POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 1 - Computer Science and Engineering

PARTENARIATO PNRR Research Field: LEARNING AND GENERATING ADAPTIVE MULTIMODAL AGENT BEHAVIOUR FOR WELL-BEING

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	The study of embodied agents such as robots or virtual agents for supporting and improving well-being has grown in recent years. However, most previous studies in this field have only used teleoperated or semi- autonomous (e.g., pre-scripted behaviour) agents. Very few works have investigated the problem of agent behavioural generation, and most of them have explored the use of unimodal or bi-modal data for learning. None of these works has introduced autonomous agents capable of adapting to human behaviours using multimodal data in settings that support and maintain well-being. This research aims to develop an autonomous adaptive agent capable of learning and generating multimodal behaviours in contexts related to well-being. The main objectives of this research are the following: 1) learning human multimodal behaviours via audio-visual data during dyadic interaction with an agent; 2) development of a generic multimodal machine-learning model (i.e., general model that will not adapt to a specific individual) to automatically generate agent behaviours; 3) development of an adaptive multimodal machine-learning model to automatically generate agent behaviours;

	4) implementation and integration of the generative model developed in (3) into an open-source framework to compose human-agent interactions; 5) [optional] evaluation of the agent?s generated behaviours conducting user studies.
Methods and techniques that will be developed and used to carry out the research	The work plan for this PhD consists of different steps following the methodology described below. First, the candidate will identify a set of existing datasets suitable for generating adaptive behaviours (e.g., dyadic interaction datasets). The candidate will then create an AI-driven learning model to understand human behaviours in the context of well-being. After that, the candidate will develop a general model to automatically generate agents' behaviours given the human input (e.g., facial expressions, human voice) without adapting it to the person's specific behaviours. The candidate will first analyse and interpret the behaviours generated by the general model and then develop an adaptive model to generate agents' behaviours according to individual behaviours as the next step. Finally, the candidate will integrate the adaptive model implemented in an open-source framework named HARMONI to compose social human-agent interactions. The project aims to apply the developed models in real-world settings, but if the candidate has other preferences, this is open for negotiation. According to the candidate's preferences, they can also qualitatively evaluate the adaptive multimodal behaviours generation model embedding it into an agent system (e.g., a robot) in a user study within the well-being context.
Educational objectives	The main educational objectives includes development of : - technical skills for generative AI (e.g., design of neural network to generate multimodal behaviours) - multi-

	disciplinary expertise in HAI and agent behaviour generation (e.g., acquiring skills in the field of affective computing, generative AI, and human-agent interaction) - hands-on human perception study design skills or applications for well-being for human-agent interaction (HAI)
Job opportunities	During the PhD study: - Research visit and collaboration opportunities with the Affective Intelligence and Robotics Lab at the University of CambridgeAfter the PhD study: - Postdoc in cutting-edge research group - Research engineer at tech companies.
Composition of the research group	0 Full Professors 2 Associated Professors 5 Assistant Professors 10 PhD Students
Name of the research directors	Prof. Nicola Gatti, Micol Spitale

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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research:

Affective Intelligence and Robotics (AFAR) Lab, University of Cambridge (possibility of a research visit at the AFAR Lab)

Teaching assistantship:There are various forms of financial aid for activities of support to the teaching practice.The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

In the framework of PNRR - PARTENARIATO ESTESO FUTURE ARTIFICIAL INTELLIGENCE RESEARCH
D.D. 341 del 15/03/2022 Avviso pubblico per la presentazione di Proposte di intervento per la creazione di Partenariati estesi alle universita`, ai centri di ricerca, alle aziende per il finanziamento di progetti di ricerca di base nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 Istruzione e ricerca Componente 2 Dalla ricerca all'impresa Investimento 1.3, finanziato dall'Unione europea NextGenerationEU
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