FLAVIO MAIORANA

EDUCATION

Master of Science in Artificial Intelligence & Robotics

Oct 2022 – Present | Sapienza University of Rome

- Weighted Average: 29.65 / 30.0
- Voto di partenza: 110
- Expected Degree Date: 30 October

Thesis

Humanoid Locomotion and Obstacle Avoidance via Model-Based Abstractions for DRL

Advisor: Luca Iocchi **Co-Advisor: Nicola Scianca**

This thesis extends the work done within "Exploiting Robot Abstractions in Episodic RL via Reward Shaping and Heuristic", which was published in a RAS special issue. More specifically, we move to a significantly more complex task, such as humanoid locomotion and obstacle avoidance. The core idea is to develop a DRL pipeline leveraging the predictive nature of a LIP-based MPC as a high-level abstraction to guide the learning of a low-level locomotion policy. Being a highly trending topic and a relatively unexplored approach, we plan on publishing a paper from the results of this work.

Bachelor of Science in Computer Science

Sep 2016 – Jul 2022 | University of Calabria

- Final Grade: 109 / 110
- *Thesis: Path Planning by using Switching Potentials*

Academic Degree in Piano

Nov 2009 - Mar 2020 | Conservatorio "Fausto Torrefranca"

- Final Grade: 9 / 10

TRANSCRIPT OF RECORDS – M.S. AIRO

Course Name	Grade	CFU
Artificial Intelligence	30 / 30	6
Robotics I	30 with honors	6
Reinforcement Learning	30 with honors	6
Robotics II	30 / 30	6
Machine Learning	30 with honors	6
Vision and Perception	30 / 30	6
Autonomous and Mobile Robotics	30 / 30	6
Research Topics in Artificial Intelligence	30 with honors	6
Deep Learning	28 / 30	6
Elective in Robotics (I & II)	30 with honors	12
Intelligent and Hybrid Control	30 with honors	6
Neural Networks	30 / 30	6
Probabilistic Robotics	27 / 30	6

RESEARCH & WORK EXPERIENCE

Dev @ ALMA Project

May 2025 - Current | Sapienza University of Rome

- Digital Education Hub project, devoted to creating digital tools for professors, students and researchers of Sapienza University
- Participation as backend and deployment developer
- Developing a webapp to host remote labs for the usage of robots or physics instrumentation

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Junior Research Fellow

Nov 2024 – Mar 2025 | Sapienza University of Rome

- Conducted research on Deep Reinforcement Learning for continuous control tasks in environments with sparse rewards.
- Developed and evaluated reward shaping and heuristic methods to improve sample efficiency and policy convergence in robotic systems.
- Compared abstraction-based methods to fully model-based methods (trajectory optimization), highlighting advantages and shortcomings of both approaches.
- **Outcomes:** Accepted papers at IAS-19 and RAS; GitHub Repository
- **Tech:** PyTorch, Mujoco, Casadi, Pinocchio

Junior Research Fellow

Jun 2023 – Sep 2023 | Sapienza University of Rome

- Developed a desktop GUI for drone mission planning, enabling operators to define and visualize aerial inspection waypoints on a 2D map.
- GitHub Repository
- **Tech:** Qt6, QML, C++

PUBLICATIONS

- R. Cipollone, M. Favorito, **F. Maiorana**, G. De Giacomo, L. Iocchi **and** F. Patrizi, "Exploiting robot abstractions in episodic rl via reward shaping and heuristics," *Robotics and Autonomous Systems*, **journvol** 193, **page** 105 116, 2025, ISSN: 0921-8890. DOI: https://doi.org/10.1016/j.robot.2025.105116.
- F. Frattolillo, **F. Maiorana**, A. Trapasso **andothers**, *Discrete abstraction for multi-UAV applications with sparse rewards using deep reinforcement learning*, 2025.
- F. Ansalone, **F. Maiorana**, D. Affinita **andothers**, *Real-time multimodal signal processing for hri in robocup: Understanding a human referee*, 2024. arXiv: 2411.17347 [cs.CV]. **url**: https://arxiv.org/abs/2411.17347.

PROJECTS & RESEARCH SOFTWARE

RoboCup SPL "SPQR Team" Member

University Student Project

Jan 2023 – Current

- Individual Contributions:
  - High-level behaviors
  - Whistle detection through CCNN
  - Coordinated development of 2024 Autonomy Challenge
  - Experiments on MPC-based locomotion
- Team Achievements:
  - RoboCup 2023 Bordeaux: 7th place
  - RoboCup 2024 Eindhoven: 5th place
  - RoboCup 2024 Challenge: 3rd place
  - GermanOpen 2025 Nurnberg: 3rd place
  - RoboCup 2025 Salvador: 4th place

Vehicle Control through MPC with cascaded models

Group Project for Autonomous and Mobile Robotics

Feb 2024 - Jun 2024

- Implementation of a planning and control architecture for a racing car based on nonlinear model predictive control, using CasADI and Python.
- GitHub Repository

Hindsight Goal Ranking

Individual Project for Reinforcement Learning

Jul 2024 - Sep 2024

- Implementation of a state-of-the-art paper on RL algorithms for sparse robotics environments, specifically the Fetch environment, where bad sample efficiency can be prohibitive.
- GitHub Repository

Adaptive PD+Feedforward Control for Manipulators

Group Project for Robotics II

Jun 2024 - Sep 2024

- Implementation of a control architecture that is able to control robots under uncertainties about their dynamic model.
- GitHub Repository

Whistle Detection through Continuous Convolutional Neural Networks

Individual Project for Neural Networks

Jan 2024 - Jun 2024

- Implementation of a CCNN in PyTorch for whistle detection
- Trained from scratch on a dataset made of recordings of RoboCup games.
- Used in actual RoboCup games on the Nao v6 platform
- Gave good results, making the difference in RoboCup competitions
- GitHub Repository

Communication Interface for a Nao v6 in the RoboCup Context

Individual Project for Human-Robot Interaction

Apr 2024 - Jul 2024

- Used in actual RoboCup games on the Nao v6 platform
- GitHub Repository

MPC for Stable Humanoid Gait Generation

Individual Project for Underactuated Robotics

May 2024 - Nov 2024

- Implementation of an MPC algorithm for a humanoid gait, specifically intended to be used on the Nao v6 platform, inside the RoboCup Soccer competition.
- Efficient implementation in C++, using ProxQP solver for MPC formulation
- GitHub Repository

ROS2 Crazyflie Swarm

Group Project for Multi-Robot Systems

Sep 2024 - Jan 2025

- Implementation of a ROS2 stack to control a crazyflie swarm with a flocking algorithm
- Successful experiments with real crazyflies at CNR research institute
- GitHub Repository

ROS2 Wrapper for Humanoid Gait Generation via MPC

Individual Project for Robot Programming

May 2025 - May 2025

- ROS2 wrapper for the ISMPC algorithm, representing the humanoid through markers and frames in RVIZ
- GitHub Repository

Planar Monocular SLAM

Individual Project for Probabilistic Robotics

Jun 2025 - Jun 2025

- SLAM pipeline operating on a planar robot with a monocular camera
- GitHub Repository

SKILLS

Python | C++ | MATLAB | SQL | Java | PyTorch | CasADi | ROS / ROS2 | Qt6 | NumPy | SciPy | Mujoco | Reinforcement Learning | Model Predictive Control | Robotics | Control Systems | Algorithms & Data Structures | Git & GitHub | Linux | LaTeX | Docker