

# BCI Competition II, Dataset Ia

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Due to the fact that the dataset consists of trials recorded on two different days we tried clustering to receive this structure. By a technique called Normalized Cut [1] two clusters can be found which consist of 168 resp. 100 trials. If we additionally add the test set for the clustering we get a similar structure (with all test points in the 100 trial cluster above).

Accordingly we should assume that the 168 trials in cluster 1 belong to the first day and 100 trials in cluster 2 to the second one. By taking a deeper look upon the data we can see that a high shift in the channel C4a is responsible for this cut.

Since the test set was recorded on the second day we modify our usual strategy to measure classification performance like this: Cross Validation takes only place on the data set of the second day, the trials for first day are only used additionally for training a classifier, but never as test trials in this Cross Validation. <sup>1</sup>

In [2] we suggest methods to combine different features for BCI. We use a technique described there called MetaCombiner convenient for the situation here. In the paper we suggest to combine ERD and SCP features, here we focus on different features, namely the following:

- In the beginning of the trials you can find a peak which is probably a response from visual cortex. A good classification can be done on this component by calculating some means in a suitable interval after setting a baseline.
- Due to the fact that the subject can prepare the negatvation resp. positivation before the given feedback we classify directly on the calculated means without setting a baseline. The trials of the first day were used in the following manner: For each trial the correlation to all trials of the second day was calculated and was shifted to have the same baseline in the whole time window like the most correlated trial on the second day. To avoid high frequency effect a small moving average was calculated on the data. The data were also subsampled in time for dimensionality reduction.

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<sup>1</sup>With classification only on the second day and ignoring all trials from the first day we have found a classification performance error of about 15 %.

All 6 channels and simple classifiers like regularized discriminant analysis, linear programming machine and so on were used. With the calculated classifier and the modified Cross-Validation technique we have found a classification error of about 10 %. Our results on the test set are provided in the file Testdata.txt.

## References

- [1] J. Shi and J. Malik, "Normalized Cuts and Image Segmentation", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 22(8): 888–905, 2000.
- [2] G. Dornhege, B. Blankertz, G. Curio, and K.-R. Müller, "Combining Features for BCI", in: *Advances in Neural Inf. Proc. Systems (NIPS 02)*, vol. 15, 2003, accepted.