

ABSTRACT

Motor Imagery (MI) based Brain-Computer Interface (BCI) systems utilize electroencephalogram (EEG) signals to interpret imagined limb movements. Due to the non-stationary and high-dimensional characteristics of EEG data, effective feature selection is essential to improve classification accuracy and reduce computational demands. This study proposes an improved feature selection method that enhances the traditional maximum relevance minimum redundancy (MRMR) algorithm by integrating the Equal Grouping Method (EGM) and Pearson correlation coefficient. EEG data from the BCI Competition IV Dataset 2b was analyzed, focusing on left and right hand MI tasks from nine subjects. Feature extraction employed Filter Bank Common Spatial Pattern (FBCSP) over 17 overlapping sub bands 4 - 40 Hz, yielding 102 features per trial. Three classification strategies were compared using Support Vector Machine (SVM): (1) raw features, (2) traditional mRMR, and (3) the proposed Improved MRMR (IMRMR). IMRMR achieved the highest average classification accuracy 80,7%, outperforming MRMR 74% and raw features 70,5%. The IMRMR method effectively balances relevance and redundancy, enhancing EEG-based MI classification. This hybrid approach is promising for feature optimization in real-time BCI applications.

Keywords: EEG, motor imagery, FBCSP, MRMR, feature selection, EGM, classification.