Differential Connectivity Graph: Application on the Identification of Leading Epileptic Regions

In this presentation, a new graph analysis method: Differential Connectivity Graph (DCG) is aimed to be explained. DCG is a robust method for identification of discriminative connections between two states. When the data includes a mixture of interested and uninterested events, it is complicated to extract the graph specific to the interested event. DCG is developed to extract the most statistically significant connections related to the interested event by decreasing the effect of uninterested event. DCG is robust due to 1) large number of sample size, and 2) powerful statistical methods like permutation. DCG nodes include regions involved in the interested event either source, sink, or transit. To differentiate between source and other sink or transit nodes, we propose a new graph measure: local information (LI). DCG can be calculated for different frequency bands. To infer a set of source nodes from LI values of different DCGs, a multi-objective optimization method (Pareto) is used.

The DCG method is applied on the intracerebral EEG (iEEG) recordings of epileptic patients to identify the leading epileptic regions (source nodes). The method is applied on the iEEG recordings of five patients. The estimated leading epileptic regions are congruent with visually inspected results provided by the epileptologist.