

Summary – PhD Prospectus

Presenter: Jason Barrett

Advisor: Prof. Weiying Dai

Title: Spectral Clustering for Functional Connectivity Detection

Objective:

Study the effects of clustering techniques for monitoring the different regions of the brain that are activated at different times. The main imaging technique that has been targeted is fMRI (functional magnetic resonance imaging) that enables us to observe temporal fluctuations in human brain activity. The presenter shows how spectral clustering algorithm (SCA) can be improved to robustly identify networks at varying levels of noise than traditional SCA.

Proposed Work:

Baseline formed using seed base analysis, which is the most common model driven method in resting state fMRI analysis. So basically, form a baseline based on the brain image data collected when the subject is in a resting state.

The presenter also showed that how k-means and SCA, both can be used to detect functional networks, but I could not follow why and how SCA was better at performing at this task than k-means.

The presenter then also explained the SCA pipeline which included – preprocessing, correlation, and Laplacian matrix, etc. Also used Nystrom approximation algorithm because SCA requires matrix eigen decomposition which is a huge matrix – so Nystrom uses only a subset of the matrix.

Also, used pearson's correlation to study the problem but could not follow some the limitations he encountered while using this method.

A long discussion took place with committee members Prof. Kenneth Chiu and Prof. Weiying Dai on the real-time data results over all the methods.

Finally results were shown by comparing the dice coefficient scores for different methods used SCA-ED, SCA-PC etc.

Future work included more variations of SCA methods on ASL data and improving them further.