

With respect to the intended cursor application we see the main challenge in the extraction of features carrying the relevant information needed to solve the given pseudo online task (CUR). For this we have reduced the given high dimensional and noisy data to representants of three classes of cognitive states (movement 1, movement 2, idle). We utilized the Common Spatial Patterns (CSP) algorithm and a classifier arrangement that combines the probabilities of a cognitive idle state and the kind of motor imagery.

1. Preprocessing

After resampling all sets to 200Hz, epochs with 4 seconds of length where generated from the calibration sets:

- Motor imagery epochs (MIE), starting with the visual cues indexed by the set's `mrk.pos` structure
- cognitive idle state epochs (IE), starting 4 seconds after preceding MIEs (i.e. when a blank screen was shown to the subjects)

2. Feature extraction and classification

Feature extraction was done by calculating the logarithmic bandpower of three pairs of CSP metachannels for two types of discriminative logics: A movement classifier (MOV) that discriminates the union of the MIEs from the IEs and a direction classifier (DIR) discriminating the MIEs. (classifiers are based on Restricted Boltzmann Machines, Logistic Regression and LDA).

3. Parameters

In order to maximize performance (i.e. to minimize the mean squared error (MSE) over a continuous EEG signal) for each calibration trial > we performed a $[[10 \times 10] \times 5]$ -fold nested chronological crossvalidation for parameter selection (heuristic chosen spectral bands and time windows). Notice that here the MSE over the epoch has been the optimization criterion and not the classification accuracy.

4. Application

For the final estimation of the gradual probability of classmembership at each time point of the test dataset, features have been extracted and classified with the parameters chosen from the appropriate calibration set. The gradual outputs of the DIR classifier over the domain $[-1,1]$ were multiplied by the absolute value of scaled gradual MOV outputs. The resulting map reflects the CUR-task optimized for MSE within this approach.