Empirical Mode Decomposition Coupled with Fast Fourier Transform based Feature Extraction Method for Motor Imagery Tasks Classification

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ABSTRACT

Brain-Computer Interfaces (BCI) offers a robust solution to the people with disabilities and allows for creative connectivity between the user's intention and supporting tools. Different signals from the human brain, including the motor imagery, steady-state visual evoked potential, error-related potential (ErrP), motion-related potentials and P300 have been employed to design a competent BCI system. Motor imagery is commonly seen in almost every BCI system among these neural signals. This article has implemented feature extraction and feature selection techniques to classify the Electrocorticography (ECoG) motor imaging signal. The empirical mode decomposition (EMD) coupled fast Fourier transform (FFT) has been utilized as the feature extraction and recursive feature elimination (RFE) has been utilised to select the features. Finally, the extracted features have been classified using K-nearest neighbor, support vector machine and linear discriminant analysis. Two classes ECoG data from dataset I (BCI competition III) have been considered to validate the proposed method. In contrast with other state of the art techniques that employed the same dataset, the presented feature extraction and selection method significantly improve the classification accuracy (maximum achieved accuracy was 95.89% with SVM).

KEYWORDS: Electrocorticography (ECoG), Empirical Mode Decomposition (EMD), Brain Computer Interfaces (BCI), Machine Learning, Motor Imagery.

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