

BCI Competition IV Dataset 1 Submission by

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Files Description

The predicted output for each subject are saved in the text file '*Result_BCIC_IV_ds1x.txt*' where x is the subject a to f .

Method Description

The algorithm used is called Constrained Multi Time Interval Filter Bank Common Spatial Pattern (CMTIFBCSP). This algorithm is a multi-time segment extension of Filter Bank Common Spatial Pattern (FBCSP) [1]. The CMTIFBCSP algorithm decomposes the EEG signal into multiple time intervals and multiple filter banks whereas the FBCSP algorithm only decomposes the EEG signal into multiple filter banks. Hence the CMTIFBCSP is able to select discriminative spatial-temporal features from a discriminative motor imagery time interval. This eliminates the need of manual calibration of channel selection, time interval and frequency filtering selection for the use of the Common Spatial Pattern algorithm.

A multi-class version of CMTIFBCSP is employed using multiple One-Against-the-Rest (OVR) classifiers. Besides the classes -1 , 1 provided in the calibration data, a third class 0 that represents the rest class is included in the training of the algorithm. Hence, three component classifiers are used whereby each of the component classifier yields a probability and the final output is determined from all three probability results from the component classifiers.

The algorithm selects one out of the three motor imagery time interval using a constrained version of the Mutual Information Best Individual Feature algorithm [2]. For each classifier, classification of selected CSP features is performed using the Naïve Bayes Parzen Window classifier [2] to yield a probability result.

When evaluating the 10×10-fold cross-validation performances of CMTIFBCSP, exceptional results are obtained for subjects d and e . Hence, we postulate that they are artificially generated.

As the computation of each and every time point of the evaluation data is computationally extensive, a computation of every alternate time point is performed instead. Post processing using moving average filtering is also employed to improve overall mean square error results.

The algorithm and computation are performed using MATLAB 7.5 R2007b running Windows XP SP3.

References

- [1] K. K. Ang, Z. Y. Chin, H. Zhang, and C. Guan, "Filter Bank Common Spatial Pattern (FBCSP) in Brain-Computer Interface," in *Proceedings of the IEEE International Joint Conference on Neural Networks (IJCNN'08)*, Hong Kong, 2008, pp. 2391-2398.
- [2] K. K. Ang and C. Quek, "Rough Set-based Neuro-Fuzzy System," in *Proceedings of the IEEE International Joint Conference on Neural Networks (IJCNN'06)*, Sheraton Vancouver Wall Centre Hotel, Vancouver, BC, Canada, 2006, pp. 742-749.