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Research Article

Selection of Effective EEG Signal Channels for Recognizing Emotional States based on Frequency Sub-band Information

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Abstract

The design of a reliable emotion recognition system by selecting electrodes with more EEG signal information is considered in this study. The main challenge in using the EEG signal is the high number of recording electrodes, which results in an increase in the computational complexity and processing time. In order to reduce the impact of these cases in the present study, an emotion recognition system was presented using the common spatial pattern (CSP) algorithm to select effective channels. The EEG signals of the DEAP database, were used to evaluate the proposed method. Theta, Alpha, Beta and Gamma frequency subbands were separated for EEG signals; And then the best channels were chosen by the CSP method for the subbands. By applying the method, the F4-F8 AF4-FP2-FZ-CZ electrodes were selected from the first 32 channels; And the maximum power spectrum for the frequency subbands of the selected channels was calculated as a feature. Then, using t-test and principal component analysis (PCA), the process of feature selection and feature space mapping was done. The support vector machine (SVM) was used for data classification and emotion detection. The obtained results indicate the optimal performance of the proposed system in identifying four emotional states, with emotions being identified with 84% accuracy.

Keywords: Principal component analysis, Common spatial pattern, Emotion recognition, EEG signal, Power spectrum, Support vector machine.

Highlights

- The use of the CSP algorithm to select effective EEG channels based on frequency sub-band information.
- Selection of prefrontal and frontal electrodes, which correspond to the brain lobes that control emotions.
- Improved system performance in emotion recognition despite using only one power spectrum feature.

Citation: [in Persian].