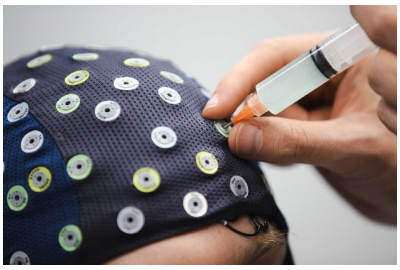
Bachelor's Thesis: Effect of stimulus duration during an rapid serial presentation task

Description



Brain activity can be measured using µ-volt voltage measurements via electrodes placed on the human scalp: Electroencephalography (EEG). This activity is often measured over multiple trials in relation to an event and then averaged over these events to get the event-related potential (ERP). However, calculating ERPs in this way is "flawed" in a sense. They cannot account for trial-wise influences on the brain's response.

Recently, we became interested in such trial-wise influences stemming from the duration of a stimulus, that is, in what ways does your brain react differently if you see a face for one second or half a second?

To evaluate this empirically, we recorded a dataset where participants were presented with pictures of human faces for variable durations. Importantly, these faces were presented in rapid succession, at a rate of multiple faces per second. Such a rapid succession inevitably leads to the overlap between brain responses potentially obscuring our results. To deal with overlap we can make use of linear deconvolution to get the true underlying signal. However, it is not yet clear how well deconvolution works on a rapid presentation task.

In this thesis, you will investigate the influence differing stimulus durations have on the brain's response. In particular, you will preprocess an already recorded dataset and analyze it using a novel, but already implemented, method. We will make use of the unfold-toolbox and deconvolution-based linear regression methods, thus combining overlap correction with stimulus duration estimation.

Primary research questions

- Methodological goal: Investigate the application of deconvolution-based overlap correction in rapid presentation paradigms.
- Scientific goal: Does the duration for which you see a face influence the brain response on a sub-second scale?

Primary goals:

- Preprocess recorded data, building on an existing pipelines in matlab/python
- Analyze the data using deconvolution models via the unfold.jl-toolbox.
- Analyze non-linear duration effects in both conditions (with/without overlap)

Stretch goals:

- Provide a comparison of modelling duration effects non-linearly and linearly

Requirements:

- MATLAB, Python and/ or Julia experience will be necessary.
- Statistics and EEG experience will be helpful but not necessary.

The project will be jointly supervised by René Skukies and Benedikt Ehinger (CCS/VIS/SimTech)

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