

Neurocognitive Training via Child-Robot Interaction using EEG-Neurofeedback to Monitor Children's Concentration towards Improving Academic Engagement

Applications are invited for a Ph.D. scholarship to be undertaken within the School of Physics, Engineering and Computer Science at University of Hertfordshire, Hatfield, UK. The successful applicant will join an established group of Robotics and A.I. within the Computer Science Department to work with the following topics: **Cognitive (Socially Assistive) Robotics**, **Computational Neuroscience** and **Applied Machine Learning**.

Background of the Project

Context & Significance: Undoubtedly, assistive technology in education helps children develop necessary skills, and it also opens up opportunities for a much more fluid learning experience while they have fun. However, for many children with any kind of impairment, adapted play opportunities are often limited. Inclusion in education contributes to the physical and psychological protection of children with special needs, their families, and communities. This research project aims to find ways to advance educational therapy towards assisting the facilitation of adaptive learning-related coping and improved cognitive skill outcomes in educational settings, focusing on aiding children with attention deficit and other related disorders. This includes studies on children behaviour and interaction, effects on their quality of life, social outcomes, and influences on learning experience. By providing means of improving children's quality of life and well-being, we may prevent future problems through a developmental cascade of early intervention.

Objectives: This project will investigate the use of a robot (i.e. Kaspar Robot developed at Herts) with an intelligent adaptive behaviour that, for the first time, will personalise to each child based on user profiling and their engagement via emotional response and mental states of concentration levels. Every child who requires special education deserves to have that education tailored to their own specific needs, which will be enabled by monitoring brain activity and reacting accordingly. Brain-Computer Interfaces (BCI) will allow acquisition of brainwave patterns for classification of concentration levels (Neurofeedback) during the engagement in an educational environment. When the child's concentration drops or the engagement monitored via facial feedback is low (i.e., lack of attention detected), the robot will learn to adapt to the child's needs by changing challenges or providing new stimuli such as visual and/or auditory cues. The solution will be achieved via: (i) Development of new models for brainwave classification and signature generation to provide goal-based aims to be integrated into an AI-adaptive System; (ii) Data analysis of children's brainwaves when interacting with Kaspar Robot and digital games to identify their concentration levels and compare concentration signatures to evaluate gains; and (iii) data analysis related to social and psychological aspects, such as behaviour (e.g. emotional response and length of engagement) via child's facial and body expressions. With that we can check whether this approach is useful for inclusion in schools, and the acceptance of new technologies by both children and professionals of education and health care. The project's goals can only be achieved by interdisciplinary collaboration between the multiple fields of engineering and informatics (A.I & Robotics), social psychology, computational neuroscience, and education.

Person Specification

The successful applicant should have a first class or upper second-class honours degree or equivalent qualification in Computer Science or Electrical Engineering or other related degrees. Preferred skill requirements include basic knowledge of one or more topics such as machine learning, bio signals computation, artificial perception and/or robotics. We would particularly like to encourage application from women seeking to progress their academic careers. University of Hertfordshire is committed to the principles of the Athena SWAN Charter, and we pride ourselves on our vibrant, friendly, and supportive environment and family atmosphere.

Supervisory Team

Dr Diego R. Faria, Main Supervisor
Prof. Farshid Amirabdollahian, Co-Supervisor
Dr Olga Tveretina, Co Supervisor

Contact

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