

Mattia Mantovani

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Summary

Robotics Ph.D. building planning, guidance and control for multi-UAV systems, from theory (IEEE T-RO, RA-L, RSS, ICRA) to real flight on a PX4/ROS 2 drone swarm with onboard Jetson compute. Specialised in sampling-based MPC (MPPI), trajectory optimisation, and multi-robot coverage and exploration under uncertainty with Gaussian Processes; now extending into learned planners (model-based diffusion). Built a full-stack ground control station (FastAPI, React) for swarm field operations. Visiting Ph.D. at Harvard (2025), resulting in an RSS 2026 paper. EU citizen, available from January 2027.

Experience

ARSControl Lab, University of Modena and Reggio Emilia

Reggio Emilia, Italy

Ph.D. Candidate (full-time employment); Research Fellow Jul.–Nov. 2023

Jul. 2023 – Present

- Develop **mullet**, the lab's UAV swarm stack (Holybro X500, Jetson Orin Nano, PX4 + ROS 2): the onboard mission and safety state machine (mullet-core, C++) and the **ground control station** I built (mullet-paddock: FastAPI, TypeScript/React, 3D mission builder over live robot positions) that flies the swarm in OFFBOARD mode in the field.
- Pitched **Skymule**, a lab spin-off project for drone delivery of healthcare supplies; **finalist** in a local startup pitch competition. Skymule now hosts the stack above.
- Designed an **online constrained ergodic coverage controller**: MPPI tracking an explicit potential with constant-memory feedback and a finite-trajectory coverage certificate (IEEE T-RO, under review).
- Leading the onboard implementation of **LiDAR- and visual-inertial odometry** (FAST-LIO, VINS) for safe autonomous flight in forests, where GNSS is unreliable; supervising a student on integration and field tests.
- Co-developed distributed Gaussian-Process coverage control for time-varying processes, cutting datasets by **68%** and onboard computation by **74%** (IEEE T-RO 2025; rebuilt the simulations and figures, contributed to the method).
- Extended it to **federated GP learning**, cutting consensus samples by **70%** (IEEE ICRA 2025).
- Developing **witness-driven ergodic control with model-based diffusion**, a step towards learned planners (paper in preparation).

Revismart, UNIMORE spin-off

Reggio Emilia, Italy

Full-Stack Engineer Intern

Mar. 2026 – Sep. 2026

- Built the usage-analytics backend and internal user-management tools (**FastAPI**, **Supabase**/PostgreSQL) behind the founders' product decisions.

REACT Lab, Harvard University

Cambridge, MA, USA

Visiting Ph.D. Student

Jun. 2025 – Dec. 2025

- Built **motion-uncertainty-aware next-best-view planning** for 3D reconstruction of a moving object, using Gaussian-Process trajectory prediction; published at **RSS 2026**.
- Produced a follow-up paper (IEEE ICRA 2027, under review) and started the ergodic coverage work now under review at IEEE T-RO.

Project RED, University Rover Team

Reggio Emilia, Italy

Robotics Division Leader

Jun. 2022 – Oct. 2023

- Led a **12-person division** building the rover's ROS autonomy (navigation, localisation, arm and drill control) for the European Rover Challenge; **Best Remote Navigation Award**.

Education

Ph.D. in Industrial Innovation Engineering

Nov. 2023 – Mar. 2027 (defence)

University of Modena and Reggio Emilia, Italy

Thesis submitted Dec. 2026

Thesis: *Covering the Unknown: From Static Deployment to Persistent Ergodic Coverage*

M.Sc. in Mechatronics Engineering, 110/110 cum laude

Oct. 2021 – Jul. 2023

University of Modena and Reggio Emilia, Italy

B.Sc. in Mechatronics Engineering

Oct. 2018 – Oct. 2021

University of Modena and Reggio Emilia, Italy

Selected Publications

- K. Li, **M. Mantovani**, R. Wood, L. Sabattini, S. Gil, “Motion-Uncertainty-Aware Next-Best-View Planning for Moving Object Reconstruction,” *Robotics: Science and Systems (RSS)*, 2026. [link]
- **M. Mantovani**, M. Catellani, L. Sabattini, “Distributed Multi-Robot Ergodic Coverage Control for Estimating Time-Varying Spatial Processes,” *IEEE Robotics and Automation Letters*, vol. 11, no. 4, 2026. [link]
- M. Gabbi, M. Catellani, **M. Mantovani**, L. Sabattini, “From Active Search to Persistent Monitoring: A Blended Ergodic-Voronoi Control Strategy,” *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, 2026.
- F. Pratissoli, **M. Mantovani**, A. Prorok, L. Sabattini, “Distributed Coverage Control for Time-Varying Spatial Processes,” *IEEE Transactions on Robotics*, vol. 41, 2025. [link]
- **M. Mantovani**, F. Pratissoli, L. Sabattini, “Online Multi-Robot Federated Learning for Distributed Coverage Control of Unknown Spatial Processes,” *IEEE ICRA*, 2025. [link]
- **M. Mantovani**, F. Pratissoli, L. Sabattini, “Distributed Coverage Control for Spatial Processes Estimation With Noisy Observations,” *IEEE Robotics and Automation Letters*, vol. 9, no. 5, 2024. [link]

Under review

- **M. Mantovani**, M. Catellani, L. Sabattini, “Online Constrained Ergodic Coverage with Constant-Memory Potential Feedback,” *IEEE Transactions on Robotics*.
- K. Li, **M. Mantovani**, R. J. Wood, L. Sabattini, S. Gil, “Sensing-Aware Next-Best-View Planning Under Range Risk for Moving Object Reconstruction,” *IEEE ICRA*, 2027.
- C. Cartella, **M. Mantovani**, M. Catellani, L. Sabattini, “Decentralized Topological Map Merging for Autonomous Multi-Robot Exploration of Unknown Environments,” *IEEE Robotics and Automation Letters*.
- M. Gabbi, M. Catellani, **M. Mantovani**, L. Sabattini, “Merging Global Exploration and Local Coverage: a Multi-Fidelity Air-Ground Framework for Environmental Monitoring,” *IEEE Robotics and Automation Letters*.

Technical Skills

- **Planning & control:** MPC, MPPI and sampling-based control, trajectory optimisation, ergodic and Voronoi coverage control, next-best-view planning
- **Estimation:** Gaussian Processes, Kalman filtering, LiDAR- and visual-inertial odometry (FAST-LIO, VINS)
- **Learning:** PyTorch, JAX; diffusion models and flow matching for planning; federated learning
- **Software:** C++, Python, C (STM32); ROS 2, PX4, ArduPilot; FastAPI, TypeScript/React; Linux, Git, Docker
- **Hardware & simulation:** Holybro X500, Pixhawk, NVIDIA Jetson Orin Nano; PX4 SITL and HITL (multirotor and VTOL)

Certifications & Languages

- **Drone pilot certifications (Italy/EU):** A1/A3, BVLOS, Swarm operations
- **Languages:** Italian (native), English (C1, university certificate covering all four skills)