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Non-Uniform Filter Banks-based Minimum Distance to Riemannian Mean Classifition in Motor Imagery Brain-Computer Interface

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Abstract : The motion intention in the motor imagery braincomputer interface is identified by classifying the event-related desynchronization (ERD) and event-related synchronization ERS characteristics of sensorimotor rhythm (SMR) in EEG signals. When the subject imagines different limbs or different parts moving, the rhythm components and bandwidth will change, which varies from person to person. How to find the effective sensorimotor frequency band of subjects is directly related to the classification accuracy of brain-computer interface. To solve this problem, this paper proposes a Minimum Distance to Riemannian Mean Classification method based on Non-Uniform Filter Banks. During the training phase, the EEG signals are decomposed into multiple different bandwidt signals by using multiple band-pass filters firstly; Then the spatial covariance characteristics of each frequency band signal are computered to be as the feature vectors. these feature vectors will be classified by the MDRM (Minimum Distance to Riemannian Mean) method, and cross validation is employed to obtain the effective sensorimotor frequency bands. During the test phase, the test signals are filtered by the bandpass filter of the effective sensorimotor frequency bands, and the extracted spatial covariance feature vectors will be classified by using the MDRM. Experiments on the BCI competition IV 2a dataset show that the proposed method is superior to other classification methods.

Keywords : non-uniform filter banks, motor imagery, brain-computer interface, minimum distance to Riemannian mean
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