NeuroField

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Abstract

Draft on publication of NeuroField to document capability, usage, and example results. Other internal documents exist: a user manual and a developer manual.

Keywords: Neural field theory, EEG, neurophysiology, methods, modeling

1. Introduction

Motivation behind neural field theory: large-scale neural dynamics.

Neural field theory of Robinson et al, EEG spectra, alpha and beta peaks, etc:

$$D_{ab}V_{ab}(\mathbf{r}, t) = \nu_{ab}\phi_{ab}(\mathbf{r}, t),$$

$$Q_a(\mathbf{r}, t) = S_a\big[\sum_b V_{ab}(\mathbf{r}, t)\big],$$

$$\mathcal{D}_{ab}\phi_{ab}(\mathbf{r}, t) = Q_b(\mathbf{r}, t - \tau_{ab}).$$

NeuroField: a general code to solve the neural field theory by allowing users to:

1. Specify an arbitrary number of populations and connections between populations;

2. Specify the parameters for any objects, including populations, dendritic responses, firing responses, propagators, synapses, and stimulus pattern;

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2. Method and Results

NeuroField solves each equation within the Robinson et al. model with an object:

$$P = \nu_{ab}\phi_{ab}, \qquad\qquad \texttt{Couple}$$

$$D_{ab}V_{ab} = P, \qquad\qquad \texttt{Dendrite}$$

$$Q_a = S_a\Big[\sum_b V_{ab}\Big], \qquad\qquad \texttt{QResponse}$$

$$\mathcal{D}_{ab}\phi_{ab} = Q_b, \qquad\qquad \texttt{Propag}$$

where an arbitrary number of these objects, with each object may be a different type (e.g. constant synaptic coupling vs plastic synaptic coupling), and all parameter values may be tailored.

Examples for single excitatory population, cortical population, corticothalamic model. Each example has a population diagram, and related results. All examples should preferably be published result?

3. Discussion

Overview of any tricky issues with the problem being solved e.g. EEGLAB mentiones limitations of time/frequency decompsition. Discuss limitations or qualifiers on the usage of the code.

4. Acknowledgements

To add.

5. References