Practicum: Extending BCILAB and Implementing Custom Methods

EEGLAB Workshop 2013, Track B

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1. Concrete Case Study
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Concrete Case Study

• **Goal**: Implement a method that can predict continuous target values based on brain oscillations
  – Learns spatial filters
  – Learns frequency weighting

• **Data**: Predict time-on-task target variable in imagined-movements dataset userdata/imag.set

• **Script**: Use scripting_tutorial.m, section *Data Curation Example II*
1.1 BCI Paradigm Plugins

Implementing SPoC
The SPoC Algorithm

• Recent method:

• Generalization of CSP to regression settings, similar implementation
  – Start from ParadigmCSP
2.1 Machine Learning Plugins

Implementing Ridge Regression
Ridge Regression

• Regression with l2 regularization
• Implementation available on Wikipedia\(^1\)
• Start from a short/simple existing plugin: ml_trainsvmperf/ml_predictsvmperf
• Introduces a regularization parameter (set to 1 by default)

\(^1\): [http://en.wikipedia.org/wiki/Tikhonov_regularization](http://en.wikipedia.org/wiki/Tikhonov_regularization), 4\(^{th}\) equation
3.1 Signal Processing Plugins

Implementing Delay Embedding
Delay Embedding

• Idea: stacking delayed versions of the signal into multiple channels
• Allows to generalize linear spatial models to linear spatio-temporal models which can implement temporal filters, e.g., FIR filters
• Known to work well with CSP, see: Lemm, Steven, et al. Spatio-spectral filters for improving the classification of single trial EEG, Biomedical Engineering, IEEE Transactions on 52.9 (2005): 1541-1548 – should work with SPoC, too
• Can be implemented on epoched signals or continuous signals – for simplicity, start from simple epoch-based filter (flt_fft)

¹: note, independent_channels must be changed to false