

Project Proposal : Machine Learning and Signal Processing (E-599)

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Electroencephalography Data Classification to Identify Motor Imagery Movements

I. Introduction

Brain-Computer Interfacing provides a communication platform with external devices for the patients whose neuromuscular system has been affected by severe diseases (eg: Parkinson disease) or higher order spinal cord injuries. Those external devices may encompass a group of prosthetics or computers running inside different noninvasive wearables that continuously monitor electroencephalography (EEG) signals related to different cerebral activities. Due to the vast number of neuromuscular activities that take place within the body such as eye blinks, eye movements, muscle noises and heart signals, EEG recordings are often contaminated with a high degree of noise [2]. The final goal of this project is to identify EEG components related to four motor movements (left hand, right hand, tongue and a foot) from noisy EEG recordings and then train a supervised model to successfully classify the four movements. We will be using the multi-class cued motor imagery data set from the BCI competition 2005 [3].

II. Methodology

In the literature, several methods, including regression based and principal component analysis (PCA) have been used to remove artifacts from EEG recordings [1, 2]. We propose to perform a quantitative and qualitative analysis of techniques for artifacts removal and feature identification of EEG recordings. Following approaches will be considered in this project to identify the four motor imaginary movements.

1. Blind source separation using PCA and independent component analysis (ICA).
2. Short time Fourier transform (STFT).
3. Multilayer Perceptron.

III. References

- [1] Sivakami, A., and S. Shenbaga Devi. "ANALYSIS OF EEG FOR MOTOR IMAGERY BASED CLASSIFICATION OF HAND ACTIVITIES."
- [2] Jung, Tzyy-Ping, et al. "Removing electroencephalographic artifacts by blind source separation." *Psychophysiology* 37.2 (2000): 163-178.
- [3] http://www.bbc.de/competition/iii/#data_set_iiia