Martina Lippi

Researcher (RTD-A) in Robotics and Automatic Controls
Department of Civil, Computer Science and Aeronautical Technologies Engineering, Roma Tre University
Via della Vasca Navale 79, Rome, Italy
martina.lippi@uniroma3.it
m-lippi.github.io
www.linkedin.com/in/martina-lippi/en

Table of contents

1. EMPLOYMENT

Researcher (RTD-A) June 2022 - Present
Roma Tre University, Rome (RM), Italy

- **Activities:** Design, development, and validation of strategies for the distributed control of multi-agent systems, possibly interacting with human operators, in precision agriculture contexts. The activities also include participation in the H2020 European project CANOPIES.

Postdoctoral Fellow Nov. 2020 - May 2022
Roma Tre University, Rome (RM), Italy

- **Activities:** Design, development, and validation of strategies for the distributed control and optimization of multi-agent systems in precision agriculture contexts. The activities also included participation in the H2020 European projects PANTHEON and CANOPIES.

PhD Student Nov. 2017 - Oct. 2020
University of Salerno, Fisciano (SA), Italy

- **Activity:** Design, development, and experimental validation of methodologies for the distributed control of multi-robot systems that can interact with human operators.

Research Fellow May 2017 - Oct. 2017
University of Salerno, Fisciano (SA), Italy

- **Activity:** Design and development of control algorithms for the decentralized control of cooperative manipulators and testing on a work-cell composed of 2 Comau SmartSix arms.

Intern in Artificial Vision Aug. 2014 - Oct. 2014
A.I. Tech s.r.l, Fisciano (SA), Italy

- **Activity:** Design and development of an application for people counting based on video analysis techniques.

2. EDUCATION ACTIVITIES

2.1. EDUCATION

PhD Degree in Information Engineering Nov. 2017 - Oct. 2020
University of Salerno, Fisciano (SA), Italy

- **Final mark:** Excellent
- **Research topics:** The research activity concerned the distributed control of multi-robot systems that may operate in the presence and/or collaboration of human operators; it was under the supervision of Prof. Alessandro Marino and Prof. Pasquale Chiacchio.
- **Exams:** Academic writing and publishing, patents and startups, funding and management of research projects, English, natural computing, numerical signal processing, industrial information systems.

Master's Degree in Computer Engineering Jan. 2015 - Feb. 2017
University of Salerno, Fisciano (SA), Italy

- **Final Mark:** 110/110 cum laude
- **Thesis:** *Decentralized control of cooperative mobile manipulators: synthesis and experiments*, Supervisors: Prof. Alessandro Marino, Prof. Pasquale Chiacchio.

Bachelor's Degree in Computer Engineering Oct. 2011 - Dec. 2014
University of Salerno, Fisciano (SA), Italy

- **Final Mark:** 110/110 cum laude
- **Thesis:** *Design, implementation, and performance comparison of three algorithms based on artificial vision for people counting*, Supervisors: Prof. Mario Vento, Assoc. Prof. Alessia Saggese.

2.2. VISITING

Visiting PhD Student in Information Engineering Feb. 2020 - Mar. 2020
University of Cassino and Southern Lazio, Cassino (FR), Italy

- **Research topics:** The research activity focused on recognizing and classifying forces that a manipulator exchanges with the environment and on reacting accordingly for human-interaction scenarios.

Visiting PhD Student in Information Engineering Apr. 2019 - Dec. 2019
KTH Royal Institute of Technology, Stockholm, Sweden

- **Research topics:** The research activity focused on multi-manipulator systems aimed at co-manipulating deformable objects; it was under the supervision of Prof. Danica Kragic and included the collaboration with the group led by Prof. Carme Torras at UPC Universitat Politècnica de Catalunya, Spain.

2.3. SUMMER SCHOOLS/COURSES

Grenoble Summer School on Data and Learning for Control organized by GIPSA-lab Sept. 2021
GIPSA-lab, Grenoble, France (online course)

- **Topics:** Different methodologies for data-driven control were presented.

Model Predictive Control Course organized by IMT Lucca Jun. 2020
School for Advanced Studies Lucca, Lucca, Italy (online course)

- **Topics:** General concepts of Model Predictive Control were introduced as well as linear time-varying, nonlinear, hybrid, stochastic, and data-driven cases were addressed.

PhD Summer School organized by IEEE Robotics and Automation Society Jul. 2019
Czech Technical University, Prague, Czech Republic

- **Topics:** Multi-robot systems were analyzed from different point of views: from the control perspective to the planning part up to the learning one. Experimental activity on a setup composed of three aerial vehicles has also been carried out.

PhD Summer School organized by the Italian Association of Professors and Researchers in Automation (SIDRA) Jul. 2018
Ce. U. B, Bertinoro (FC), Italy

- **Topics:** Two modules were attended, which are “Adaptive Control: analysis and design methods” coordinated by Prof. Andrea Serrani and “Optimization Methods for Decision Making over Networks”, coordinated by Prof. Giuseppe Notarstefano and Prof. Maria Prandini. The final test for the certification of credits has been passed.

3. TEACHING ACTIVITIES

3.1. TEACHING

Teacher for the course “Robotics” (7 CFU) Oct. 2023 - Jan. 2024
Roma Tre University, Rome (RM), Italy

- **Activity:** Teaching in the field of industrial robotics to the students enrolled in the second year of the Master’s Degree of Automation Engineering (class of about 10 students).

Teacher for the course “Robotics” (7 CFU) Sept. 2022 - Jan. 2023
Roma Tre University, Rome (RM), Italy

- **Activity:** Teaching in the field of industrial robotics to the students enrolled in the second year of the Master’s Degree of Automation Engineering (class of about 10 students).

Teacher for the course “Complements of Automatic Controls” (3 CFU) Sept. 2020 - Dec. 2020
Roma Tre University, Rome (RM), Italy

- **Activity:** teaching in the field of Automatic Controls to the students enrolled in the second year of the Master’s Degree of Mechanical Engineering (class of about 20 students).

Academic tutor for the course “Fundamentals of Automatic Controls” Mar. 2018 - Jun. 2018
University of Salerno, Fisciano (SA), Italy

- **Activity:** didactic support in the field of Automatic Controls to the students enrolled in the second year of the Bachelor’s Degree of Computer Engineering (class of about 100 students); the activity included the preparation of exercises and 1 weekly lesson of 3 hours each.

Academic tutor for the course “Fundamentals of Programming ” Oct. 2016 - Gen. 2017
University of Salerno, Fisciano (SA), Italy

- **Activity:** didactic support in the field of Computer Science to the students enrolled in the first year of the Bachelor’s Degree of Electronic Engineering (class of about 35 students); the activity included the preparation of exercises and 2 weekly lessons of 2 hours each.

3.2. STUDENT SUPERVISION ACTIVITIES

- The following Master’s students have been co-supervised: Andrea Miele (Roma Tre University), Cecilia Palmieri (Roma Tre University), Giulia Maffucci (Roma Tre University), Francesca Patriarca (University of Cassino and Southern Lazio), Ines Sorrentino (University of Salerno), Paolo Vigilante (University of Salerno).
- The following Bachelor’s students have been co-supervised: Andrea Ferrari (Roma Tre University), Niccolò Bonucci (Roma Tre University), Davide Portunato (Roma Tre University).

3.3. INSTITUTIONAL RESPONSIBILITIES

Member of the Department Council of Civil, Computer Science and Aeronautical Technologies Engineering June. 2022 - Present
Roma Tre University, Rome (RM), Italy

Member of the Computer Science Engineering Teaching Committee June. 2022 - Present

Roma Tre University, Rome (RM), Italy

4. RESEARCH ACTIVITIES

4.1. RESEACH TOPICS

The research activity mainly concerns the following topics:

A. **Coordination and estimation in multi-agent systems.**

Systems composed of multiple interconnected agents or robots, which coordinate autonomously to pursue a common goal, represent an effective solution in a variety of application contexts, such as logistics settings, monitoring sectors, hostile environments for people, and agricultural settings. In particular, compared to single-agent scenarios, the use of multiple collaborative robotic platforms generally improves the system efficiency, robustness, and scalability. These advantages are further amplified in distributed architectures, where no central control unit exists coordinating the robots and each robot only relies on information from local sensors and neighboring robots. In this regard, in [J9],[C23], [C26], a distributed strategy for coordinating a system composed of *multiple industrial* manipulators has been proposed, assuming a desired global task trajectory. More specifically, a two-layer architecture has been designed for each robot where, at the top layer, the state of the overall system (comprising the robots for which there is no direct communication) is estimated and, then, this is exploited at the bottom layer to define the local control law to track the desired task trajectory. Further actions for managing the human multi-robot interaction have also been addressed as discussed in point B.. In addition, the control of internal stresses that may arise in the case of tight connection between the industrial robots has been included in [J8],[C23], while the possibility of fault occurrence has been considered in [Ch1] and [C24], where a distributed fault detection and isolation strategy based on an observer-controller scheme has been proposed.

An additional crucial aspect for successfully coordinating multiple robots is determining how to assign multiple tasks to them. In this regard, a multi-Steiner Traveling Salesman Problem (TSP) has been proposed in [J5] to compute the optimal task assignment for mobile robots as well as the respective optimal paths to be followed. The optimality criterion aims to minimize the total time required to execute all the tasks, as well as the cumulative execution times of the robots. Costs for traveling from one location to another, for maneuvering and for executing the task as well as limited energy capacity of the robots have been considered. A scenario involving multiple heterogeneous agents including human operators has been considered in [C7],[C20] where a solution is proposed which combines an optimal offline allocation with an online reallocation strategy that accounts for inaccuracies of the offline plan and/or unforeseen events, human subjective preferences and cost of task switching. This has been extended in [C8], [C10] to agricultural settings.

Finally, a common problem in multi-agent systems is how to estimate quantities of interest based on a local knowledge of the system. In this regard, the problem of distributively tracking the minimum infimum (or maximum supremum) of a set of time-varying signals in finite-time has been addressed in [J2], [J7], [C5],[C14]. In this scenario, each agent has access to a local time-varying exogenous signal, and all the agents are required to follow the minimum infimum (or the maximum supremum) of these signals in a distributed fashion. The proposed protocols allow to provably solve the above problem in finite-time for multi-agent systems with undirected connected network topologies ([J7],[C14]) or directed strongly connected topologies ([J2], [C5]).

B. **Human-robot interaction (HRI).**

The benefits of having humans and robots interacting for the execution of complex tasks lay in the possibility of achieving flexible and highly reconfigurable production systems.

Indeed, complementary capabilities characterize human and robot entities: reasoning and manipulation skills for the human component, strength and endurance capabilities for the robotic one. The different abilities make humans and robots better suited to different sets of tasks, e.g., the former are more apt to handle objects of small size or with particular shapes and/or materials, while the latter are more appropriate for manipulating heavy objects with regular shapes or for performing repetitive tasks. In this context, different types of interaction exist that can be mainly classified into two categories: sharing of the same workspace and physical human-robot collaboration. More specifically, in the case of workspace sharing, the control strategy is supposed to ensure human avoidance at all times in order to prevent unsafe contact. In this regard, a human multi-robot scenario has been considered and a trajectory scaling approach has been proposed [J3][J9][C19][C25][C26] in which the human safety is assessed by a safety field that takes into account the whole multi-robot system as a source of danger to the human operator and the cooperative task trajectory is then modified to ensure a safe interaction while trying to preserve as much as possible the nominal path. In addition, the devised strategy has been implemented in a decentralized fashion and validated on a real-world experimental setup.
The human multi-robot physical collaboration has also been investigated [J8][C23] in which multiple manipulators are tightly connected to a common rigid object and the human can physically interact with it. In detail, a two-layer solution has been devised in [J8] and [C23] where, at the top layer, a virtual dynamic model for the object is defined for a shared control task and an assistance task, respectively, whereas, at the bottom layer, the virtual dynamic model is actually imposed to the object in a decentralized fashion by keeping into account possible internal wrenches that may arise.
In the context of physical human-robot collaboration, the problem of distinguishing accidental and intentional contacts between humans and robots in a co-existence scenario has been addressed [C17][C22]. In particular, a solution based on Recurrent Neural Networks (RNNs) and Gaussian Mixture Models (GMMs) has been proposed to detect and classify the nature of the contact with the human, even in the case the robot is interacting with the environment because of its own task. Then, reaction strategies based on Control Barrier Functions (CBFs) have been devised.

Finally, a further crucial aspect in HRI is how to optimally distribute tasks between robotic and human counterparts. In this regard, as mentioned in point A., the framework proposed in [C7],[C20] takes into account the fact that each agent, either human or robotic, can be differently skilled at a given task. Multiple manipulators can tightly collaborate if required to carry out a task, while human operators can either directly execute tasks or play a supervisory role, allowing to guarantee a minimum task execution accuracy. Indeed, the supervisory role can be useful, for example, in case where the robotic component is not fully capable at a task and the person monitors its activity to prevent errors from occurring. A Mixed-Integer Linear Programming (MILP) problem has been formulated aiming at minimizing the overall execution time while optimizing the quality of the executed tasks as well as the human and robotic workload.

C. **Agricultural robotics.**

Continuous plant-by-plant monitoring and targeted interventions are key features of the Precision Agriculture (PA) paradigm, that potentially enable increased crop productivity while reducing waste. Deploying mobile robots in the field, which autonomously navigate among plants and carry out agricultural tasks, provides an effective solution to realize PA paradigm in large-scale fields. Different agricultural applications have been explored. More specifically, in [J4] a fully autonomous sucker management architecture is proposed which is able to *i)* detect the presence of suckers for each plant, by relying on a You Only Look Once (YOLO)-based recognition system, *ii)* reconstruct them in three-dimension and estimate the amount of herbicide solution needed for the specific plant, based on a data-driven approach, and *iii)* apply the herbicide solution using a ground robot equipped with a spraying system. This approach allows to significantly reduce pollution and waste. Experimental results in a real-world (1:1 scale) hazelnut orchard located in Caprarola, Italy, corroborated the proposed architecture. In [C15] and [C18], the autonomous early detection of pests, in particular of true bugs and gall-mites, respectively, is considered. To this aim, custom datasets in real outdoor environments have been collected, publicly released, and used to train YOLO-based Convolutional Neural Network (CNN). The influence of data augmentation techniques and of depth information has been deeply investigated as well. Furthermore, since instant-by-instant detection techniques may be unreliable in variable and poorly structured contexts, such as for most precision agriculture settings, a framework for tracking objects of interest over time using a mobile robotic platform equipped with RGB-D camera has been proposed in [C6] and [C11]. More in detail, an Extended Kalman Filter (EKF) is used which takes into account the motion of the robot to update the estimate of the localization of the objects. The approach has been validated in a realistic Unity-based simulator, where a mobile robot is tasked with tracking table-grape bunches within a vineyard environment.

Finally, the possibility of deploying *multiple*, possibly heterogeneous, robots in the agricultural field has been investigated in [J5], [C8], and [C10], as mentioned in point A..

D. **Deformable object manipulation.**

Deformable object manipulation is a key component of a variety of applications, ranging from domestic housework to medical or agricultural scenarios up to industrial setups. However, the large configuration space of deformable objects generally causes traditional modeling, planning, and control approaches to fail when dealing with them. More specifically, unlike the case of rigid objects, two main challenges arise: i) there is no clear and unified state representation and ii) their dynamic model is complex and highly non-linear. To address these challenges, a planning strategy from raw image data has been proposed in [J6],[C13],[C21]. This enables the generation of both visual plans (i.e., sequences of images) and action plans (i.e., sequences of actions to transition between images). In particular, the proposed method is based on generating a structured low-dimensional latent space, that embeds images, and building a graph, called Latent Space Roadmap, in this space to capture the latent system dynamics. Then, this graph is used to generate plans given start and goal images. The effectiveness of the method has been validated on several simulated tasks, such as a box stacking task and a shelf arrangement task, as well as on a T-shirt folding task performed with a real robot. The proposed framework has been extended in [C12] to tackle cases of data scarcity, in [C3] to improve the system robustness by resorting to an ensemble paradigm and in [C1] to handle multiple heterogeneous agents.

In addition, the possibility of endowing robots with tactile capabilities has been explored in [C2],[C9] to manipulate possibly soft and fragile objects, such as fruits in agricultural scenarios. More in detail, low-cost vision-based tactile sensors have been considered and a manipulation algorithm has been designed to adapt to both rigid and soft objects without requiring any knowledge of their properties. The approach has been validated on seven different objects, with different properties in terms of rigidity and fragility, to perform unplugging and lifting tasks.

Finally, to promote the comparison among different solutions, three benchmarks [J10] have been proposed for three basic tasks in bimanual cloth manipulation: spreading a tablecloth over a table, folding a towel, and dressing. Different complexity levels have been included for each task and baseline solutions for all the tasks have been defined and evaluated according to the proposed metrics.

Experimental activity
The methodological research activities have been supported by the following experimental activities on **different industrial and collaborative manipulators and mobile bases**:

- test of autonomous navigation algorithms in a table-grape vineyard using a Alitrak-DCT350P tracked vehicle;
- test of coordinated maneuvering algorithms in a table-grape vineyard using two Alitrak-DCT350P tracked vehicles;
- test of data-driven strategies for the recognition of the contact type in human-robot interaction scenarios using a Kinova Jaco2 arm [C17][C22];
- test of algorithms for an assisted dressing task with two Franka Emika Panda [J10] robots;
- test of algorithms for T-shirt folding with a dual-arm Baxter robot [C21] and use of Pytorch library for machine learning algorithms;
- test of distributed control algorithms with two Comau Smart Six manipulators [J9] equipped with C4G controllers and based on Real-Time Linux/OROCOS programming environment;
- test of distributed control algorithms with multiple mobile MOVO manipulators in Matlab/V-REP programming [C23][C24] environment as well as on real platform [Ch1]
- test of algorithms for motion planning and human-robot interaction with a UR10 manipulator equipped with RGB-D vision system and based on Linux/ROS programming environment;
- test of variable admittance control algorithms with a Comau Smart Six manipulator equipped with wrist force sensor and based on Real-Time Linux/OROCOS programming environment.

4.2. SCIENTIFIC COLLABORATIONS

Research group at KTH Royal Institute of Technology, Sweden Apr. 2019 - Present

- **People involved:** Prof. Danica Kragic, Dr. Michael C. Welle, Dr. Anastasia Varava, Dr. Petra Poklukar.
- **Topics:** Multi-arm manipulation, deformable object manipulation and visual planning.
- **Results:** Publication of 2 journal papers, 5 conference papers, and 2 workshop papers. Organization of 4 workshops at top international conferences.

Research group at Universitat Politècnica de Catalunya, Spain Apr. 2019 - May 2021

- **People involved:** Prof. Carme Torras, Dr. Júlia Borràs Sol, Dr. Guillem Alenya, Irene Garcia-Camacho.
- **Topics:** Deformable object manipulation and benchmarking.
- **Results:** Publication of one journal paper and organization of one workshop at a top international conference.

Research group at Rice University, USA Sept. 2021 - May 2023

- **People involved:** Prof. Lydia E. Kavraki, Asst. Prof. Constantinos Chamzas (currently at Worcester Polytechnic Institute)
- **Topics:** Visual planning and representation learning.
- **Results:** Publication of one conference paper.

Research group at University of Southern California, USA Sept. 2021 - Present

- **People involved:** Asst. Prof. Daniel Seita
- **Topics:** Representation and manipulation of deformable objects
- **Results:** Organization of 2 workshops at top international conferences.

Research group at University of Cassino and Southern Lazio, Italy 2018 - Present

- **People involved:** Assoc. Prof. Alessandro Marino, Prof. Filippo Arrichiello, Dr. Paolo di Lillo, Dr. Giuseppe Gillini
- **Topics:** Multi-robot coordination, human-robot interaction, fault detection
- **Results:** Publication of 7 journal papers, one chapter, 17 conference papers, and 3 workshop papers. Organization of 2 workshops and 2 special sessions at top international conferences.

Research group at University of Cagliari, Italy 2021 - Present

- **People involved:** Assoc. Prof. Mauro Franceschelli, Asst. Prof. Mojtaba Kaheni (now at Mälardalen University)
- **Topics:** Multi-agent optimization, federated learning.
- **Results:** Publication of one journal paper.

Research group at University of Tuscia, Italy 2021 - Present

- **People involved:** Assoc. Prof. Valerio Cristofori, Dr. Mario Contarini, Assoc. Prof. Stefano Speranza
- **Topics:** Autonomous sucker management and early pest detection
- **Results:** Publication of one journal paper and two conference papers.

4.3. AWARDS AND RECOGNITIONS

Finalist for the prize "Most promising researcher in robotics and artificial intelligence" promoted by Fondazione Mondo Digitale Mar. 2024

- **URL:** https://romecup.org/research-award-2024/
- **Project:** Development of human-multi-robot interaction strategies for precision agriculture settings

Finalist of the Best Student Paper Award Oct. 2019

- **Conference:** IEEE International Conference on Systems, Man, and Cybernetics (SMC)
- **Paper:** "Distributed Fault Detection and Isolation for Cooperative Mobile Manipulators"

5. ACADEMIC SERVICE

5.1. WORKSHOP AND SPECIAL SESSION ORGANIZATION

The following **workshops at national and international** conferences have been organized:

- "Empowering Human-Robot Collaboration: Shared Autonomy, System Transparency, and Trustworthiness", co-organized with M. Faroni, A. Marino, A. Umbrico at *IEEE International Conference on Automation Science and Engineering (CASE)*, 2024, https://shared-autonomy-ws.github.io/case2024/;
- "4th Workshop on Representing and Manipulating Deformable Objects", co-organized with M. C. Welle, D. Seita, F. Zhang at *IEEE International Conference on Robotics and Automation (ICRA)*, 2024, https://deformable-workshop.github.io/icra2024/;
- "3rd Workshop on Representing and Manipulating Deformable Objects", co-organized with M. C. Welle, D. Seita, F. Zhang at *IEEE International Conference on Robotics and Automation (ICRA)*, 2023, https://deformable-workshop.github.io/icra2023/;
- "Human-robot collaboration: needs, challenges and directions in different application domains", main organizer and co-organized with A. Marino at *Italian Conference on Robotics and Intelligent Machines (I-RIM)*, 2022, https://m-lippi.github.io/irim-2022-hrc/;
- "2nd Workshop on Representing and Manipulating Deformable Objects", main organizer and co-organized with M. C. Welle, D. Seita at *IEEE International Conference on Robotics and Automation (ICRA)*, 2022, https://deformable-workshop.github.io/icra2022/;
- "Representing and Manipulating Deformable Objects", main organizer and co-organized with A. Varava, M. C. Welle at *IEEE International Conference on Robotics and Automation (ICRA)*, 2021, https://deformable-workshop.github.io/icra2021/;
- "Control, Robotics, Sensing and Artificial Intelligence for Precision Agriculture", co-organized with A. Gasparri, D. Nardi at *IEEE Mediterranean Conference on Control and Automation (MED)*, 2021.

The following **special sessions** have been organized:

- "Learning methods in modeling and control of robotic systems" at the 9th International Conference on Control, Decision and Information Technologies (CODIT), https://codit2023.com/Special-Sessions/Special-Session-13.pdf, held in Rome, Italy in July 2023;
- "Multi-Robot Systems Interacting with Humans" at the IEEE International Conference on Systems, Man, and Cybernetics (SMC), held in Bari, Italy in October 2019.

5.2. INVITED TALKS

The following **invited talks** have been made:

- "Farming, Automation, and Robotics: where are we, where we want to go – The vision of an Engineer" at BrIAS Forum on Robotics in Agriculture, held in Bruxelles in February 2024 (https://brias.be/en/brias-forum-on-robotics-in-agriculture-where-we-are-where-we-are-going)
- "Towards human-robot collaboration paradigm in precision agriculture settings" at the Italian Conference on Robotics and Intelligent Machines (I-RIM), Workshop on Artificial Intelligence and Robotics for Precision Agriculture, held in Rome in October 2023 (http://www.agrorama.it/airap.html)
- "Task allocation in human multi-robot settings" at the IEEE International Conference on Robotics and Automation (ICRA) 3rd Annual Workshop on Robot Teammates in Dynamic Unstructured Environments (RT-DUNE), London, United Kingdom, in June 2023 (http://rtdune.com/)
- "Human Multi-Robot Teams: From Safety to Task Allocation" at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Workshop Human-Multi-Robot Systems: Challenges for Real World Applications, Kyoto, Japan, in October 2022 (https://sites.google.com/view/hmrs-iros2022)
- "Il Ruolo dei Robot nell'Agricoltura di Precisione" for the European Researchers' Night at Roma Tre University, in September 2022
- "Human multi-robot interaction: from safety to task allocation" at the National Research Council, Institute of Cognitive Sciences and Technologies (ISTC-CNR), virtually held, in February 2022
- "La Robotica nell'Agricoltura di Precisione" for the European Researchers' Night at Roma Tre University and Tuscia University, virtually held, in September 2021
- "Visual Planning for Human-Robot Interaction", at the Italian Conference on Robotics and Intelligent Machines (I-RIM), Workshop on Task and Motion Planning for Effective Human-Robot Collaboration, virtually held, in December 2020;
- "Multi-robot distributed control" at KTH Royal Institute of Technology, RPL Department, in May 2019

5.3. MEMBERSHIP OF SCIENTIFIC SOCIETIES/PROGRAM COMMITTEES

- Co-chair of the Working Group on Human-Robot Interaction of the Robotics and Intelligent Machines Institute (I-RIM), 2022 - Present
- IEEE Member, 2022 - Present
- Member of the Program Committee for the Italian conference *Conference on Robotics and Intelligent Machines (I-RIM)* (https://i-rim.it/en/conference-i-rim-2022/), 2022
- Member of the National Program Committee for the international conference *Workshop on Discrete Event Systems (WODES)* (http://wodes2018.unisa.it/committees.php), 2018
- Member of the Workshop Program Committee for the *Workshop on Agricultural Robotics and Automation* (https://sites.google.com/view/icra22agriws/programme-committee?authuser=0) at the IEEE International Conference on Robotics and Automation (ICRA), 2022

- Member of the Workshop Program Committee for the research Workshop *Towards the factory of the future: advancements in planning and control of industrial robots* (https://2022.ieee-etfa.org/static/files/ws_cfps/WS08_FactoryofFuture.3c4176567f30.pdf) at the IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), 2021

5.4. PARTICIPATION TO CONFERENCES

The following international conferences have been attended as **speaker**:

- *IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, in May 2024;*
- *IEEE International Conference on Robotics and Automation (ICRA), London, United Kingdom, in May-June 2023;*
- *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Kyoto, Japan, in October 2022;
- *IFAC Conference AGRICONTROL*, virtually held, in September 2022;
- *IEEE International Conference on Decision and Control (CDC)*, virtually held, in December 2021;
- *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, virtually held, in August 2021;
- *IEEE Mediterranean Conference on Control and Automation (MED)*, virtually held, in June 2021 (also chair of the session "Artificial Intelligence");
- *IEEE International Conference on Robotics and Automation (ICRA)*, virtually held, in June 2021 (also co-chair of the session "Human-Robot Interaction: Detection");
- *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, virtually held, in August-September 2020;
- *Robotics: Science and Systems (RSS)*, virtually held, in July 2020;
- *IFAC Symposium on Robot Control (SYROCO)*, held in Budapest, Hungary in August 2018;
- *IEEE Mediterranean Conference on Control and Automation (MED)*, held in Zara, Croatia in June 2018.

6. PARTICIPATION TO RESEARCH PROJECTS

H2020 European Project CANOPIES Jan. 2021 - Present

- **Role:** Leader of Work Package 7 "Multi-robot coordination"
- **Project objective:** development of a novel collaborative paradigm for human workers and multi-robot teams in precision agriculture systems with validation on a table-grape vineyard
- **Activities:** The personal contribution to the project is mainly related to the design, development, and validation of coordination strategies for multi-robot teams and for their interaction with human operators as well as to the design, development, and validation of autonomous navigation algorithms for tracked vehicles; moreover, dissemination and communication activities have been carried out.

H2020 European Project PANTHEON Nov. 2020 - Oct. 2021

- **Role:** Member
- **Project objective:** Development of the agricultural equivalent of an industrial Supervisory Control And Data Acquisition (SCADA) system to be used for the precision farming of large orchards of hazelnut
- **Activities:** The personal contribution to the project is mainly related to the design, development, and validation of strategies for the autonomous management of suckers and

for the early detection of pest infestations; moreover, dissemination and communication activities have been carried out.

7. PUBLICATIONS

In the following papers, the first author denotes the person who contributed the most to the work except for the cases where there is shared co-first authorship (marked with *). In these cases, the shared co-first authors have contributed equally and are listed in alphabetical order.

7.1. THESES

[T1] **M. Lippi,** "Human multi-robot interaction: from workspace sharing to physical collaboration", *PhD Thesis*, University of Salerno, 2020

[T2] **M. Lippi,** "Decentralized control of cooperative mobile manipulators: synthesis and experiments", *Master's Thesis*, University of Salerno, 2017

7.2. JOURNALS

[J1] M. Kaheni*, **M. Lippi***, A. Gasparri, M. Franceschelli, "Selective Trimmed Average: A Resilient Federated Learning Algorithm With Deterministic Guarantees on the Optimality Approximation," *IEEE Transactions on Cybernetics*, 2024 (IF in 2022: 11.8, not available for 2024 yet)

[J2] A. Furchì, **M. Lippi**, A. Marino, A. Gasparri,"A distributed protocol for finite-time supremum or infimum dynamic consensus: The directed graph case," *Systems & Control Letters,* vol. 186, 2024 (IF in 2022: 2.6, not available for 2024 yet)

[J3] J. Palmieri, P. Di Lillo, **M. Lippi**, S. Chiaverini, A. Marino, "A Control Architecture for Safe Trajectory Generation in Human-Robot Collaborative Settings," *IEEE Transactions on Automation Science and Engineering*, 2024 (IF in 2022: 5.6, not available for 2024 yet)

[J4] **M. Lippi***, M. Santilli*, R. F. Carpio*, J. Maiolini*, E. Garone, V. Cristofori, A. Gasparri, "An Autonomous Sucker Management Architecture for Large-scale Hazelnut Orchards ," *Journal of Field Robotics*, 2023 (IF in 2022: 8.3, not available for 2023 yet)

[J5] A. Furchì, **M. Lippi**, R. F. Carpio, A. Gasparri, "Route Optimization in Precision Agriculture Settings: A Multi-Steiner TSP Formulation," *IEEE Transactions on Automation Science and Engineering*, 2022 (IF in 2022: 5.6)

[J6] **M. Lippi***, P. Poklukar*, M. C. Welle*, A. Varava, H. Yin, A. Marino, D. Kragic, "Enabling Visual Action Planning for Object Manipulation through Latent Space Roadmap," *IEEE Transactions on Robotics*, vol. 39 (1), pp. 57-75, 2022 (IF in 2022: 7.8)

[J7] **M. Lippi**, A. Furchì, A. Marino, A. Gasparri, "An Adaptive Distributed Protocol for Finite-time Infimum or Supremum Dynamic Consensus", *IEEE Control Systems Letters (L-CSS) and IEEE Conference on Decision and Control (CDC)*, 2022 (IF in 2022: 3.10)

[J8] **M. Lippi**, A. Marino, "Human Multi-Robot Physical Interaction: A Distributed Framework," *Journal of Intelligent and Robotic Systems*, vol. 101(2), pp. 1-20, 2021 (IF in 2021: 3.129)

[J9] **M. Lippi**, A. Marino, "Human Multi-Robot Safe Interaction: A Trajectory Scaling Approach Based On Safety Assessment," *IEEE Transactions on Control Systems Technology*, pp. 1-16, 2020 (IF in 2020: 5.485)

*Contributed equally, listed in alphabetical order

[J10] I. Garcia-Camacho*, **M. Lippi***, M. C. Welle, H. Yin, R. Antonova, A. Varava, J. Borras, C. Torras, A. Marino, G. Alenyà, D. Kragic, "Benchmarking Bimanual Cloth Manipulation", *Robotics and Automation Letters*, 2020 (IF in 2020: 5.49)

7.3. CHAPTER

[Ch1] G. Gillini, **M. Lippi**, F. Arrichiello, A. Marino, F. Pierri,"Distributed Fault Detection and Isolation Strategy for a Team of Cooperative Mobile Manipulators", *IET BOOK: Fault Diagnosis and Fault-tolerant Control of Robotic Systems*, Chap. 7, pp. 143-166, 2020

7.4. CONFERENCES

[C1] **M. Lippi***, M. C. Welle*, M. Moletta, A. Marino, A. Gasparri, D. Kragic, "Visual Action Planning with Multiple Heterogeneous Agents," *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2024

[C2] **M. Lippi***, M. C. Welle*, M. K. Wozniak, A. Gasparri, D. Kragic, "Low-Cost Teleoperation with Haptic Feedback through Vision-based Tactile Sensors for Rigid and Soft Object Manipulation," *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2024

[C3] **M. Lippi***, M.C. Welle*, A. Gasparri, D. Kragic, "Ensemble Latent Space Roadmap for Improved Robustness in Visual Action Planning", *IEEE International Conference on Robotics and Automation (ICRA)*, 2024

[C4] J. Gallou, **M. Lippi**, J. Palmieri, M. Galle, A. Marino, A. Gasparri, "Modeling and Control of the Vitirover Robot for Weed Management in Precision Agriculture," *International Conference on Control, Decision and Information Technologies (CoDIT)*, 2024

[C5] A. Furchì, **M. Lippi**, A. Marino, A. Gasparri "Distributed Finite-Time Supremum/Infimum Dynamic Consensus Under Directed Network Topology", *IEEE Conference on Decision and Control (CDC)*, 2023

[C6] A. Arlotta, **M. Lippi**, A. Gasparri, "An EKF-Based Multi-Object Tracking Framework for a Mobile Robot in a Precision Agriculture Scenario, " *European Conference on Mobile Robots (ECMR)*, 2023

[C7] **M. Lippi**, P. Di Lillo, A. Marino, "A Task Allocation Framework for Human Multi-Robot Collaborative Settings," *IEEE International Conference on Robotics and Automation (ICRA)*, 2023

[C8] **M. Lippi**, J. Gallou, J. Palmieri, A. Gasparri, A. Marino, "Human-Multi-Robot Task Allocation in Agricultural Settings: a Mixed Integer Linear Programming Approach," *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2023

[C9] M. C. Welle*, **M. Lippi***, H. Lu, J. Lundell, A. Gasparri, D. Kragic, "Enabling Robot Manipulation of Soft and Rigid Objects with Vision-based Tactile Sensors," *IEEE International Conference on Automation Science and Engineering (CASE)*, 2023

[C10] **M. Lippi**, J. Gallou, J. Palmieri, A. Gasparri, A. Marino, "An Optimal Allocation and Scheduling Method in Human-Multi-Robot Precision Agriculture Settings," *IEEE Mediterranean Conference on Control and Automation (MED)*, 2023

[C11] A. Arlotta, **M. Lippi**, A. Gasparri, "A ROS-based Architecture for Object Detection and Relative Localization for a Mobile Robot with an Application to a Precision Farming Scenario," *IEEE Mediterranean Conference on Control and Automation (MED)*, 2023

[C12] **M. Lippi***, M. C. Welle*, P. Poklukar, A. Marino, D. Kragic, "Augment-Connect-Explore: a Paradigm for Visual Action Planning with Data Scarcity," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022

[C13] C. Chamzas*, **M. Lippi***, M. C. Welle*, A. Varava, L. E. Kavraki, D. Kragic, "State Representation Learning with Task-Irrelevant Factors of Variation in Robotics," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS),* 2022

[C14] **M. Lippi**, A. Furchì, A. Marino, A. Gasparri, "Finite-Time Distributed Protocol for Tracking the Upper (Lower) Bound For a Set of Time-Varying Reference Signals", *Mediterranean Conference on Control and Automation (MED)*, 2022

[C15] **M. Lippi**, R. F. Carpio, M. Contarini, S. Speranza, A. Gasparri, "A Data-Driven Monitoring System for the Early Pest Detection in the Precision Agriculture of Hazelnut Orchards," *IFAC Conference on Sensing, Control and Automation Technologies for Agriculture (AGRICONTROL)*, 2022

[C16] **M. Lippi**, M. Santilli, G. Oliva, A. Gasparri, "A Finite-time Distributed Protocol for Link Prediction in Networked Multi-Agent Systems," *IEEE Conference on Decision and Control (CDC)*, 2021

[C17] **M. Lippi**, G. Gillini, F. Arrichiello, A. Marino, "A Data-Driven Approach for Contact Detection, Classification and Reaction in Physical Human-Robot Collaboration," *IEEE International Conference on Robotics and Automation (ICRA)*, 2021

[C18] **M. Lippi**, N. Bonucci, R. F. Carpio, M. Contarini, S. Speranza, A. Gasparri, "A YOLO-Based Pest Detection System for Precision Agriculture," *IEEE Mediterranean Conference on Control and Automation (MED)*, 2021

[C19] **M. Lippi**, A. Marino, "A Control Barrier Function Approach to Human-multi-robot Safe Interaction," *IEEE Mediterranean Conference on Control and Automation (MED)*, 2021

[C20] **M. Lippi**, A. Marino, "A Mixed-Integer Linear Programming Formulation for Human Multi-Robot Task Allocation," *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2021

[C21] **M. Lippi***, P. Poklukar*, M. C. Welle*, A. Varava, H. Yin, A. Marino, D. Kragic, "Latent Space Roadmap for Visual Action Planning of Deformable and Rigid Object Manipulation," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020

[C22] **M. Lippi**, A. Marino, "Enabling Physical Human-Robot Collaboration Through Contact Classification And Reaction," *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, 2020

[C23] **M. Lippi**, A. Marino, S. Chiaverini, "A Distributed Approach To Human Multi-Robot Physical Interaction," *IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, 2019

[C24] G. Gillini, **M. Lippi**, F. Arrichiello, A. Marino, F. Pierri, "Distributed Fault Detection and Isolation for Cooperative Mobile Manipulators," *IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, 2019, **Finalist of the Best Student Paper Award**

[C25] **M. Lippi**, A. Marino, "Safety In Human-Multi Robot Collaborative Scenarios: A Trajectory Scaling Approach," *12th IFAC Symposium on Robot Control (SYROCO)*, 2018

[C26] **M. Lippi**, A. Marino, "Distributed Kinematic Control and Trajectory Scaling for Multi-Manipulator Systems in Presence of Human Operators," *IEEE Mediterranean Conference on Control and Automation (MED)*, 2018

[C27] **M. Lippi**, A. Marino, "Cooperative Object Transportation by Multiple Ground and Aerial Vehicles: Modeling and Planning," *2018 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 1084-1090, 2018

7.5. WORKSHOPS

[W1] M.C. Welle, N. Ingelhag, **M. Lippi**, M. Wozniak, A. Gasparri, D. Kragic, " Quest2ROS: An App to Facilitate Teleoperating Robots," *ACM/IEEE International Conference on Human-Robot Interaction (HRI) 7th International Workshop on Virtual, Augmented, and Mixed-Reality for Human-Robot Interactions*, 2024

[W2] J. Palmieri, P. Di Lillo, **M. Lippi**, A. Marino, "A safety planner based on trajectory scaling and path deviation for human-robot interaction," *IEEE International Conference on Robotics and Automation (ICRA) 3rd Annual Workshop on Robot Teammates in Dynamic Unstructured Environments (RT-DUNE)*, 2023

[W3] A. Arlotta, **M. Lippi**, A. Gasparri, "Enabling Multi-Object Tracking with a mobile robot in precision agriculture settings, " *European Conference on Mobile Robots (ECMR) Workshop on Robotics in Agriculture and Forestry*, 2023

[W4] C. Chamzas*, **M. Lippi***, M. C. Welle*, A. Varava, A. Marino, L. E. Kavraki, D. Kragic, "State Representations in Robotics: Identifying Relevant Factors of Variation using Weak Supervision," Conference Neural Information Processing Systems (NeurIPS) 3rd Robot Learning Workshop: Grounding Machine Learning Development in the Real World, 2020

[W5] **M. Lippi***, P. Poklukar*, M. C. Welle*, A. Varava, H. Yin, A. Marino, D. Kragic, "Latent Space Roadmap for Visual Action Planning," *Robotics: Science and Systems (RSS) Workshop on Visual Learning and Reasoning for Robotic Manipulation*, 2020