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Recovering cognitive events from trial-level pupil time courses

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Abstract

Pupil dilation is assumed to be a slow and indirect reflection of latent cognitive events. Deconvolution approaches promise a more precise study of these events, assuming that they all trigger a delayed pupil response.

However, conventional deconvolution approaches neglect the possibility that between-event timings and the shape of the pupil responses differ between subjects, trials, and cognitive events. Accounting for this variability however is crucial to 1) achieve precise recovery of latent events and 2) to investigate how trial-level predictors influence cognitive processes.

We present a new method that performs trial-level deconvolution by combining generalized additive mixed models with Hidden semi-Markov models. We tested this method on synthetic data and subsequently applied it to data from a lexical decision experiment (N=24) and recovered six processing events. Investigating the trial-level durations of the recovered events revealed that early visual and late decision-related processing were influenced differently by frequency and word-type.

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