BCI-Competition 2003, Data sets IIIb

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Algorithm

- Generated features:
  - original signals for C3, C4
  - some frequency-bands computed via 5th order butterworth filter, squared and smoothed
    - alpha (8 – 12 Hz) and beta band (13 – 30 Hz)
    - 1 – 3 Hz, 4 – 6 Hz, 7 – 9 Hz, 10 – 12 Hz, 13 – 15 Hz, 16 – 18 Hz, 19 – 21 Hz, 22 – 24 Hz, 25 – 27 hz, 28 – 30 Hz
    - 1 – 6 Hz, 7 – 12 Hz, 13 – 18 Hz, 19 – 24 Hz, 25 – 30 Hz
  - estimated mean of alpha and beta band
  - some ratios of original signals, alpha band, beta band and other frequency-bands (C3 / (C3 + C4))
  - difference of alpha and beta band
- The best 4 features $x_{j_i}, i = 1, \ldots, 4$, are determined by multivariate analysis of variance (MANOVA) for each sample point k followed by a time weighting with MANOVA$/(t - 3s)$ for $t > 3.5s$. The relevances are smoothed by a triangular function to avoid usage of non-robust features.
- Classification is done for the sample point with the best relevance via support vector machines (SVM and Kernel Methods Matlab Toolbox [1]). It results in four weighting coefficients a_i for the best four time series $\hat{y}[k] = \sum_{i=1}^{4} a_i \cdot x_{j_i}[k]$ (algorithm in *_*alg.m*, results in *_*res.mat*, SVM-coefficients in *_*svm_system.mat*)

Comments

- As one would expect, the lower frequency-bands (... – 6 Hz) do not contain any information.
- From our point of view the unfiltered signal in dataset S4b contains a "Bereitschaftspotential" starting near samplepoint 430; but maybe it's only an artifact due to eye-blink or eye-movement. It is mainly detected by a ratio of the original signals.
- IIR-filtered signals are more robust but time-delayed, so they deliver worse Mutual-Information-Values.

References

[1] Canu, S., Grandvalet, Y., Rakotomamonjy, A.: Svm and kernel methods matlab toolbox. Perception Systèmes et Information, INSA de Rouen, Rouen, France (2003)