Miller, Vonda, “Osicllatory Networks for Pattern Recognition”

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Computer algorithms that match human performance in recognizing written text or spoken conversation remain elusive. The reasons why the human brain far exceeds any existing recognition scheme to date in the ability to generalize and to extract invariant characteristics relevant to category matching are not clear. However, it has been postulated that the dynamic distribution of brain activity (spatiotemporal activation patterns) is the mechanism by which stimuli are encoded and matched to categories. This research focuses on modeling and analyzing dynamic patterns for category discrimination. It is assumed in this research that EEG patterns are related to perception. It is further assumed that the distribution of brain activation patterns are self-emergent and this self-organization is sufficient for categorization. These assumptions have loose biological underpinnings; nonetheless, there is evidence to support these premises. An oscillatory neural network has been designed based upon a canonical model. The results of experiments for setting the parameters of this neural network are presented along with the emergent spatiotemporal activation patterns to simple stimuli. Classification of spatio-temporal frequency transitions and their relation to a priori assessed categories is shown. Classification is accomplished using a trajectory based distance metric. The results indicate that this spatiotemporal representation of stimuli and the associated distance metric is useful for simple pattern recognition tasks.