IVAN ALBERICO

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**

PROFILE

Originally from Italy, I have successfully completed my MSc in *Robotics, Systems, and Control* at ETH Zürich in October 2023. I am currently seeking admission into a PhD program to further advance my academic career and contribute to cutting-edge research in the areas of computer vision, deep learning and state estimation.

I am an enthusiastic, motivated and hard working person. I am an excellent team worker and I am able to take instructions from all levels. I am able to work well under pressure and adhere to strict deadlines.

WORK EXPERIENCE

Visiting Student Researcher — **Mar - Oct 23**
NASA Jet Propulsion Laboratory, Pasadena CA

During my internship with the Aerial Mobility Group (347T), I undertook a pivotal role in the development of the Mid-Air Helicopter Deployment system for the Mars Science Helicopter. This internship, integral to the completion of my Master's thesis at ETH, focused on the challenging task of state estimation at high altitudes and across highly non-planar Martian terrain. Specifically, I contributed to the integration of sensor data with visual-inertial odometry frameworks, enhancing the precision and reliability of the future rotorcraft's deployment on the Martian surface.

Computer Vision Engineer — **Apr 22 - Jan 23**
Verity AG, Zürich

Working on improving the localization system of autonomous indoor drones for warehouses inventory tracking. Design, development, and testing of deep learning networks in C++ to be deployed in real-time on the drones for improving feature detection outlier rejection. During my internship, I brought various improvements to Verity's localization technology concerning the core algorithms, deployment tools, and simulation.

Teaching Assistant, ETH Zürich — **Sep 21 - Jan 22**
Rehabilitation Engineering Lab

The main tasks of my assistantship were to prepare and correct assignments and to direct lab lectures for the course *Physical Human-Robot Interaction* under the Rehabilitation Engineering Lab. My responsibilities extended beyond classroom activities, including the supervision of students' final graded projects.

Bachelor's Thesis Internship — **Feb - July 20**
Pirelli & C. S.p.A.

The goal of the thesis was to design a robust defects detection system, using 3D cameras and Convolutional Neural Networks, able to identify possible defects occurring during the manufacturing process of a tyre. During the whole working period I set up bi-weekly meetings with Pirelli Research Interns to share results and discuss alternative strategies to improve the model.

LANGUAGES

Italian – Native speaker

English – Advanced (C1)

French – Basic level (A2)

Chinese – Basic level (A1)

Spanish – Basic level (A1)

Germany – Basic level (A1)

AWARDS

***Migliore Media* prize**

December 2016
Liceo Scientifico F. Quercia

Awarded *Migliore Media* certificate of merit for obtaining the highest GPA in the whole school during the academic year 2015/2016.

***Alfiere del Lavoro* prize**

June 2017
Liceo Scientifico F. Quercia

Awarded *Alfiere del Lavoro* certificate of merit for obtaining a GPA of at least 8/10 throughout all the years of high school. Furthermore, I was chosen among all the students to represent the school at the related national contest.

First Position Holder in *Maths Olympic Games*

April 2015
Liceo Scientifico F. Quercia

Secured the first-place position in the *Maths Olympic Games* for the academic year 2014/2015.

EDUCATION

MSc in *Robotics, Systems and Control* **2020 - 2023**
ETH Zürich

Main focus of these studies was in computer vision, machine learning, state estimation and robots navigation & perception.

- ***Fall Semester 2020***: Advanced Machine Learning, Computer Vision, Physical Human-Robot Interaction, Probabilistic Artificial Intelligence, Robot Dynamics
- ***Spring Semester 2020***: 3D Vision, Autonomous Mobile Robots, Big Data for Engineers, Deep Learning for Autonomous Driving, Programming for Robotics (Introduction to ROS), Virtual Reality I, Recursive Estimation
- ***Fall Semester 2021***: Mixed Reality, Planning and Decision Making for Autonomous Robots, Semester Project (RPG lab)
- ***Spring Semester 2022***: Perception and Learning for Robotics

BSc in *Automation Engineering* **2017 - 2020**
Alma Mater Studiorum - University of Bologna

Main focus of these studies was in control systems theory and robotics. Great importance was also attributed to mechanics, electronics and programming.

- **Final grade**: 110/110 *with honors*
- **Final thesis**: *Defect Detection in the Tyre Manufacturing Process using Convolutional Neural Networks* in partnership with Pirelli S.p.A.

Double degree programme, BSc in *Control Theory and Control Engineering* **2018 - 2019**
Tongji University, Shanghai

During the second year of my Bachelor's degree, I embarked on an exciting journey by participating in a year-long program in Shanghai. This experience not only allowed me to immerse myself in a completely new environment but also provided the invaluable opportunity to engage with exceptional students from diverse global backgrounds. The vibrant and intellectually stimulating atmosphere in Shanghai significantly contributed to both my personal and academic growth.

High school Diploma **2012 - 2017**
Liceo Scientifico F. Quercia, Caserta, Italy

Main focus of high school studies was on scientific subjects like maths, physics, chemistry and biology. **Final grade**: 100/100 *with honors*

Exchange student **Jan - May 14**
St. Joseph's Secondary School, Drogheda, Ireland

Participated in a 5-month student exchange program in Ireland during my second year of high school. Hosted by a local family, I seamlessly integrated into the local community and attended classes alongside Irish students, fostering a cross-cultural experience that significantly enriched my personal and academic growth.

CERTIFICATIONS

GRE General test

March 2020
Quantitive reasoning: 162/170
Analytical writing: 4/6

IELTS Academic test

February 2020
Overall band score: 7.5/9

Cambridge Advanced English (CAE)

August 2016
Level obtained: C1 Grade C

European Computer Driving Licence (ECDL)

February 2014
IT Security - Level Specialized

HOBBIES

- Playing the piano
- Karate (black belt)
- Amateur photographer
- Travelling and experiencing different cultures

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.

INTERPERSONAL SKILLS

- Positive attitude
- Good organisational and prioritisation skills
- Accustomed to work under pressure
- Strong logical, analytical and computational skills
- Strong motivational and leadership skills

Robotics Summer School — **July 2021**
RobotX, ETH Zürich

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 — **Feb - June 21**
3D Vision course project, ETH Zürich

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 online adaptation to address the domain shift issue. The project was supervised by *Google* Research Interns.

Deep Learning for Autonomous Driving projects — **Feb - June 21**
ETH Zürich

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 — **Apr - June 21**
ETH Zürich

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 — **Feb - June 21**
Virtual Reality I course project, ETH Zürich

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 — **Nov - Dec 20**
ETH Zürich

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
Nov - Dec 20

pHRI course project, ETH Zürich

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
Sep - Dec 20

ETH Zürich

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
Sep - Dec 20

ETH Zürich

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
Sep - Dec 20

ETH Zürich

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