# BCI competition IV: data set 1–Methods

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The methods used in this work are based on the methods published in [1].

## 1 Preprocessing

A subset of 13 electrodes was chosen for analysis. The subset comprised only the necessary electrodes to compute 3 Laplacian derivations at electrode positions: C3, Cz and C4. All channels were filtered between 8 and 35 Hz (Chebyshev order 7).

Two consecutive spatial filters were used, namely, a common average reference and three Laplacian derivations.

## 2 Feature extraction

The EEG signals from the Laplacian derivations were individually described in the time-frequency (TF) domain by means of logarithmic band power (logBP). A TF description from 8 to 32 Hz (2 Hz width, non overlapping) and time windows of 1 s (with 50% overlap) was used. All features were labeled as positive/negative, according to the expected MI, in the interval 2 s to 4 s and labeled as zero in other case. A trial was considered from -2 s to 5 s relative to the cue (presented at t = 0 s).

One training pattern was formed from the concatenation of all logBP (12 bands) across all derivations (3). No feature selection was performed.

## 3 Classifier

Two support vector machines (SVM) were used to predict the class label of every pattern. Both SVM were trained for detection of one class of motor imagery versus the rest. A 10 fold cross-validation procedure with 100 patterns per class randomly selected among all trials was used to select the parameters of the SVM with a Gaussian kernel.

The parameters associated with the maximum difference between true positive rate and false positive rate were used to train a definitive SVM The SVM were also trained to predict the *a posteriori* class probability. Both classifiers were combined into a single output by the subtraction: $P(class2) - P(class1)$, where class 1 was labeled as negative and class 2 as positive.

## References

[1] Solis-Escalante, T., Müller-Putz, G. R. and Pfurtscheller, G. Overt foot movement detection in one single Laplacian EEG derivation Journal of Neuroscience Methods, 2008, 175, 148-153