A Sensory Management Recommendation System to Assist Children with Autism Spectrum Disorders

Lingling Deng (lingling.deng2@nottingham.edu.cn)
Supervisor: Dr. Prapa Rattadilok (prapa.rattadilok@nottingham.edu.cn)

Background

Autism Spectrum Disorder (ASD) refers to a group of neurological and developmental disorders, beginning early in childhood and lasting throughout an individual’s life. Sensory issues are prevalent and idiosyncratic in individuals with ASD which would require highly customized and precise solutions. The behavioral output of the issue can be very different across individuals with ASD, such as appearing to not listen when being spoken to, having difficulty paying attention, and having problems of distractibility and behavior control. An advanced system is needed for monitoring ASD children’s sensory behaviors and providing their caregivers with suitable management strategies. This study focuses on using off-the-shelf mobile devices to develop a machine learning-based sensory management recommendation system to facilitate sensory experience of children with Autism Spectrum Disorders.

Sensory Profile

In the experiments with ASD children, it is found that Sensory Profile is an indispensable factor for predicting attentional level results. The integration of a validated sensory profiling tool and smart devices is a promising approach to realise the development of a sensory management recommendation system for ASD user groups. Specifically for sensory profiling, Dunn’s Sensory Profile of Children 3 to 10 Years Caregiver Questionnaire, a standardised test to gather information about one’s sensory preference and patterns, is used in this study. There are four sensory patterns to classify a person’s atypical sensory responses according to the individual’s neurological thresholds: low registration, sensation seeking, sensory sensitivity and sensation avoiding.

Recommendation System

An iOS-based application is developed to collected data about ASD children’s sensory profiles, environmental factors, physiological data and attentional levels using sensors, smart watch and mobile devices. A total of 35 children with ASD aged between 4 and 8 have been involved in the information collection phase. This phase followed a single subject design where each participant underwent 15 different pre-defined experimental sessions individually. Machine learning models were trained to process a user’s sensory profile features, physiological and environmental factors to identify the potential situation where the ASD user may present fierce hand movements or low attentional levels. The trained machine learning model is then deployed into the iOS-based application using CoreML.

Figure 1: Dunn’s model of four sensory patterns

Figure 2: Recommendation Process

Work-in-progress:

- Automatically determines neurological thresholds of its user (the ASD individual).
- Notifies the user, their care-giver and the behaviour specialist about any potential breaches.
- Makes suggestions on sensory management strategies, i.e., adjustments that can be made to oneself or to one’s environment.

References: