

Adaptive and Continual Learning for Socially Intelligent Robots

Exploring how social robots can learn, adapt, and foster emotional connection to enhance human well-being.

We invite applications for a fully funded PhD to investigate adaptive and continual learning in social human-robot interaction (HRI). The project aims to advance the development of next-generation socially intelligent robots that can form meaningful, empathic, and emotionally adaptive relationships with humans. These robots will be capable of continuous learning from interaction experiences and modulating their behaviour to support human trust, engagement, and overall well-being.

Supervisors

Principal Supervisor: Dr Abolfazl Zaraki

Co-supervisors: Dr Maryam Banitalebi Dehkordi and Prof Farshid Amirabdollahian

Research Context

This PhD continues a strong line of research within our lab on continual adaptation and agentic AI in HRI, led by Dr Zaraki research team, which has already produced several high-impact studies on reinforcement learning for continual adaptation. Building on this foundation, the proposed PhD will extend adaptive mechanisms toward emotionally intelligent and well-being-aware social interactions. As this is an emerging area of research, the required steps, and methods will evolve through collaboration between the student and supervisory team.

Aims and Objectives

The project seeks to design and study AI systems that enable social robots to learn continually and adapt emotionally in response to human behaviour and feedback.

Potential objectives include:

1. Developing continual learning frameworks for personalised social interaction.
2. Investigating adaptive mechanisms for trust-building, empathy, and affective engagement.
3. Evaluating the impact of robot adaptation on human emotional and psychological well-being.

These objectives are exploratory and may evolve during the PhD based on emerging insights, data, and candidate expertise.

Tentative Methodological Framework

Phase 1 – System Redevelopment and Extension

Build upon existing AI-based continual adaptation systems developed in our lab (Ghamati et al., 2024–2025; Zaraki et al 2014-2025). Enhance these systems to support emotionally intelligent interaction, with components such as continual learning and adaptation

pipelines, novelty detection and drift management, and agentic memory and affect recognition modules.

Phase 2 – Real-World Robot Integration

Implement and test the developed algorithms on social robot hardware. Robots will engage users through adaptive dialogue, gaze, or body language, adjusting their behaviour dynamically over time.

Phase 3 – Human Evaluation and Impact Assessment

Evaluate robot-human interaction using questionnaires measuring trust, empathy, stress, and engagement; physiological and EEG-based signals to quantify emotional responses; and multimodal data analysis to validate robot adaptation performance.

The above methodological outline is tentative and will be refined based on ongoing results and student expertise.

Candidate Profile

Essential:

1. Degree (BSc/MSc) in Robotics, Computer Science, AI, or Electrical Engineering.
2. Proficiency in Python/C++ and familiarity with machine learning frameworks (PyTorch, TensorFlow).
3. Interest in human-robot interaction, reinforcement learning, or affective computing.
4. Familiarity with ROS/ROS2, robotic simulation environments, and Linux-based systems (e.g., Ubuntu).
5. Basic understanding of version control tools (Git) and containerisation (Docker).

Desirable:

1. Experience with physiological or EEG signal analysis, emotion recognition, or human-subject studies.
2. Knowledge of data fusion, signal processing, or trust modelling in HRI.
3. Familiarity with the development and implementation of Large Language Models (LLMs), Vision-Language Models (VLMs), and/or Reinforcement Learning (RL) frameworks.
4. Understanding of research ethics, participant study design, and collaborative software development workflows.

Contact (Informal contact before application is encouraged)

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References

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