

PhD Position

Professional Gesture Recognition for Movement-based Interaction with Collaborative Robots in Manufacturing

Context:

The Centre for Robotics of MINES ParisTech is involved in several research projects on human motion pattern recognition applied to the Human-Machine Collaboration (Collaborative Robotics, Automated Guided Vehicle, etc.) in the Factory of the Future. The main objective of these projects is the development of novel methodologies and technological paradigms that improve the perception of the machine and allows for a natural collaboration between the robot and the operator.

Topic:

In the framework of a new European H2020 project, the Centre for Robotics opens a PhD position on the Professional Gesture Recognition for Human-Robot Collaboration (HRC). HRC requires a smooth, natural and efficient coordination between robots and human operators. During collaborative tasks, it is crucial to establish a safe framework for the human worker by improving the robot's perception. The machine, whether a Humanoid Robot or an AGV, must be able to detect: 1/ not only the human presence (e.g. operator or visitor) but also 2/ specific actions/intentions and/or gestures. The operators perform these gestures in production lines (e.g. to screw, to assembly, etc.) or generally in space (e.g. when a human tends to cut the motion trajectory of the AGV or is giving to it basic gestural commands, e.g. to charge or not a palette, to go back to the starting point, etc.). To achieve this goal, the student will use computer vision for both scene understanding and human tracking, whether the camera is fixed (e.g. on a Humanoid Robot) or in motion (e.g. on an AGV). With regards to the scene analysis, the use of machine learning will be studied in order to extract meaningful features from RGB-D sensing (e.g. Random Decision Forests, Geodesic distances etc.) and segment the scene into objects, workbench etc.. Moreover, the tools of the worker will be augmented by using inertial sensors and detect whether they are used or not, when needed. For the gesture/action recognition itself, it shall be based on spatial trajectories of tracked joints and other time-series. Since the ultimate goal of this research is a safe Human-Robot Collaboration framework, early recognition and prediction techniques will be used, such as Hidden Markov Models, Gaussian Mixture Models, Deep Learning, etc. In particular, the use of time-series specific methods of Deep-Learning, recently proposed by the Centre for Robotics, shall be investigated. The student will deliver a generic methodology and a technological prototype for professional gesture and intentions recognition, which will be tested in 4 use-cases: a. car starter assembly, b. windshield visual quality control, c. LCD TV assembly and d. aircrafts parts manufacturing.

This PhD will give the possibility to the student to work with other European researchers both in the project and in the wider academic community, as well as opportunities to work directly with industrial partners. Moreover, the student will acquire transferable skills that will enhance future employability through leading and contributing to highly interactive and collaborative work. Finally, the student will be autonomous and concentrated on his/her work and will contribute to the project management tasks, such as preparation of the project meetings (distance calls or physical meetings in different European countries – 3 per year), reports and deliverables.

Required skills:

Electrical Engineering, or Computer Science University Degree, or MSc in Applied Mathematics or in Human-Robot Collaboration (or similar with the above degrees). More precisely, the student should have skills on:

- Machine Learning
- Computer Vision
- Programming: C++, Python, ROS, etc...
- The candidate must be proficient in both written and spoken English and possess excellent presentation and communication skills which will be needed for regular interactions with the project partners.

Funding:

The student will have a 3-years contract with a gross monthly salary of 2233€ (complementary activities to research, such as teaching or providing reports and deliverables, etc., are included into the salary)

How to apply or for further information:

Please send your CV and cover letter to Dr Sotiris Manitsaris
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For more information please visit the following links :

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