Robust Understanding of Motor Imagery EEG Pattern in Voice Controlled Prostatic Arm Design

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Introduction: Understanding neural mechanism of communication between human and machine has become more interesting research issue in last few decades. One of the most motivating purposes is to help the people with motor disabilities. This excites researchers to work on the interaction between brain-computer-interfacing (BCI) systems, which in turn needs a fast and accurate algorithm to decode the commands in the brain or electroencephalogram (EEG) signals. EEG signals are very noisy and contain several types of artifacts, so it would be very important to use efficient methods to train the BCI system. **Aims and Goals:** The goal of this project is to train an intelligent system based on the information in the sample EEG data. This system is going to predict the person's intention in future experiments with new EEG data. Finally, this project can be used in controlling a moving object like a robot, a wheelchair, or many other devices. **Data Acquisition and methods:** In this project, we are working with the EEG signals taken from 20 subjects thinking about English vowels \a\, \e\, \i\, \o\, and \u\. This means we can define only 5 clusters, which contain all signals with similar features. We are going to use part of the signals for training and the rest for testing. In training section, we have to first preprocess the data, and then categorize it into 5 clusters. Robust Principle Component Analysis (PCA) helps us to analyze the data to extract the features. Afterwards based on principle component features of signals, we employ a Hidden Markov Model (HMM) classifier to send similar signals to the same cluster. As EEG data is a randomly variant signal, we are using Hybrid HMM classifier for classification of EEG pattern. Our Initial results are promising in robust understanding of auditory command, which is been explored from EEG pattern analysis.

Keywords: Motor Imagery, Prostatic Arm, Electroencephalogram (EEG), Principle Component Analysis (PCA), Hidden Markov Model (HMM).