A Computational Approach to Perception and Language in Autism Based on Self-Organizing Maps

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Abstract

A Self-Organizing Map (SOM) is a type of artificial neural network. Artificial neurons in the SOM form local assemblies that become specialized in responding to categories of stimuli. Assemblies emerge through competition and cooperation between artificial neurons. Here we present a SOM aimed to model autism by means of increasing cooperation between neurons in the map. Descriptions of local hyperconnectivity in neuronal circuits in ASD make our implementation biologically sound. Remarkably, the change in low-level processing of our model, led to high level atypicalities mirroring ASD behavior. Increasing cooperation produced deficient organization of neuronal assemblies accounting for fragmented representations of perceptual categories, idiosyncratic use of word labels, and atypical shape bias in lexical development. The results of our model successfully matched the behavioral performance of children with ASD in a categorization task, and shed light on how to understand the atypical development of the neurocognitive profile of ASD.