Software - Unified algorithm for data cleaning, source separation, and imaging of electroencephalographic signals: Recursive Sparse Bayesian Learning (RSBL)

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BACKGROUND

Electroencephalographic source imaging (a.k.a. magnetic/electric or M/EEG source imaging, ESI, or brain electrical tomography) usually depends upon sophisticated signal processing algorithms for data cleaning, source separation and imaging. Typically, these problems are addressed separately using a variety of heuristics, making it difficult to systematize a methodology for extracting robust brain source images on a wide range of applications.

TECHNOLOGY DESCRIPTION

Researchers from UC San Diego have developed an algorithm based on a probabilistic framework proposed, that allows solving these, apparently dissimilar, problems in a principled manner by optimizing a single mathematical quantity; this quantity is called the Bayesian evidence for the probabilistic generative model of the signal (in short, the evidence of the model). Named RSBL, this algorithm stands for Recursive Sparse Bayesian Learning.

The algorithm is based on two key innovations:

1.Users explicitly model the corrupting effect artifact sources by augmenting the standard distributed generative model of the M/EEG with an empirical dictionary of non-brain source scalp projections such as those induced by eye, muscle, and single channel spatially uncorrelated spike-like activity.
2.Leverage an anatomical brain atlas to encourage the sparsity of the functional images obtained, resulting in a reduced number of relevant brain activations per image, thereby facilitating their interpretation. The sparsity constraint is automatically regulated in a data-driven manner.

APPLICATIONS

When the algorithm is used to obtain a time series of brain images (brain mapping/imaging use), the aforementioned innovations have the desired property of inducing the segregation of the cortical electrical activity into a few maximally independent components with known anatomical support, while artifactual activity is also segregated into their respective components (source and artifact separation use). Thus, clean data can be obtained by zeroing out the contribution of artifactual sources (data cleaning use).

MATLAB code and examples maybe downloaded for educational use only from the PEB repository: downloaded from the PEB2

repository: https://github.com/aojeda/PEB

INTELLECTUAL PROPERTY INFO

License Information. For commercial use or those desiring to incorporate the RSBL software into commercial products or use for commercial purposes, please contact UC San Diego for a commercial license.

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OTHER INFORMATION

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