Abstract

Despite their high prevalence, many people often misinterpret symptoms of Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactive Disorder (ADHD) as willful or misconduct behavior. As conventional method is time-consumptive and susceptible to human-decision-making bias, a diagnostic support system to identify developmental disorder symptoms becomes requisite.

Previous studies have been proposing diagnostic support systems employing either bio-signal or behavioral test. Using bio-signals, previous works measured children's brain activity when they performed certain tasks. Then, using features extracted from the signals, the proposed approaches differentiated typical from disorder children with machine learning algorithm. As these approached required attaching sensors to children's body that might irritate children, other studies proposed to examine children's behavior directly using visual sensors or eye trackers.

This paper presents a diagnostic support system employing multiple visual sensors and eye tracker to measure children's behavior during indoor physical activity and the Go/NoGo task. The proposed system comprised group-level monitoring and individual-level monitoring. Group-level monitoring measured children's interaction with their environment and peers during playing activity in nursery schools. While individual-level monitoring examined children's game performance and gaze behavior in playing a game version of the Go/NoGo task.

The proposed system used deep distance learning (DDL) to identify developmental disorder symptoms in children. It allowed the proposed model to measure similarity of a query to typical and disorder groups. Using DDL also enabled retrieval that provided evidence-based results. Estimation results were interpreted by employing SHAP values to provide specific information for the psychiatrist to identify developmental disorder in children.

This study includes four sections. First, we explained our study in estimating human activity with multiple cameras using Deep Neural Network model. Next, based on the finding of the first study, we proposed behavioral monitoring system employing multiple Kinect sensors and RGB cameras. Third, we examined the relation between children's response and gaze behavior and investigated features relating to ASD and ADHD

symptoms when they played Go/NoGo game. Last, we proposed a diagnostic support system employing Cluster Hard Triplet Loss to compute similarity between a query and typical and disorder groups and perform retrieval based using the query. It also provided an interpretation of the similarity score based on SHAP values.