A comparative study between a simplified Kalman filter and Sliding Window Averaging for single trial dynamical estimation of event-related potentials

The classical approach for extracting event-related potentials (ERPs) from the brain is ensemble averaging. For long latency ERPs this is not optimal, partly due to the time-delay in obtaining a response and partly because the latency and amplitude for the ERP components, like the P300, are variable and depend on cognitive function. This study compares the performance of a simplified Kalman filter with Sliding Window Averaging in tracking dynamical changes in single trial P300. The comparison is performed on simulated P300 data with added background noise consisting of both simulated and real background EEG in various input signal to noise ratios. While both methods can be applied to track dynamical changes, the simplified Kalman filter has an advantage over the Sliding Window Averaging, most notable in a better noise suppression when both are optimized for faster changing latency and amplitude in the P300 component and in a considerably higher robustness towards suboptimal settings. The latter is of great importance in a clinical setting where the optimal setting cannot be determined.

General information
Publication status: Published
Organisations: Department of Electrical Engineering, Department of Micro- and Nanotechnology, Biomedical Engineering, University of Copenhagen
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Pages: 252-260
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Computer Methods and Programs in Biomedicine
Volume: 99
Issue number: 3
ISSN (Print): 0169-2607
Ratings:
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.54 SNIP 1.326
Web of Science (2010): Impact factor 1.238
Web of Science (2010): Indexed yes
Original language: English
Keywords: Sliding Window Averaging, Kalman filter, Single trial, Event-related potentials
Source: orbit
Source ID: 266771
Research output: Contribution to journal › Journal article – Annual report year: 2010 › Research › peer-review