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EPJ Nonlinear Biomedical Physics

Thematic series on Advances in Neural Population Models and Their Networks

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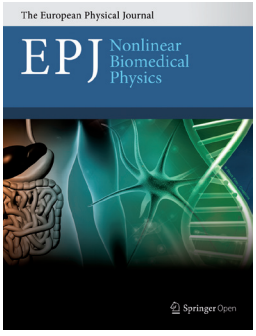

Neural population models (NPMs) describe the overall behaviour of large ensembles of neurons. Various names have been used for this general approach according to mathematical and conceptual detail: neural mass models, mean field models, neural field models, cortical field theory, etc. Since not all neurons are modelled individually, a distinct advantage of these lumped models is the reduction in dimensionality of both the parameter and variable space, which reduces computation time and makes possible sophisticated mathematical analyses of the model's behaviour as well as their application to experimental data. Nevertheless, NPMs retain their biological interpretability, allowing researchers to investigate a wide range of brain function in health and disease, as well as the effects of drugs and other extraneous influences.

Current non-invasive neuroimaging methods such as EEG, fMRI and MEG measure in various ways the activity of sizable groups of neurons, making their data a natural target for NPMs. Furthermore, thanks to the speed with which NPMs can be evaluated one can computationally match the ability of these modalities to record the activity of entire brains. In combination with rapid experimental progress in determining the large scale connectivity (the connectome), this is leading to novel NPM-based methods for the modelling of partial or even full brain networks. Typically such models are characterized by time delays via signal propagation along connecting fibres with NPMs as network nodes. They promise to make NPMs the tool of choice for neuroimaging analysis in the future.

Topics of interest for this thematic series include but are not limited to the following advances in neural population modelling:

- the inclusion of neural mechanisms such as spike rate adaptation or bursting
- the effects of higher order statistics on the dynamics
- the formal and/or computational correspondence between microscopic and macroscopic models
- adapting models for different regions of the brain
- describing pathologies and drug effects
- the development of new analytic tools for these systems
- determining the effects of connectivity on dynamics
- building partial and full brain networks
- studying large scale brain dynamics in health and disease
- addressing cognition through associated brain processes

Authors are cordially invited to submit original research papers on novel techniques, theoretical analyses and simulations, as well as applications to experiment and data analysis, of recent developments in neural population models and their networks.

Submission Schedule

► Manuscript due:
November 15, 2013

Submission Instructions

Before submission, authors should carefully read over the 'Instructions for Authors', which are located at http://www.epjnonlinearbiomedphys.com/authors/instructions. Prospective authors should submit an electronic copy of their complete manuscript through the SpringerOpen submission system at http://www.epjnonlinearbiomedphys.com/manuscript according to the submission schedule. They should choose the section 'Systems Neurosciences and Integrative Brain Research' and then choose the subsection "Thematic series: Advances in Neural Population Models and Their Networks". In addition, they should specify the manuscript as a submission to the "Thematic series on Advances in Neural Population Models and Their Networks" in the cover letter.

Guest Editors

Ingo Bojak, School of Systems Engineering, University of Reading, UK and Donders Centre for Neuroscience, Radboud University Nijmegen (Medical Centre), The Netherlands

Stephan A. van Gils, Applied Mathematics, University of Twente, The Netherlands

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