Thank you, abstract #4660 has been submitted

Click here to print this page now.

You have submitted the following abstract to the International Meeting for Autism Research . Receipt of this notice does not guarantee that your submission was complete, free of errors, or accepted for presentation.

Heart Rate Variability and Electrodermal Activity in Children with Atypical Sensory Processing: Exploratory Pattern Analysis

E. Hedman[1], M. Eckhardt[1], M. Z. Poh[1], M. S. Goodwin[1], L. J. Miller[2], B. Brett-Green[2], S. A. Schoen[2], D. M. Nielsen[2] and R. W. Picard[1], (1)Massachusetts Institute of Technology, The Media Laboratory, Cambridge, MA, (2)Research Institute, Sensory Processing Disorder Foundation, Greenwood, CO

Background: Atypical sensory processing can cause significant functional impairment, and is widely reported in persons with autism. The Sensory Processing Disorder Foundation has designed and carried out carefully controlled experiments for eliciting and measuring Autonomic Nervous System (ANS) responses to six types of sensory stimuli (i.e., pure tone, auditory, visual, olfactory, tactile, and vestibular). Electrodermal activity (EDA) and heart rate variability (HRV) data have been gathered from a number of children with and without sensory processing problems while systematically exposed to these stimuli.

Objectives: We sought to evaluate how accurately various pattern recognition algorithms discriminate children with sensory processing challenges (SEN, n=34), including those with autism (n=21) and those with idiopathic sensory difficulties (n=13), from typically developing children (TYP, n=10) using EDA and HRV reactivity to the sensory stimuli mentioned above. We also evaluated which small set of features derived from raw EDA and HRV waveforms were most effective at distinguishing SEN and TYP in order to gain insight into what is different about autonomic responsivity in these two groups.

Methods: We started with 580 EDA and HRV features obtained from six different sensory stimuli (8 trials each) as well as rest (before the experiment) and recovery (after the experiment) periods. We employed an automated process to find a smaller subset of features optimized for discriminating the SEN and TYP groups. The process cascaded two techniques – multi-class principal components analysis, followed by sequential floating feature selection. The features were first grouped into three different categories (524 of EDA; 56 of HRV; 32 of EDA + 56 of HRV), and used as input to the feature selection process, which was run with four powerful pattern classifiers: Linear Discriminants, K-Nearest Neighbor, Decision Trees, and Support Vector Machines. The process resulted in

12 different classifiers, each using an optimized set of features ranging in size from 3 to 57. These classifiers have the ability to distinguish complex high-dimensional patterns in multimodal data. We ran the twelve classifiers on data from 44 individuals (34 SEN, 10 TYP).

Results: We used leave-one-out cross-validation for training and testing each classifier on separate subsets of the data (leave out one person's data, train a model on the data from 43 people, then test the trained model on the person left out). Eight of the twelve classifiers achieved greater than 80% specificity and sensitivity in separating the SEN and TYP groups. Of these eight, two achieved this performance using 5 or fewer features. The Decision Tree with only 4 EDA features achieved 94% sensitivity and 80% specificity, while K-NN with only 5 EDA features achieved 88% sensitivity and 90%.

Conclusions: Across machine learning classifiers, we identified a relatively small subset of HRV and EDA features that separated the SEN and TYP groups. The discrimination ability of these features should be replicated on an independent sample. If findings are confirmed these features may serve as diagnostic criteria and intervention outcomes in the future. This poster will present the discriminatory methods, features, and detailed findings of the study.
