

Detecting and preventing attention loss in human-robot interactions using heterogeneous and multimodal data analysis

Project

People, and especially children, with Attention Deficit Hyperactivity Disorder (ADHD) with or without hyperactivity disorder have symptoms of attention deficit, and/or motor hyperactivity and impulsivity. These symptoms often prevent them from understanding a lesson or from doing work that requires minimal concentration. If this deficit is coupled with a lack of joint attention as is the case in children with autism spectrum disorder, it makes all kinds of learning difficult. Several techniques exist to encourage the child to collaborate, but they all require the intervention of an adult (often a professional educator). In this context, researchers in the field of Human-Robot Interaction (HRI) have conducted many studies on using robots to assist educators and therapists. Robots were used for joint attention [1]–[3], as assistants in social therapies [4], [5], or as tutors or peers in education [6].

At ISEP, we are especially interested in studying the contextual triggers that can result in attention loss in order to anticipate it and mitigate its effects. In this way, we hope that a child with ADHD can fully benefit from a session with her therapist or educator by being able to predict attention loss and by taking appropriate countermeasures. More precisely, we will be using two state of the art robots: QTrobot specifically for interactions with children with autism spectrum disorders, and ARI for service robotics.

In the first phase of this research project, the successful candidate will explore the use of an EEG headset to identify episodes of attention loss and search for brain wave patterns that could lead to such episodes [7]. In the meantime, a robot will be used both as the support for interaction but also as a mean to perform both a visual and audio recording of the subject's physical behavior, posture, and surroundings. The idea is to correlate those measures to contextual data that could be:

- The characteristics of the surrounding environment such as noise, smells, light, etc.
- External Disruptive elements: Presence of other children / adults, lunar cycles,
- Interest in the subject taught
- The difficulty of the subject taught
- The learning supports

In the second phase of this project, the candidate will then analyze both the EEG and contextual data to determine whether episodes of attention loss can be successfully predicted and prevented based on real-time incoming data. A remediating action could then be to allow the child to take a break or to draw her attention back through a message.

Keywords: Human-Robot Interaction, Attention Deficit Hyperactivity Disorder, Autism spectrum disorder

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