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Functional Analysis of Networks in the Neural System

Technology ID
z09185-z09028

Category
Life Sciences/Diagnostics & Imaging
Life Sciences/Research Tools

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Functional Analysis of Neural Networks for Disease Monitoring

A groundbreaking functional assessment of networks algorithm called Simultaneous Departure from the Equilibrium (SDE) has been developed for the analysis of global interactions in a system. The technology was developed to evaluate how departure from equilibria can be used to assess the stability or health of a complex network. The software algorithm has been applied to the interaction of neurons in the neural system in order to map neural function both in vitro and in vivo. Used as a functional in vivo biomarker, initial studies demonstrated an 85% correct classification rate of Alzheimer's patients versus healthy controls using magnetoencephalography (MEG). It is expected that the technology will be compatible with other imaging modalities, such as electroencephalography (EEG) and magnetic resonance imaging (MRI). Moreover, the efficacy of therapeutic treatments can be monitored from the perspective of network health. Additionally, as a research tool it has been validated with in vitro studies of cultured brain tissue exposed to a known risk factor of Alzheimer's disease.

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Functional Network Analysis for the Neural System

Networks comprise daily life; society, organizations, cells, and even neural networks constitute complex, interrelated networks. While current methods of assessing the functional status of systems focus on aggregate measures such as means, variances and distributions, very little attention is given to how the interactions between individual facets of the system affect its overall function. Effects on the dynamics of the system are not included in current network assessments, which only evaluate 2-element interactions and disregard the network as a whole. Technology that focuses on the entire system and the interactions between all of its elements would be invaluable in the study of many types of networks, specifically neurons in the neural system in terms of health and disease monitoring.

BENEFITS OF NEURAL SYSTEM FUNCTIONAL ANALYSIS:

- Potential diagnostic and monitoring capabilities for neurological diseases
- Compatible with MEG and potentially MRI and EEG
- Assesses interactions in large complex networks that may be infeasible via other means
- Can be applied to a diversity of networks beyond neural networks
- Correctly identifies and predicts dynamics of entire networks rather than pairs or subsets of network elements as it typically done

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