

Davide Allegro

EDUCATION

- 2022–2026 **PhD in Information Engineering (cum Laude)**, University of Padova, Padova, Italy.
Fully funded 3-year PhD scholarship by the Department of Information Engineering. (BD)
Thesis title: Perception from the Robot's Perspective: Unified Calibration for Human Understanding and Robot-Object Interaction in Human-Robot Collaboration
- 2019–2022 **Master in Automation Engineering (106/110)**, University of Padova, Padova, Italy. Systems theory, identification of dynamic systems, control system, robotics, industrial automation, computer vision and deep learning.
Thesis title: Automatic multi-camera hand-eye calibration for robotic workcells.
- 2016–2019 **Bachelor in Information Engineering (101/110)**, University of Padova, Padova, Italy.
Mathematical analysis, physics, algebra, telecommunications, automatic controls, analog and digital electronics.
Thesis title: Neural networks and deep learning.

CURRENT POSITION

- 2026-now **Postdoctoral researcher**, (Assegno di ricerca tipo A), Department of Information Engineering, University of Padova, Padova, Italy.
- Research topic:** Active Mapping of Dynamic Objects for digital twin generation and multi-camera calibration and 3D reconstruction for robotic workcells in human-robot collaboration scenarios.

RESEARCH ACTIVITY

My research activity focuses on developing advanced multi-camera to robot pose estimation methods to enable dynamic human-robot collaboration involving mobile manipulators. My work aims to optimize the robot's external and on-board visual perception systems, improving the robot's capability to accurately localize human operators and surrounding objects with respect to a single reference frame, typically the robot's base reference frame. This advancement will

significantly increase the robot's awareness of its workspace which is critical for ensuring safe human-robot interactions.

Key aspects of my research include:

- **Camera to Robot Pose Estimation:** investigating novel algorithms that enable real-time localization of robot arms within a camera network surrounding the manipulator in a robotic workcell. This is particularly crucial in dynamic environments where occlusion frequently occurs.
- **Object Pose Estimation:** exploring and optimizing methods to extract 3D spatial features from surrounding objects, thereby enhancing the robot's ability to interact with its environment in a precise and context-aware manner.
- **Active Mapping for 3D Dynamic Objects:** investigating several approaches to plan camera trajectories to efficiently reconstruct 3D dynamic objects.

Additionally, part of my research includes the investigation of multi-view human pose estimation methods, specifically tailored for industrial human-robot collaboration tasks.

PREVIOUS WORK EXPERIENCE

Nov 2025 **Short-term contractual work**, Danieli Automation, Udine, Italy.

AI & Robotics Trainer / Consultant: Advanced course on multi-camera hand-eye calibration tailored to company-specific robotic systems. Practical course on ROS and Gazebo applied to industrial robotic systems.

Sep-Oct 2024 **Short-term contractual work**, Department of Information Engineering, University of Padova, Via Gradenigo 6/b 35131, Padova, Italy.

Research activity: Development of a perception systems for Human-Robot Collaboration in Industrial Environment. I focused on the design of a robotic workcell with a collaborative robot surrounded by a multi-camera setup. I developed a multi-camera hand-eye calibration method and tested an automatic joint detection system of an industrial robot from RGB images for online calibration.

Apr-Oct 2022 **Research scholarship**, Department of Information Engineering, University of Padova, Via Gradenigo 6/b 35131, Padova, Italy.

Research activity: Development of a multi-camera hand-eye calibration algorithm. The method shall be capable of exploits just few images of a calibration pattern attached to the robot end-effector for determining the position of each camera with respect to the robot base reference frame. This research activity was carried out for the WP4 "AI-based human perception for human robot collaboration" in the DrapeBot project, which has been supported by the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006732.

Mar-Jun 2022 **IoT intern / Digital Academy**, Siemens, via Vipiteno 4, 20128, Milan, Italy

Key Activities: Project work on IoT for Data Analytics. I have mainly worked on the design of a data acquisition system with a Siemens PLC to acquire energy data from a machine tool and the subsequent data analysis with a dashboard.

Jun-Dec 2020 **Internship**, Azzurro Digitale, Via della Croce Rossa, 42, 35129, Padova, Italy.

Key Activities: I mainly focused on HMI programming for Manufacturing Industries projects, on the development of IoT device for data acquisition and on a small computer vision project involving Intel LiDAR sensor L515 and Intel depth camera D455.

TEACHING ACTIVITY

2025-2026 **Co-Lecturer**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Master class in Computer Engineering (ING-INF/05, 20 hrs): Computer Vision.

2025-2026 **Teaching Assistant**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Bachelor class in Computer Engineering (ING-INF/05, 20 hrs): Laboratorio di Programmazione.

2024-2025 **Teaching Assistant**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Master class in Computer Engineering (ING-INF/05, 4 hrs): Computer Vision.

2024-2025 **Lecturer** – Secondary School M. Todesco, Via Giacomo Leopardi 16, 35126 Padova, Italy.
Coding and Educational Robotics.

2024-2025 **Teaching Assistant**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Bachelor class in Computer Engineering (ING-INF/05, 22 hrs): Laboratorio di Programmazione.

2023-2024 **Tutor Junior**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Master class in Computer Engineering (ING-INF/05, 40 hrs): Computer Vision.

2023-2024 **Tutor Junior**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Bachelor class in Computer Engineering (ING-INF/05, 60 hrs): Laboratorio di Programmazione.

2022-2023 **Tutor Junior**, Department of Information Engineering (DEI), University of Padova, Padova, Italy.

Master class in Computer Engineering (ING-INF/05, 40 hrs): Computer Vision.

2022-2023 **Tutor Junior**, Department of Information Engineering, University of Padova, Padova, Italy.

Bachelor class in Computer Engineering (ING-INF/05, 60 hrs): Laboratorio di Programmazione.

COMPLETED PHD COURSES

- Python Programming for Data Science and Engineering (5 CFU)
- Elements of Deep Learning (6 CFU)
- Introduction to Reinforcement Learning (5 CFU)
- Entrepreneurship and Startups (5 CFU)

COORDINATION AND PARTICIPATION IN RESEARCH PROJECTS

2022-2024 **Participation** in the workpackage “WP4 - AI-based human perception for human-robot collaboration” European project “DrapeBot – Collaborative draping of carbon fiber parts”, funded by the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101006732. Grant value: € 6 012 142,50. My role involves the development of a multi-camera hand-eye calibration algorithm, which exploits just few images of a calibration pattern attached to the robot end-effector for determining the position of each camera with respect to the robot base, within a collaborative robotic workcell. I have also contributed to the implementation of software modules with those produced by other partners during multiple integration weeks.

REVIEWER ACTIVITIES

Davide Allegro served as a reviewer for the following international journals:

- IEEE/ASME Transactions on Mechatronics
- IEEE Robotics and Automation Letters
- IEEE Transactions on Automation Science and Engineering
- IEEE Transactions on Instrumentation and Measurement

And for the following international conferences:

- IEEE International Conference on Intelligent Robots and Systems
- IEEE International Conference on Robotics and Automation
- IEEE/CVF Conference on Computer Vision and Pattern Recognition
- Advances in Neural Information Processing Systems

ORAL PRESENTATIONS

- 2026 **Invited speaker** at the Computer Vision Trento Symposium (CVTS) 2026, hosted by Fondazione Bruno Kessler (FBK) in Trento, Italy to present “Paparazzo: Active Mapping of Moving 3D Objects”.
- 2025 **Oral presentation** on “Multi-camera hand-eye calibration for human-robot collaboration in industrial robotic workcells” at the IEEE International Conference on Robotics and Automation (ICRA).
- 2024 **Oral presentation** on “MEMROC: Multi-Eye to Mobile Robot Calibration” at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).
- 2023 **Oral presentation** on “Dealing with Hand-Eye Calibration in Large Robotic Workcells: the METRIC Dataset” at the 5th Italian Conference of Robotics and Intelligent Machines (I-RIM), 2023, Rome, Italy.

- 2022 **Oral presentation** on “Towards a holistic human perception system for close human-robot collaboration” at the 9th Italian Workshop on Artificial Intelligence and Robotics (AIxIA), 2022, Udine, Italy.

AWARDS AND RECOGNITIONS

- 2026 **Participation Scholarship, CVPR26:** Awarded travel support to attend the 2026 IEEE/CVF Conference on Computer Vision and Pattern Recognition.
- 2025 **IEEE RAS Travel Grant, ICRA 2025:** Awarded travel support to attend the 2025 IEEE International Conference on Robotics and Automation.
- 2024 **Winner of Manager Anch'io Competition 2024:** Recognized for the best thesis in Artificial Intelligence, Automation, and Robotics.
- 2023 **Klaus Fischer Degree Awards Edition 2023** on the theme “Innovations in processes, equipment and instrumental systems for the digitalization and automation of industrial production”.
- 2022 **1st place** in the 1st Advanced Agile Production (ADAPT) field campaign competition organized by Tampere University, Finland, in the context of the Metrics european project. The competition involved the development of a robotic workcell for human-robot collaboration in an assembly task. The winning IAS-Lab team was composed by Matteo Terreran (team leader), **Davide Allegro**, Daniele Evangelista, Emanuele Menegatti and Stefano Ghidoni.

LONG-TERM MOBILITY

- Apr-Sep 2025 Activity research at the Imagine Lab of the Institut Polytechnique de Paris - ENPC, in Paris, France, under the supervision of Professor Vincent Lepetit, to conduct research on object tracking to enable robots to perceive and interact with objects in dynamic environments.

CERTIFICATIONS AND MEMBERSHIPS

- 2022-now **Italia Association for Artificial Intelligence (AIxIA)**
- 2022-now **IEEE Membership**
- 2022-now **IEEE Young Professionals**

LANGUAGES

- Italian **Mother tongue**

PERSONAL SKILLS

Computer skills	- excellent knowledge of Microsoft Office Suite (Word, Excel, PowerPoint) - excellent knowledge of C++, Python programming languages - good knowledge of MATLAB - good knowledge of Ubuntu and MacOS operating systems
Other skills	- excellent knowledge of OpenCV library for computer vision - excellent knowledge of ROS (Robot Operating System), especially for collaborative robots - excellent knowledge of Ceres Solver library for modeling and solving large optimization problems - good knowledge of Keras, PyTorch and Tensorflow frameworks for machine learning and deep learning

PUBLICATIONS (LAST UPDATED ON 11.09.2025)

Citations **135** (source: Google Scholar)

H-Index 5 (source: Google Scholar)

i10-index 5 (source: Google Scholar)

International peer-reviewed journals

Published

- [1] **Allegro, D.**, Terreran, M., & Ghidoni, S. (2024). Multi-Camera Hand-Eye Calibration for Human-Robot Collaboration in Industrial Robotic Workcells. In: *IEEE Robotics and Automation Letters*. IEEE.
- [2] **Allegro, D.**, Terreran, M., & Ghidoni, S. (2023). METRIC—Multi-Eye to Robot Indoor Calibration Dataset. *Information*, 14(6), 314.

International peer-reviewed conferences

Published

- [1] **Allegro, D.**, Li, S., Ghidoni, S., & Lepetit, V. Paparazzo: Active Mapping of Moving 3D Objects. *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2026.
- [2] Picard, D., Dufour, N., Degeorge, L., Ghosh, A., **Allegro, D.**, et al. PoM: A Linear-Time Replacement for Attention with the Polynomial Mixer. *Findings of IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2026.
- [3] Barcellona, L., Zadaianchuk, A., **Allegro, D.**, Papa, S., Ghidoni, S., & Gavves, E. Dream to manipulate: Compositional world models empowering robot imitation learning with imagination. In: *The Thirteenth International Conference on Learning Representations (ICLR)*, 2025.
- [4] Terreran, M., Bragagnolo, L., **Allegro, D.**, & Ghidoni, S. A Lightweight Ensemble Framework for Online Skeleton-Based Human Action Recognition in Industrial Environments In: *European Conference on Mobile Robots (ECMR)*, 2025.

- [5] **Allegro, D.**, Terreran, M., & Ghidoni, S. MEMROC: Multi-Eye to Mobile Robot Calibration In: *IEEE/RSJ International Conference on intelligent Robots and Systems (IROS)*, 2024.
- [6] Bacchin, A., **Allegro, D.**, Ghidoni, S., & Menegatti, E. SOOD-ImageNet: a Large-Scale Dataset for Semantic Out-Of-Distribution Image Classification and Semantic Segmentation. In: *European Conference on Computer Vision (ECCV, Workshop for Out-of-Distribution Generalization in Computer Vision Foundation Models)* 2024.
- [7] Bragagnolo, L., Terreran, M., **Allegro, D.**, & Ghidoni, S. Multi-view Pose Fusion for Occlusion-Aware 3D Human Pose Estimation. In: *European Conference on Computer Vision (ECCV, Workshop on Assistive Computer Vision and Robotics)* 2024.
- [8] Evangelista, D., Olivastri, E., **Allegro, D.**, Menegatti, E., & Pretto, A. (2023). A Graph-Based Optimization Framework for Hand-Eye Calibration for Multi-Camera Setups. In: *IEEE International Conference on Robotics and Automation (ICRA)*, 2023.
- [9] Terreran, M., Barcellona, L., **Allegro, D.**, & Ghidoni, S. Towards a holistic human perception system for close human-robot collaboration. In *CEUR WORKSHOP PROCEEDINGS (Vol. 3417, pp. 1-7)*. CEUR-WS. Proceedings of the *9th Italian Workshop on Artificial Intelligence and Robotics (AIRO)*, 2022.
- [10] Evangelista, D., **Allegro, D.**, Terreran, M., Pretto, A., & Ghidoni, S. An unified iterative hand-eye calibration method for eye-on-base and eye-in-hand setups. In *IEEE 27th International Conference on Emerging Technologies and Factory Automation (ETFA)* (pp. 1-7), 2022.

Contributions in public repositories

- Software and data collection contribution to the public available METRIC (Multi-Eye To Robot Indoor Calibration) dataset for multi-camera hand-eye calibration composed of synthetic and real images with robotic workcell of different sizes (<https://zenodo.org/records/7976757>).
- Software contribution to MEMROC, a publicly available multi-camera calibration method for mobile robots (<https://github.com/davidea97/MEMROC>).
- Software contribution to “Multi-camera hand-eye calibration for human-robot collaboration in industrial robotic workcells”, a publicly available multi-camera calibration method for robotic workcells (<https://github.com/davidea97/Multi-Camera-Hand-Eye-Calibration>).
- Software contribution to “Paparazzo: Active Mapping of Moving 3D Objects”, a publicly available active mapping method for dynamic objects (<https://davidea97.github.io/paparazzo-page>).