

Workshop: Analysis of naturalistic EEG with the unfold toolbox

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Abstract

EEG research is increasingly moving from simple, strictly orthogonal stimulation paradigms towards more naturalistic situations that involve fast, multisensory stimulation or complex motor behavior. As a result, electrophysiological responses from subsequent events often overlap with each other. In addition, the recorded neural activity is typically modulated by numerous covariates, which influence the measured responses in a linear or non-linear fashion. Examples of paradigms where systematic temporal overlap variations and low-level confounds between conditions cannot be avoided include combined electroencephalogram (EEG)/eye-tracking experiments during natural vision, fast multisensory stimulation experiments, and mobile brain/body imaging studies. However, even “traditional,” highly controlled ERP datasets often contain a hidden mix of overlapping activity (e.g., from stimulus onsets, involuntary microsaccades, or button presses) and it is necessary to disentangle these components for a correct interpretation of the results. In this workshop, we introduce *unfold*, a powerful, yet easy-to-use toolbox for regression-based EEG analyses that combines existing concepts of massive univariate modeling (“regression-ERPs”), linear deconvolution modeling, and non-linear modeling with the generalized additive model into one coherent and flexible analysis framework. We will cover the basics of linear model and deconvolution models of EEG. In hands-on exercise, we will disentangle overlapping EEG activity in a simple face recognition experiment.

Keywords

Naturalistic EEG analysis, deconvolution, encoding models, spline regression

Prerequisites

Basic familiarity with Matlab is helpful but not required

Course Schedule (September 11th-12th, 14:00h – 18:00 CET)

Proposed duration of the workshop: lasts 4 hours

Maximum Intake

No limit

Additional requirements

For the hands-on exercises, you need a computer with a more or less recent (> Matlab 2018) version of Matlab installed on it. Matlab versions newer than 2016a may also work, but this has not been tested thoroughly.

Embedded content

www.unfoldtoolbox.org

Recommended Reading

- Smith, N. J., & Kutas, M. (2015). Regression-based estimation of ERP waveforms: I. The rERP framework. *Psychophysiology*, *52*(2), 157-168.
- Smith, N. J., & Kutas, M. (2015). Regression-based estimation of ERP waveforms: II. Nonlinear effects, overlap correction, and practical considerations. *Psychophysiology*, *52*(2), 169-181.
- Ehinger, B. V., & Dimigen, O. (2019). Unfold: An integrated toolbox for overlap correction, non-linear modeling, and regression-based EEG analysis. *PeerJ*, *7*, e7838.
- Ehinger, B. V., & Dimigen, O. (2019). Unfold: An integrated toolbox for overlap correction, non-linear modeling, and regression-based EEG analysis. *PeerJ*, *7*, e7838.