Dynamic Functional Connectivity Analysis for fMRI data: An application to Classification of Cocaine-Addicted Patients vs Healthy Controls

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Abstract:

A dynamic sliding window-based method, namely dynamic functional connectivity (DFC), which assesses temporal dynamics of functional connectivity among different brain networks based on fMRI data, was recently developed by Sakoglu et al. [1-4] and it has gained much attention. DFC method provides much more information about the dynamics of interaction among the brain regions than the static FC method does.

The DFC method can be applied to predefined brain regions of interest, as well as to brain regions determined by data-driven methods such as independent component analysis (ICA). Also, DFC can be applied to both resting-state fMRI data, and also to task-based fMRI data in order to study task-modulation of functional connectivity, since DFC can quantify the temporal evolution of functional connectivity. In addition, DFC-based features can be used as input to pattern classification / machine learning algorithms for classification of "brain states" and for classification of participants with different brain diseases or conditions; DFC-based classification can lead to better classification accuracy when compared with just using static functional connectivity based features.

In this talk, DFC-based analysis and classification results from an fMRI dataset, which was obtained from cocaine addicted patients and healthy control participants, will be presented. When combined with a powerful data-driven brain activation analysis method ICA, it will be shown that DFC-based classification method can lead to better overall classification accuracy results for classifying cocaine addicted patients vs healthy control participants, reaching over 90% sensitivity and specificity.