# Functional modelling of cortical macro-networks

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## Abstract

This dissertation is about interaction networks of cortical areas, macroscopic ensembles of neurons connected by synapses, implementing behavioural functionalities such as perception, action and cognition. Different mathematical modelling approaches can be used to test hypotheses about such networks' structure, function, and the relation of the two.

The first part of the dissertation studies the structure of cortical macro-networks: by introducing a graph theoretical measure applicable for directed networks, I identify roles of vertices in information processing and introduce a network comparison and classification method. To create a random graph model of the cortical network, I propose a graph generation algorithm. I use the introduced methodology to investigate the information processing role of the prefrontal areas.

The second part of the dissertation studies functional subnetwoks of the cortex: a model consisting five areas, implementing associative learning, is proposed, and tested against measurement data using statistical model inversion and comparison. I investigate alterations of the connectivity model in schizophrenia to test possible deficits in cognitive control. I study the intrinsic connectivity changes in the prefrontal neural networks, possibly contributing to memory dysfunction.