**ARTIFICIAL INTELLIGENCE**

**Active Vision for intelligent robots**

**Funded By**
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**Context of the research activity**
Active Vision is a key area of research to improve the autonomy of intelligent robots particularly in scenarios where robots must collaborate with humans in complex tasks. Active Vision combines artificial vision with planning to find the most informative view sequence for a visual sensor. In such context, this PhD project focuses on proposing a joint solution for both visual perception and motion planning, combining Reinforcement Learning techniques with visual semantics.

**Objectives**
Active Vision combines artificial vision with planning leveraging several basic skills including self-localization, visual search, object detection, as well as the necessary motor skills for navigation, especially in highly cluttered and dynamic environments.

This project considers Active Vision with minimal a priori knowledge of the environment. Recent works mostly tackle this problem by intertwining deep Reinforcement Learning (RL) techniques, e.g., deep recurrent Q-network (DRQN), with visual semantics, by either feeding deep visual embeddings to policy learning networks or obtaining 3D scene semantics to guide the planning. The project will start with a careful exploration of these techniques, with an equal effort towards computer vision topics (how to gather and codify knowledge about the unknown environment) and to machine learning matters, i.e., how to properly formulate a reinforcement learning for this type of problem. The project will start from recent results obtained in our department in the context of Active Visual Search of unknown objects in indoor environment, published on top-score venues (CVPR, BMVC). The candidate will become an expert in these two main fields, with the unique possibility of advancing in the related literature exploiting the Industrial Computer Engineering (ICE) Lab.

The ICE lab is a logistics system consisting of an AGV transport line that connects different technologic areas: assembling and disassembling (with collaborative robots), visual control (from events camera to multispectral cameras), storage of parts (with automatic warehouse) and a video analytics system (with a distributed 10 camera system). This will ensure an immediate and multifaceted applicability of the studied techniques onto a unique Industry 4.0 environment.
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<th>Skills and competencies for the development of the activity</th>
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<td>The candidate should have good knowledge of machine learning and deep learning, with a preference for reinforcement learning, and computer vision-associated topics. Moreover, it is required a good knowledge of statistical methods for data analysis and model interpretability applied to robotics and cyberphysical systems.</td>
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