Paradigm Free Mapping vs Total Activation

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Abstract

Here's where the fantastic abstract will go.

Keywords: fMRI deconvolution, paradigm free mapping, total activation

1. Introduction

- Talk about our motivation for this paper.
- We could mention iCAPs Neuron, and papers with applications like PFM, TA, clinical patient papers with iCAPs.
- Apart from [[Richard F. Betzel]]'s work [1, 2, 3], we could mention the connection with the [[Multiplication of Temporal Derivatives]] method [4, 5].
  - These are basically calculating the derivative, which is the same as applying a high-pass filter and calculating the correlation.

Here is a sample reference: [6].

2. Theory

- What is deconvolution and different formulations presented as a review.
- Analysis vs synthesis
  - TA paper but without the spatial regularization
  - PFM paper
  - In Gitelman it's an **H** multiplied by a Fourier term.

The hemodynamic response to neuronal activity y_t at time t can be modeled as the convolution with a finite impulse response function of the neuronal signal $x_{t-\tau}$ at time $t-\tau$ with the haemodynamic response function h_τ:

$$y_t = \Sigma_t h_\tau x_{t-\tau} \tag{1}$$

Functional MRI (fMRI) data analyses are often directed to disentangling and understanding the neural processes that occur among brain regions. However, interactions in the brain are expressed, not at the level of hemodynamic responses, but at the neural level. Thus, an intermediate step that estimates the underlying neuronal activity is necessary for such analyses. Given the nature of the fMRI BOLD signal, the appropriate approximation of the neuronal activity can be obtained by means of deconvolution with an assumed hemodynamic response[6].

2.1. Paradigm Free Mapping

$$\hat{\mathbf{y}} = \arg\min_{\mathbf{y}} \|\mathbf{y} - \mathbf{Hs}\|_2^2 \quad \text{subject to} \quad \|\mathbf{s}\|_p \leq \alpha \tag{2}$$

2.2. Total Activation

3. Results

- Methods on how we're doing simulations and results (with simulations and experimental data)
  - Different SNRs and maybe even use CAPs
  - Selection of HRF explained if both use the same but it's different from what's used for simulating.
    - What happens? For example with gamma for simulating.
  - Selection of regularization parameter
    - Present with real data on a voxel

4. Discussion

- Pros and cons of each formulation: analysis vs synthesis
- Link with other approaches

- Finish with conclusions and a moving forward
  - We have to refine the deconvolution
  - HRF variability there are three: conference proceeding by Philippe, ISBI 2012 by césar, and Farouj with different formulation. Say conceptual differences among those.
  - Mention stability-selection[7]
  - Debiasing
  - Connected to debiasing other deconvolution algorithms that are based on norm lower than 1.

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