Modeling neural mass action in brain networks using delay differential equations

July 22, 2009 - Berlin, Germany

Workshop homepage: http://personal-homepages.mis.mpg.de/fatay/cns09.html

A satellite workshop of the CNS 2009: Eighteenth Annual Computational Neuroscience Meeting, 18-23 July 2009, Berlin, Germany.

Organizers

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Description

Information processing in the brain is largely based on dynamic interaction within a complex network of neurons. Neural mass action plays an important role in this process and is, in contrast to single neuron activity, accessible to non-invasive measurement by EEG, MEG and fMRI. Therefore, mathematical models for the dynamic behavior of interconnected neural masses are suitable for the description of the relationship between neural activity, brain measurements and psychological functions. The finite transmission speed within these networks causes time delays and creates special challenges for the mathematical treatment. In this workshop, techniques will be presented and discussed, which (1) describe masses of neurons by their mean membrane potentials and firing rates, (2) model interactions between these masses, in particular under consideration of time delays, (3) incorporate biological knowledge into the models, (3) solve the resulting systems of differential equations effectively and (4) analyze the dynamic properties of the models, in particular through bifurcation diagrams.

Program

13:30-13:35 Fatihcan Atay, Introduction

13:35-14:10 Thomas Knösche (MPI for Human Cognitive & Brain Sciences, Leipzig), Bifurcations in neural mass models.

14:10-14:45 Axel Hutt (LORIA, France), The activity dynamics of spatially extended neural populations subject to additive noise.

14:45-15:20 Hecke Schrobsdorff (BCCN Göttingen), Localized activity in two dimensional neural fields.

15:20-15:45 Break

15:45-16:20 Fatihcan Atay (MPI for Mathematics in the Sciences, Leipzig), Stability and complex dynamics in neural fields with propagation delays.

16:20-16:55 Thomas Wennekers (University of Plymouth), Neural field models of spatio-temporal receptive fields.

16:55-17:30 David Liley (Swinburne University of Technology, Australia), Mass action approaches to modeling the genesis and dynamics of the human alpha rhythm.

17:30-18:00 General discussion

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