Lorenzo Ortolani

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Summary

Robotics and automation engineering student with hands-on experience in autonomous navigation, perception systems, and embedded control. Strong background in robotics software development, sensor fusion, computer vision, and deep learning. Passionate about building intelligent, real-time autonomous systems capable of robust performance in dynamic and GPS-denied environments.

Education

Politecnico di Milano, Milano, Italy *Sep 2024 – Present*
M.Sc. in Automation and Control Engineering
Focus: Mechatronics, robotics, control theory, and artificial intelligence.
Coursework includes mobile robot control, perception, localization, mapping, robot locomotion, nonlinear trajectory optimization, advanced control algorithms, and artificial intelligence with emphasis on machine learning, deep learning, and multi-agent systems for control applications.

Politecnico di Milano, Milano, Italy *Sep 2021 – Sep 2024*
B.Sc. in Automation Engineering
Focus: Mechatronics, robotics, control theory, electronics, computer science, and automation systems.

Experience

Robotics Challenge Participant – Leonardo Drone Contest *Apr 2025 – Sep 2025*
AIRLab POLIMI, Milano, Italy

- Secured **second place** in an advanced robotics competition organized by Leonardo S.p.A., focused on autonomous navigation and perception in dynamic environments.
- Designed and implemented path planning and navigation software for an omnidirectional ground robot and a quadcopter using a ROS 2-based client–server architecture.
- Developed exploration and path planning strategies for environments containing ArUco markers and target objects, integrating SLAM for simultaneous mapping and localization.
- Integrated deep learning-based object detection using YOLO to enhance environmental perception for both robotic platforms.
- Developed a PTZ camera-based QR code detection system with pan–tilt scanning policies and YOLO-assisted detection, enabling dynamic task allocation from decoded JSON payloads.

Perception Engineering and Controls – Project FALCO *Sep 2024 – Present*
AEA Polimi – Automation Engineering Association, Milano, Italy

- Contributed to the development of an autonomous drone platform by implementing an Extended Kalman Filter (EKF) for multi-sensor fusion, integrating IMU, GPS, barometer, magnetometer, and camera-based visual odometry for GPS-denied environments.
- Implemented a stereo visual odometry pipeline based on ORB-SLAM3 to estimate drone pose using a stereo camera, deployed and optimized on NVIDIA Jetson Orin Nano.
- Designed and implemented an EKF to fuse IMU measurements with stereo ORB-SLAM3 pose estimates, improving robustness and accuracy of state estimation during flight.

- Programmed and configured a Pixhawk flight controller to enable autonomous navigation using PX4, integrating onboard Jetson-based SLAM computation with the flight control stack.
- Developed an MPC-based path planner for autonomous navigation; validated planning and control in Gazebo Harmonic using ROS 2 and deployed trajectories on embedded hardware.
- Leading the deployment of the full autonomous navigation pipeline from simulation to real-world flight, ensuring robust and responsive control behavior.

Skills

Programming: C++, Python, MATLAB, Simulink, Java
Frameworks & Tools: ROS 1, ROS 2, OpenCV, YOLO, Gazebo, Docker, Linux, PX4, ORB-SLAM3, PyTorch
Domains: Autonomous Navigation, Sensor Fusion, Computer Vision, Control Systems, Deep Learning
Languages: Italian (Native), English (Fluent)

Projects

Deep Learning Challenge – Image Classification Dec 2025
Team-based competition organized as part of the *Artificial Neural Networks and Deep Learning* course at Politecnico di Milano.
The challenge focused on supervised image classification, requiring the design of high-performing convolutional neural network models capable of generalizing effectively on a hidden test set.
Key contributions included:

- Implemented and fine-tuned a deep convolutional neural network based on ResNet-50 for image classification tasks.
- Leveraged representation learning techniques to improve feature extraction and robustness, enhancing classification performance.
- Applied advanced data augmentation strategies and regularization techniques to reduce overfitting and improve generalization.
- Performed systematic hyperparameter tuning and training optimization, including learning rate scheduling and batch size optimization.
- Evaluated model performance using validation metrics and iterative refinement based on empirical results.

Achieved **4th place out of 193 teams** (groups of 3–4 students).
Tools: Python, PyTorch, CNNs, ResNet-50, Representation Learning, Image Classification, Jupyter Notebook.

Deep Learning Challenge – Pirate Pain Classification Nov 2025
Team-based competition organized as part of the *Artificial Neural Networks and Deep Learning* course at Politecnico di Milano.
The challenge focused on time-series classification of human motion data to detect pain-related patterns from multivariate joint trajectories, requiring robust models capable of handling long temporal sequences and strong inter-subject variability.
Key contributions included:

- Designed and implemented a deep learning pipeline for multivariate time-series classification using GRU/LSTM architectures enhanced with temporal convolutional layers and attention mechanisms.
- Developed custom preprocessing and feature engineering strategies, including prosthetic indicators, feature selection, and per-sequence normalization.
- Implemented sliding-window sequence generation to transform raw motion data into fixed-length temporal inputs.

- Applied regularization techniques (L1/L2), early stopping, and extensive hyperparameter tuning to improve generalization and reduce overfitting.
- Built a complete training and evaluation framework with performance monitoring through loss and accuracy trends.

Achieved **27th place out of 193 teams** (groups of 3–4 students).
Tools: Python, PyTorch, Deep Learning, GRU/LSTM, Attention Mechanisms, Time-Series Modeling, Jupyter Notebook.

Odometry and Localization – Autonomous Car on Monza F1 Circuit Apr 2025
Course project focused on perception, localization, and autonomous navigation of mobile robots in the ROS 1 environment.
The objective was to estimate the pose of an autonomous car navigating the Monza F1 circuit using odometry and sensor fusion techniques based on wheel encoder and GPS data.
Key contributions included:

- Developed an odometry node based on the kinematic Ackermann model to estimate vehicle pose and velocity from encoder measurements.
- Implemented GPS odometry by converting raw latitude, longitude, and altitude data into a local Cartesian reference frame.
- Designed and integrated an EKF to fuse odometry and GPS data, reducing drift and improving global localization accuracy.

Tools: ROS 1, C++, EKF, GPS Conversion, Kinematic Modeling