Channel selection for common spatial pattern Based on energy calculation of motor imagery EEG signal

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ABSTRACT

One of the popular features extraction methods for recognizing motor imagery EEG signal is Common Spatial Pattern (CSP). CSP is an algorithm that maximize the variance of one class and minimize the variance of other class simultaneously to discriminate two classes of multichannel EEG signals for classification purpose. However, CSP assumes that the signals on all EEG channels are functionally interconnected even though only spurious relationship due to artefact or noise. This study will conduct several investigations on the classification performance by imposing channels selection based on calculated energy on brain excitation calculation. The improvement strategy calculates the energy in each channel and the selection will be based on the energy level. In order to validate the performance of the proposed technique, three motor imagery data sets are employed including RIKEN, BCI Competition III Data set IVa, and BCI Competition IV Data set I. In general, all these datasets are tested on the existing CSP and its variants with and without the proposed channel selection strategy. The existing techniques such as CSP, R-CSP (regularized CSP), and A-CSP (analytic CSP) are included in this study. The results show that the selected channels with higher energy can improve the CSP, R-CSP and A-CSP classification performance. Also, smaller size of selected channels in the area of motor cortex offers better performance with almost 75% channel reduction and 8% increase in accuracy.

KEYWORDS:

CSP; channel selection; energy