Analysis of Functional Brain Connectivity using Graph Theory in Alzheimer's Disease

THE UNIVERSITY of EDINBURGH informatics

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1. **Introduction**

Early diagnosis of Alzheimer's Disease (AD) may significantly delay symptoms. The projects' objective is the creation of a data processing pipeline that receives as input magnetoencephalography (MEG) recordings and predicts illness presence.

AD is the most frequent cause of dementia. Mild Cognitive Impairment is an earlier stage of AD with memory loss as the main symptom. Biomarkers based on differences between brain synchronisation may identify the illness in advance.

2. **Goals**

What are the identifiable differences in functional brain connectivity between populations of AD, MCI and control subjects (CS)?

- Signal Processing: compute correlations between pairs of MEG sensors
- Graph Analysis: compute connectivity graphs and graph measures
- Classification: predict subject group based on graph features

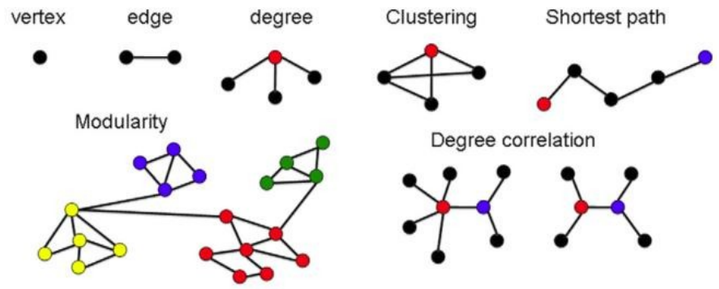

Fig. 1 Graph Measures

3. **Methodology**

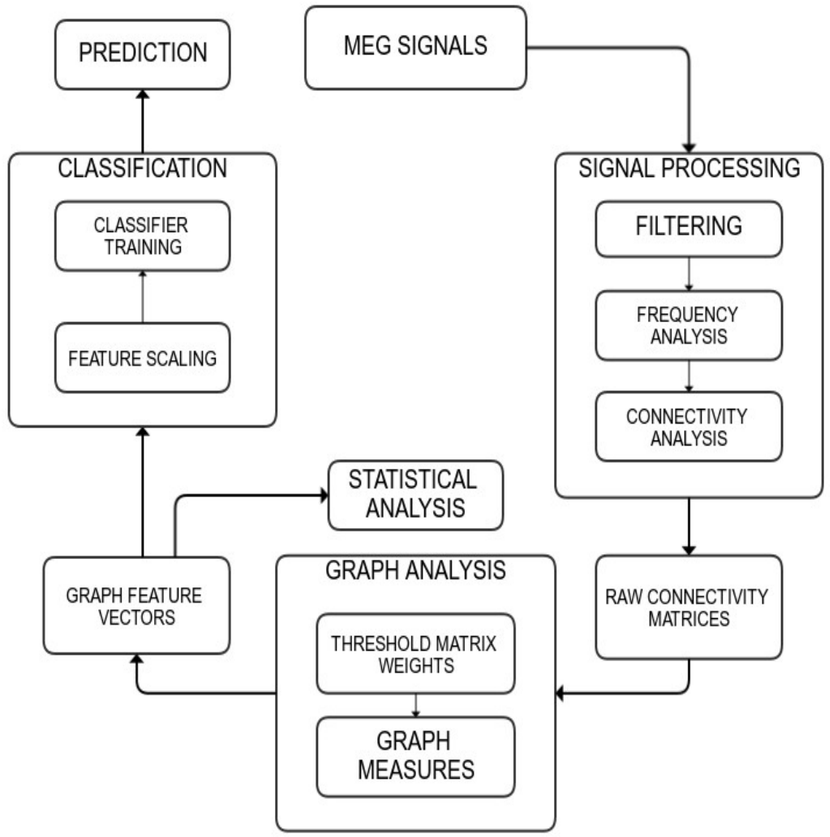

Fig. 2 Data Processing Pipeline

4. **Results and Conclusions**

- Small-world measure is smaller in AD networks than in CS graphs: decreased network organisation in AD networks
- Random forest performs better than logistic regression (F-score 0.7 vs 0.4)
- Classification not feasible in clinical setting due to sensitivity and specificity

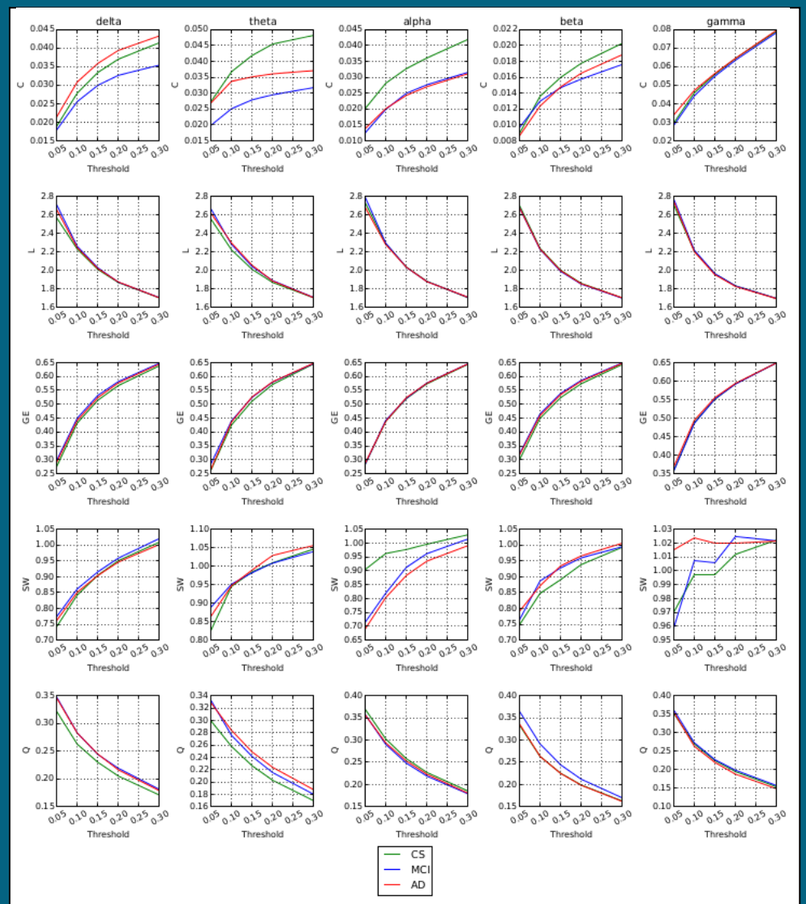

Fig. 3 Results

5. **Further improvements**

- Explore different connectivity measures
- Source reconstruction

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