

# Miroljub Mihailovic

PhD Student in Robotics and Artificial Intelligence



## Profile

PhD candidate in Robotics and Artificial Intelligence at the University of Padua. My research focuses on learning-based motion planning and perception for lower-limb exoskeletons. This work has involved the development of data-driven models for single-step generation, and it is currently expanding toward multi-step planning frameworks that integrate learning and predictive control. The general goal is to achieve adaptive locomotion that generalizes across users and environments, addressing key challenges such as sim-to-real transfer and user-specific adaptation. While my current research is centred on lower-limb exoskeletons, the underlying methods are also applicable to other robotic systems (e.g., humanoids).

## Education

### PhD in Robotics and AI

*University of Padua — IAS LAB (DEI)*

11/2024–11/2027

Research on AI-driven motion planning and perception for lower-limb exoskeletons, developing learning-based control to enable adaptation to different users and environments safely and naturally.

### M.Sc. in Computer Engineering (AI & Robotics)

*University of Padua*

10/2020–07/2022 - *GPA: 28.6/30*

Focused on Machine Learning, Artificial Intelligence, Deep Learning, Computer Vision, and Robotics. Thesis: Reinforcement Learning in Shared Intelligence Systems for Mobile Robots.

### B.Sc. in Computer Engineering

*University of Padua*

10/2017–09/2020 - *GPA: 26/30*

Solid foundation in computer science, mathematics, and engineering, with focus on programming, algorithms, computer architecture, operating systems, databases, and artificial intelligence.

## Publications

- [1] E. Trombin, M. Mihailovic, M. H. F. Moura, L. Tonin, E. Menegatti, S. Tortora, “Hybrid Kernelized Movement Primitives for Environment-Adaptive Gait Planning in Lower-Limb Exoskeletons”, *IEEE Transactions on Robotics*, In preparation, 2025.

*Abstract — Developed a hybrid control framework for lower-limb exoskeletons integrating vision-based environment perception and kernelized movement primitives (KMPs) for adaptive gait generation. The method learns human gait patterns both in task and joint space, applying real-time linear constraints based on RGB-D perception to ensure smooth, safe, and environment-aware locomotion across multiple terrains (slopes, stairs, obstacles). Validated on a commercial exoskeleton with both simulated and real-world experiments.*

[Not Available Yet]

[2] M. Mihailovic, D. Meli, A. Farinelli, S. Tortora, “Multi-Step Planning via Signal Temporal Logic for Lower-Limb Exoskeletons”, *7th Italian Conference on Robotics and Intelligent Machines*, Rome, 2025.

*Abstract — Developing a modular control framework for adaptive exoskeleton locomotion. The approach integrates robotic vision, neural predictive control, and STL-based planning to produce coordinated multi-step gait trajectories in real time.*

[Preprint]

[3] M. Mihailovic, M. Terreran, S. Ghidoni, A. Pretto, L. Tonin, E. Menegatti, S. Tortora, “Egocentric Vision Module for Adaptive Gait Planning in Lower-Limb Exoskeletons”, *7th Italian Conference on Robotics and Intelligent Machines*, Rome, 2025.

*Abstract — Developing an egocentric vision framework combining exoskeleton-mounted and AR visor cameras to build a unified 3D environment map for adaptive gait planning and real-time obstacle avoidance. The system integrates perception, planning, and augmented reality feedback for safer and more intuitive locomotion.*

[Preprint]

[4] A. Bortotto, G. Degli Agli, N. Pozzato, M. Dignani, F. Favotto, F. Mattiazzi, M. Mihailovic, et al., “Autonomous Docking Manoeuvre Testing in the Framework of the ERMES Experiment”, *Aerotecnica Missili & Spazio (Springer)*, 2025.

*Abstract — This work presents the experimental validation of an autonomous rendezvous and docking framework for CubeSat mock-ups in microgravity. The developed system integrates sensor fusion, relative navigation, and real-time control to execute fully autonomous approach and docking manoeuvres during parabolic flight campaigns. Results demonstrate centimetre-level alignment accuracy and consistent docking reliability in realistic space-like conditions.*

[DOI]

[5] A. Bortotto, G. Degli Agli, F. Favotto, F. Mattiazzi, M. Mihailovic, et al., “ERMES: Experimental Rendezvous in Microgravity Environment Study”, *72nd International Astronautical Congress (IAC)*, Dubai, 2021.

*Abstract — The ERMES project investigates autonomous docking strategies for nanosatellites under microgravity conditions. A hardware-in-the-loop setup was deployed aboard parabolic flights to assess the docking dynamics between active and passive CubeSat mock-ups. The study provides insights into guidance, navigation, and control limitations in low-gravity scenarios and establishes a foundation for future autonomous proximity operations in small satellite missions.*

[Conference Page] [PDF]

## Projects

### ERMES Project — Autonomous Docking Manoeuvre Testing for CubeSats

*European Space Agency “Fly Your Thesis!” Programme, University of Padua*

Research on autonomous rendezvous and docking of CubeSat mock-ups in microgravity. Designed and implemented the Onboard Computer System (OBCS), control architecture, and sensor fusion algorithms for real-time guidance and docking.

### Reinforcement Learning in Shared Intelligence Systems for Mobile Robots

*M.Sc. Thesis, University of Padua, 2022*

Developed an RL policy integrated into a shared teleoperation system. The agent navigates unknown environments with obstacle avoidance. Compared RL to existing rule-based policies for efficiency and safety.

[GitHub] [Thesis PDF]

## Work Experience

### ML Researcher

*Nordest Technology*

Nov 2024 – Present

Development of machine learning models using reinforcement learning and NLP to detect suspicious financial transactions and manage AML alerts.

### Lead Software Engineer in Machine Learning

*Nordest Technology*

Jan 2023 – Nov 2024

Led development of AI modules for AML products Prioritas and Kassandra. Reduced false-positive rates and improved classification accuracy.

### Software Engineer in Machine Learning

*Nordest Technology*

Apr 2022 – Jan 2023

Developed software to optimize the detection of suspicious financial transactions. Applied supervised machine learning to rank and prioritize AML alerts, significantly reducing false positives and improving efficiency in financial crime prevention.

### Research Engineer Intern

*IAS LAB, University of Padua*

Oct 2021 – Jul 2022

Developed RL-based shared intelligence system for teleoperated robots. Implemented reactive obstacle avoidance and adaptive navigation.

## Workshops & Summer Schools

**2025**

### ECMR 2025 — Workshop on Learning and Planning for Intelligent Robots

Presented the short paper “*Multi-Step Planning via Signal Temporal Logic for Lower-Limb Exoskeletons*” at the European Conference on Mobile Robots (ECMR 2025), University of Padua.

**2025**

### Cambridge Summer School on Machine Learning

Attended lectures and research sessions on introduction to probabilistic models, advanced probabilistic modelling, generative models, and causality.

**2025**

### DeepLearn 2025 — 12th International School on Deep Learning

Attended lectures and research sessions on transfer learning, explainability, and hyperbolic deep learning.

## Awards & Scholarships

**2025**

### 3rd Place — Exoplanet Search Machine Learning Challenge

Porto. Trained a deep learning model to detect exoplanets in simulated protoplanetary disk observations.

**2025**

### Cambridge Summer School on Machine Learning

Awarded a merit-based scholarship and a £300 research grant to attend the ELLIS Summer School at the University of Cambridge.

**2022 - 2025**

### Mentee at LeadTheFuture Mentorship

Selected as one of the few Italian students for the national STEM mentorship program (acceptance rate <20%).

**2018**

### NASA Space Apps Challenge, Vicenza

2<sup>nd</sup> Place — awarded €1000 prize for designing a concept of smart robotic suits for autonomous localization.

**2017**

**NASA Space Apps Challenge, Vicenza**

2<sup>nd</sup> Place — optical wireless communication system using visible light (Li-Fi concept).

## Technical Skills

**Programming:** Python, C++, C, MATLAB

**AI/ML Frameworks:** TensorFlow, PyTorch, Keras, scikit-learn

**Robotics:** ROS, ROS-Neuro, OpenCV

**Data Tools:** Pandas, NumPy, Pytest, Flask SQL

**Hardware:** Raspberry Pi, Arduino

**OS:** Ubuntu, Windows

**Version Control:** Git, GitHub

## Languages

Italian (native), English (fluent), Serbian (native)