Directed Transform Function Approach for Functional Network Analysis in Resting State fMRI Data of Parkinson Disease

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Parkinson's disease (PD) is a progressive neurological disorder characterized by tremor, rigidity, and slowness of movements. Specific changes associated with various pathological attacks in Parkinson Disease can be indicates in directional interaction of the brain Network from resting state fMRI data. For constructing the directional brain network from spontaneous activity in resting state, we used Directed Transform Function (DTF) approach combining with graph theory. The proposed method applied on each pair of reference time series of the selected regions in the frequency domain. Furthermore, topological parameters like degree of a given node were calculated for graphs in three frequency bandwidths. Minimum significant connections of between group analysis in the upper frequency bandwidth depicted that there are common influence information in upper band between PD and healthy. Moreover, inter-group comparison analysis of resting state shows that effective interactions in PD are stronger than healthy. Furthermore, some brain regions such as left thalamus has the most information flow in PD which characterized by pivotal regions which were influenced by the other brain regions. We found that DTF analysis in frequency domain combined with graph structure could potentially provide information on directional interactions within regions.