

ADRF26 Workshop

Porto, 14 October 10am
Arrábida Room

When Robots Learn to Interact: Foundation Models for Human-Robot Collaboration and Dexterous Manipulation in Healthcare and Industry

Workshop session and the ADRF 2026

This session addresses the convergence of AI and robotics through the deployment of foundation models for adaptive, dexterous, and safe robot interaction and manipulation in real-world environments. It is directly aligned with ADRForum themes on Europe's resilience, competitiveness, and strategic autonomy by focusing on how Europe can develop trustworthy physical AI capabilities for strategic sectors such as healthcare and manufacturing.

The session will examine how large language models, vision-language models, multimodal perception, adaptive cognitive pipelines, learning from demonstration, and explainable AI can enable robots to operate beyond controlled laboratory settings. Particular attention will be given to deployment challenges: safety, validation, human trust, domain adaptation, regulatory readiness, and value creation with end-users.

The workshop also supports the real-world use and value creation format by discussing concrete scenarios in healthcare and industrial production, where robots must manipulate small, soft, delicate, or deformable objects while interacting safely with people.

Advances in the field of large language models (LLM), vision-language models (VLM), multimodal perception, adaptive cognitive processing pipeline, learning from demonstration (LfD), and XAI have enabled a new breed of intelligent robots to work outside the safety and controlled conditions of laboratories. Through the fusion of semantics, context awareness, multimodal perception, adaptive decision making, and human interaction capabilities, such technologies make deployment possible in complex medical and manufacturing applications.

The combination of language, vision, perception, and robotics enhances Europe's ability to foster a strategic, European form of AI and robotics technology, which is less dependent on any other solution, and allows the creation of innovations that trustworthily put humans at the center of their efforts.

Such developments are also helping in the application of scientific studies into useful solutions. Vision-language reasoning allows machines to comprehend instructions and surroundings via language and visual input, while multimodal perception incorporates visual input, force feedback, tactile input, and environmental input for robust operation in realistic environments. The use of adaptive cognitive pipelines



enables robots to adapt to changing scenarios, while learning from demonstration makes possible the quick transfer of new skills from humans to robots.

Just as essential is the capacity to verify the performance of these systems under realistic conditions. The use of Explainable AI enhances transparency through justifiable explanations of robotic behavior that boost users' confidence, make it possible to go through the certification process, and ensure safe human-robot interactions. Continuous learning and adaptive reasoning contribute to making the system reliable under varying uncertain conditions.

Lastly, the role of the human is emphasized in the digitalization process through technologies such as natural language interaction, which removes technical obstacles for the user. Demonstration-based learning helps the healthcare professional or the factory worker transfer knowledge without much programming required, whereas explainable decision-making boosts training and supervision. All these elements create possibilities for skill development as well as responsible utilization of AI-powered robots that bring value to society, industry, and the economy.

Short description of the workshop

A dynamic workshop on how foundation models can enable robots to interact with people, reason, adapt, and manipulate delicate objects in real-world healthcare and industrial settings.

Full description and objectives of the workshop

Foundation models are rapidly changing the way robots perceive, reason, communicate, and act. Yet their deployment in real-world robotics remains challenging, especially when robots must manipulate small, soft, delicate, or deformable objects in dynamic, human-populated environments such as hospitals and factories.

This workshop will explore how foundation models can support dexterous manipulation, adaptive task planning, semantic perception, human-robot interaction, learning from demonstration, and explainable decision-making. The session will focus on concrete challenges inspired by real use cases in healthcare and industry: changing IV drip sets in a hospital ward, handling delicate gears and deformable ply-sheets in manufacturing, and adapting robot behaviour when objects, users, or operating conditions change unexpectedly.

The objective is to identify practical pathways for moving foundation-model-based robotics from promising prototypes to validated, trustworthy deployment. Participants will discuss technical, operational, ethical, and regulatory barriers, and will co-design validation strategies for robots that continuously learn and adapt in safety-critical environments.





The session aims to:

- Discuss methodologies for validating trustworthy, safe, and human-centric robotic systems under realistic operational conditions.
- Explore the integration of language, perception, reasoning, and learning capabilities to enhance robotic autonomy and adaptability.
- Examine emerging skills and expertise, and workforce needs required to support the next generation of intelligent robotic systems.





AGENDA

- 10.00-10.15 **MARTA LAGOMARSINO (IIT): Why foundation models matter for real-world robotics (intro) - Foundation models for dexterous manipulation**
Focus on manipulation of small, soft, delicate, and deformable objects; multimodal sensing; vision-language-action models; and the gap between semantic reasoning and low-level robot control.
- 10.15-10.30 **VALERIO BO (UPC): Foundation models for human-robot interaction**
Focus on understanding human intention, maintaining engagement, and trust in human-robot interactions.
- 10.30-10.45 **NÉSTOR GARCÍA HIDALGO (EURECAT): From lab prototypes to deployment in healthcare and industry**
Discussion of deployment requirements in hospitals and factories, including safety, trust, human supervision, validation, domain adaptation, and operational value.
- 10.45-11.00 **Interactive Design Sprint: “How might we validate a robot that continuously learns in a hospital or factory?”**
Participants work in small mixed groups. Each group selects one concrete scenario, for example:
- a robot learning to change IV drip sets in a hospital ward;
 - a mobile manipulator handling deformable ply-sheets in a factory;
 - a robot adapting to new objects, layouts, or human instructions during operation.
- Each group develops a practical validation pathway, including:
- key technical requirements;
 - safety and trust requirements;
 - human-in-the-loop mechanisms;
 - measurable KPIs;
 - evidence needed for end-user adoption.
- 11.00-11.10 Group pitches and audience vote.
Each group presents a 2-minute proposal. The audience votes on the most practical and scalable validation pathway.
- 11.10-11.15 Outcomes: Summary of the main recommendations and collection of audience feedback.

Expected outcomes

- a short list of deployment barriers for foundation-model-based robotics;
- practical validation criteria for adaptive robots in healthcare and industry;
- recommendations for European research, innovation, and industrial uptake;
- potential links to ADRA Topic Groups and future collaborative initiatives.

