A Novel Approach to Classify and Detect Thoughts Using Electroencephalography

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Electroencephalography (EEG) headsets, being highly portable, present a convenient, noninvasive method of recording the brain's electrical activity. This project seeks to develop a method for the classification of thoughts, memories, and stimuli from EEG data for potential use in brain-computer interface (BCI), and the treatment of Aphasia and disabilities that affect verbal communication. The two headsets used were the Emotiv EEG headset and OpenBCI containing 14 electrodes and 16 electrodes, manifesting data as 14 dimensional and 16-dimensional time series respectively. For analysis of multidimensional data, models were developed in the classification of event-related potentials corresponding to predetermined thoughts. Simple, tangible things that provoke distinct sensations, like pizza toppings, are universal and easily conceived, making them suitable classifications for our study. The models are fed EEG recordings of subjects looking at a topping, forming a classifier model based on the data's spatial and temporal configurations. This model is then able to classify events given new EEG data, and stochastic neighbour embedding allows visualization of the 14-dimensional data in 2-D. There was a similar implementation for music. Technology enabling nonverbal communication is exciting not only for its futurist appeal but its potential to help millions suffering from Aphasia and other speech impairments. While methods such as MRI capture data with very high resolution, EEG headsets would provide a noninvasive, inexpensive and accessible means of translating brain activity. This research aims to contribute to the future development of an EEG based BCI for therapeutic and rehabilitative purposes.

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