

Dataset IIIb: Non-stationary 2-class BCI data

Short description:

cued motor imagery with online feedback (non-stationary classifier)
with 2 classes, and 3 - 4 sessions from 3 subjects.
(EEG, 2 bipolar channels)

Aim:

Non-stationary (i.e. time-varying) BCI data should be classified. It can be expected that time-varying classifier performs better than a stationary (static) classifier. Moreover, the response time of each method will be evaluated.

EEG recording:

EEG-data from three different subjects during a BCI experiment. The experiment consists of 3 sessions for each subject. Each session consists of 4 to 9 runs. The data of all runs was concatenated and converted into the GDF format [1]. The recordings were made with a bipolar EEG amplifier from g.tec. The EEG was sampled with 125 Hz, it was filtered between 0.5 and 30Hz with Notchfilter on.

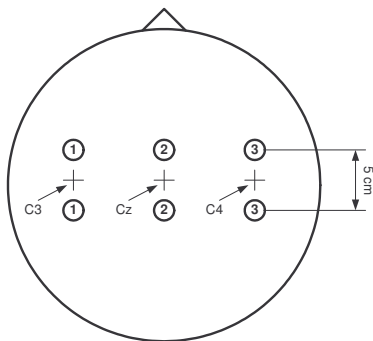
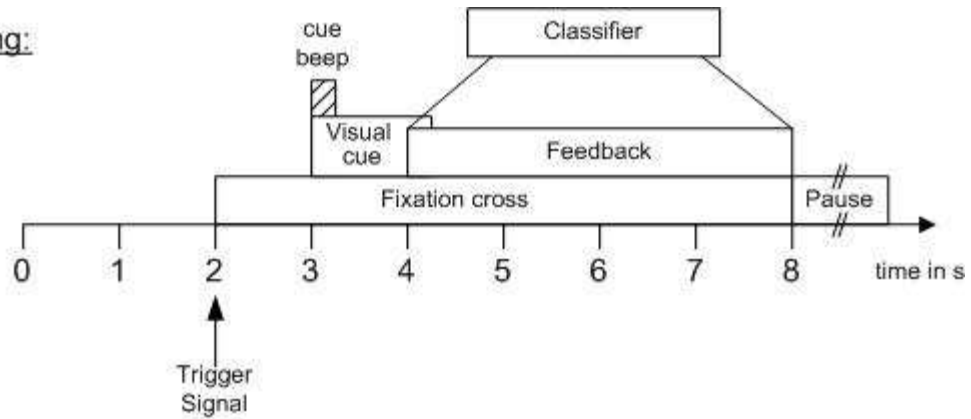


Figure 1: Electrode positions. Channel C3 and C4 are included in the EEG data.

Timing:



Trial duration = 8000 ms
 Trigger signal = 2000 ms
 Ready Signal (Fixation cross) = [2000 - 8000] ms
 Feedback = [4000 - 8000] ms
 Cue Timing (visual) = [3000 - 4250] ms
 Cue Beep (acoustic) = 3000 ms

Figure 2: Paradigm of the Virtual reality experiment used for O3. A comparable experiment is described in [2]

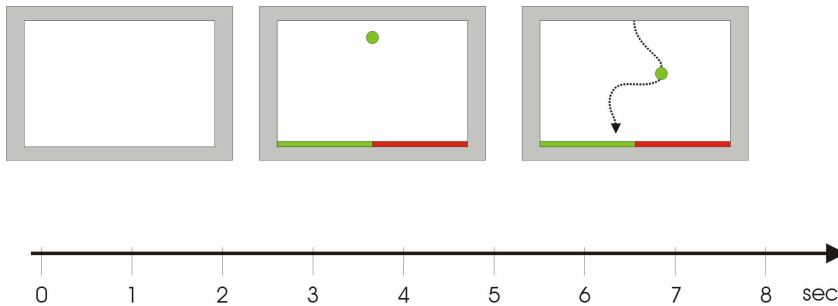


Figure 3: Basket paradigm used for S4 and X11 [3].

	Feedback	Feedback presentation	Channels	# of Trials	Classes
O3	Virtual reality [2]	4-8s	C3, C4	640	Left-Right
S4	Basket, adaptive classifier [3]	4-7s	C3, C4	1080	Left-Right
X11	Basket, adaptive classifier [3]	4-7s	C3, C4	1080	Left-Right

Format of the data

The data is stored in the GDF format [1] and can be loaded into Matlab or Octave with Biosig-toolbox [5] (version 0.81 or higher) using the command `[s,HDR] = sload(filename)`. The data `s` can contain NaN's; these NaN's indicate the breaks in between the runs or saturation of the analog-to-digital converter.

All events are stored according to the Table of eventcodes [6]. The beginning of each trial ($t = 0s$ according to Fig. 1) can be obtained from `HDR.TRIG`; the classlabels are stored in `HDR.Classlabel`. `HDR.Classlabel` can contain the values '1','2' or 'NaN'. Values '1' and '2' indicate the labels of the training set, NaN indicates the trials of the test set.

Evaluation:

Valid submissions must fulfill two requirements:

- (1) it must be demonstrated that the used algorithms are causal, at time t no sample from time $k > t$ must be used (zero-phase filtering using forward-backward filters are not allowed). In order to demonstrate the causality, the source code of the algorithm must be submitted.
- (2) a continuous classification output (continuous in time as well as magnitude) must be submitted. The classifier output should provide a value < 0 for class 1, a value > 0 for class 2, and value $= 0$ is non-decisive.

The output will be validated using the time course of the mutual information [4]. The method with the maximum increase of the mutual information (maximum steepness calculated as $MI(t)/(t-3s)$ for $t > 3.5s$) will be used for validation. On order to avoid a stimulus-response-mechanism, time $> 3.5s$ will be evaluated. The "steepness" of the mutual information quantifies the response time. The evaluation algorithm is provided in BIOSIG (see `/biosig/t490/criteria2005IIIb.m`) [5].

Remark:

Optional, the algorithm can be submitted for inclusion into BIOSIG. Each algorithm which performs better than the standard classification algorithm [5] is eligible to be included in BIOSIG.

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References:

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- [3] C. Vidaurre, A. Schlögl, R. Cabeza and G. Pfurtscheller, "A fully on-line adaptive Brain Computer Interface", Biomed. Tech. Band 49, Special issue 2, pp. 760-761, 2004.
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- [5] A. Schlögl, BIOSIG - an open source software library for biomedical signal processing. 2003-2004. available online: <http://BIOSIG.SF.NET>
- [6] available online:
<http://cvs.sourceforge.net/viewcvs.py/biosig/biosig/t200/eventcodes.txt>