The Promise of Complex Network Analysis for Neuroscience: Graphing the Adaptive Reconfiguration of Structural and Functional Brain Networks

Fred Hasselman

Behavioural Science Institute
Radboud University Nijmegen, the Netherlands

Recently, the graph theoretical analysis of signals recorded from resting-state brain activity has advanced significantly (e.g. [1-3]). Many studies have now shown it is possible to distinguish between patient populations with degenerative neuropathology such as Alzheimer's disease, Parkinson's disease, epilepsy and brain tumours [4-7] and are based on analysis of just seconds of resting state activity [8]. In this talk I will discuss these recent developments and their significance for the study of the adaptive reconfiguration of complex brain networks [9,10], for instance induced by treatment or therapy. I will especially focus on the theoretical connection between structural network topology, functional connectivity, fractal scaling [11-13] and the analysis of recurrent events (recurrence quantification analysis) [14]. I will argue that exploring this connection holds the promise of increasing our understanding of the many reciprocal micro to macro scale interactions that exist in the brain-body-environment system.

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