythm classification from raw ECG signals.
- Sleep staging classification from EEG/EMG.

Computer Vision course projects **ETH Zürich**

Sep - Dec 20

During the course I was assigned weekly graded projects based on the implementation and understanding of the traditional Computer Vision techniques. The projects were developed in Python and Matlab, and they included the following topics:

- Camera Calibration
- Harris Corner Detector and Features Matching
- Particle Filter and Monte Carlo Localization
- Model Fitting and Multiple View Geometry
- Image Segmentation
- Stereo Matching and Structure from Motion
- Shape Context and Shape Matching
- Condensation Tracker
- Image Categorization