Title (tentative): The site of initiation of action potentials in the axon determines the maximal information transfer bandwidth in cortical neurons in silico

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Description

Motivation and application domain

Recent experimental measurements showed that cortical neurons display an information transfer bandwidth much wider than predicted by classic Hodgkin and Huxley models, linked to fast action potential onset kinetics.

General objectives and main activities

Previous studies suggested a relation between the distance of the initial axonal segment from the soma and the rapid onset of action potentials (Telenczuk, 2016) and between the rapid onset of action potentials and the information transfer bandwidth (Testa-Silva, 2014). We then suggest the existence of a direct relation between such a distance and the information transfer bandwidth. The aim of this thesis project is to extend the protocol of these previous works and to explore this relation through in silico simulations of a variety of models, from simple two compartmental models, to morphologically reconstructed multi compartmental models.

Training Objectives (technical/analytical tools, experimental methodologies)

Use and development of advanced neuronal computational models.
Learning program language for running simulations of ad hoc computational models.
Data processing.
Data analysis.

Place(s) where the thesis work will be carried out: University of Antwerp

Additional information

Pre-requisite abilities/skills: Computational Neuroscience

Maximum number of students: 1

Financial support/scholarship: Erasmus +