Human-Robot Teaming – Autonomous Behaviour Adaptation through Mental Modelling in Industrial Contexts

Applications are invited for a PhD scholarship to be undertaken within the School of Physics, Engineering and Computer Science at the University of Hertfordshire, Hatfield, UK. The successful applicant will join the Computer Science Department to work on the following topics: **Robot Perception**, **Learning and Adaptability**, **Computational Modelling**, **Trustworthy Autonomous Systems**, and **Applied Machine Learning**.

Background

Human-robot teaming is a collaboration between humans and robotic systems whereby they work together to perform a joint activity. In this context, one of the crucial keys to the team's success is that the robot and human teammates can collaborate accordingly in a coordinated manner. Each teammate should be aware of what the other teammate will perform and likely need. For that, a robot is expected to understand human teammate intention and performance and adapt its behaviours and decisions to its teammate. Behaviour coordination could be an easy task to do only if the teammates follow a specific given protocol which is pre-programmed on the robot to respond; however, there is no guarantee to realize such an optimal situation in a dynamic real-world setting, as things can change unexpectedly and deviate from the original plan. The capability to model the expectation of a human teammate empowers the robot to collaborate with humans understandably and expectedly, leading to effective teaming. Through forming "mental modelling", the robot can understand the impact of its own behaviour on the mental model of the human. Successful mental modelling in a robot can result in not only adaptability but also behavioural fluency, trust-building, and effective communication in human-robot teaming. In this PhD project, we will consider all desirable traits in teaming, focusing mainly on adaptability and effective communication in industrial contexts.

Objectives

The objectives of this PhD project are as follows:
- The Development of a real-time active perception system, using RGBD vision system and other sensors, to enable semantic reasoning and autonomous behaviour control in different robotic platforms.
- Design of computational models and algorithms to create an approximate mental model of humans.
- The Development of an adaptability component, as part of the main control loop, using machine learning techniques.
- Establish a relationship between the robot's behaviour adaptation capability and other high-level factors such as human perception and trust, and teaming effectiveness.

Person Specification

The successful applicant should have a background in Computer Science, AI and Robotics, or similar fields. Preferred skill requirements include basic knowledge of topics such as machine learning, programming, and/or robotics. Experience in planning, designing, and conducting experiments with human participants is desirable.

Supervisory Team

Dr Abolfazl Zaraki, Principal Supervisor
Prof. Farshid Amirabdollahian, Co-Supervisor

Contact

For informal enquiries about this PhD position, please get in touch with Dr Abolfazl Zaraki at a.zaraki@herts.ac.uk