Determining Dynamic Brain Networks from resting-state fMRI data

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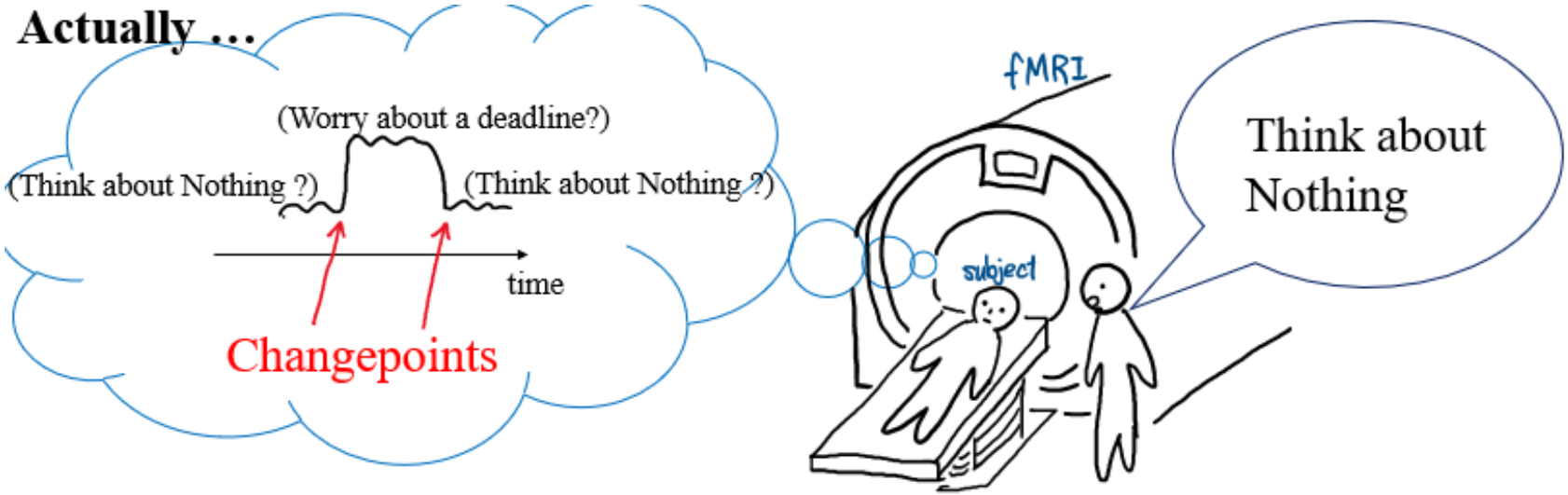
Introduction

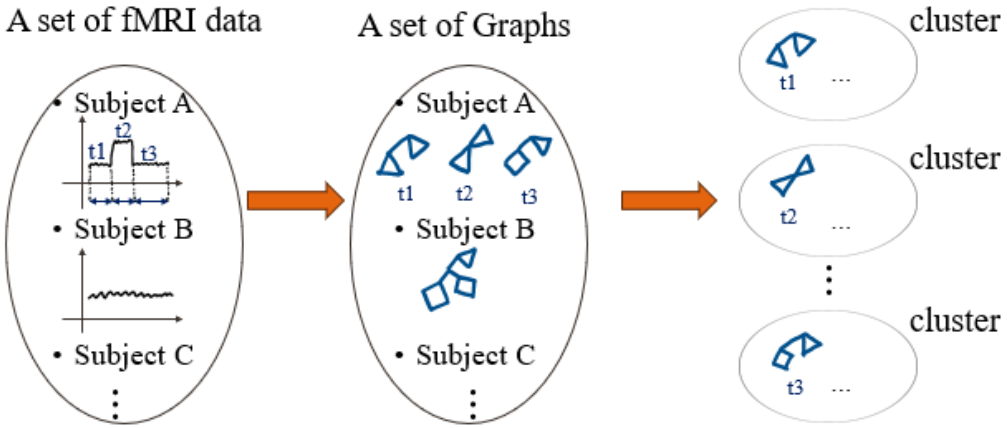
Data (rs-fMRI data):
Some subjects have change points in their mean time series.

- Aim: Determine dynamic brain networks



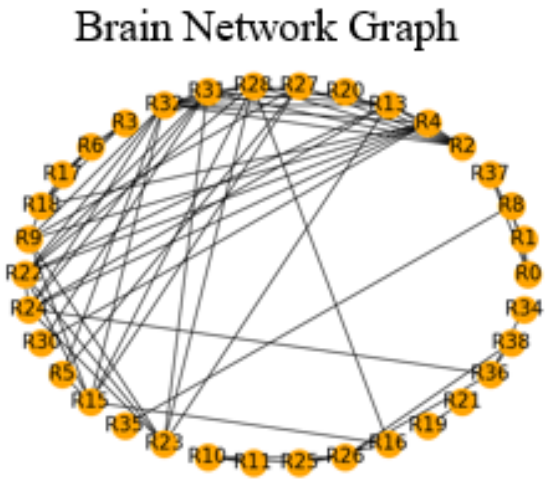
Method

1. Produce brain connectivity graphs
   - Each graph corresponds to a time section segmented by changepoints
   - For subjects with no change points, only one graph is produced
2. Find clusters in the set of graphs
3. Compare networks from each cluster



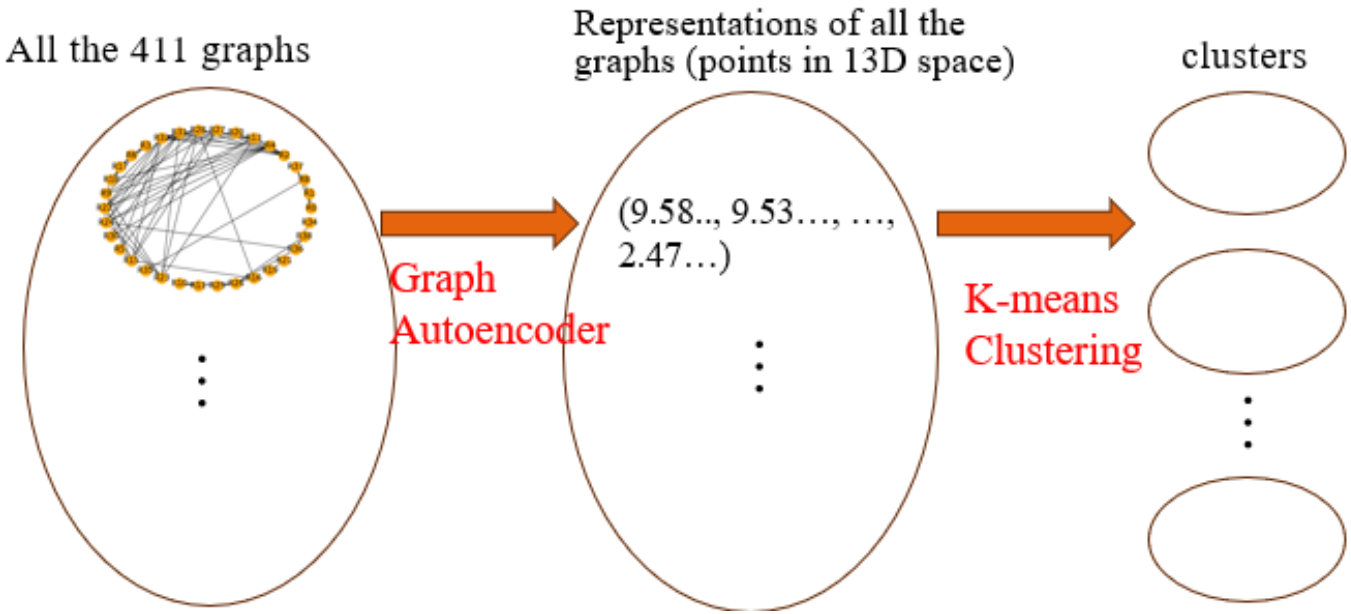
Produce brain networks

- Preprocessing (detrend & fix motion and change shapes to match with template)
- MSDL atlas with 39 regions.

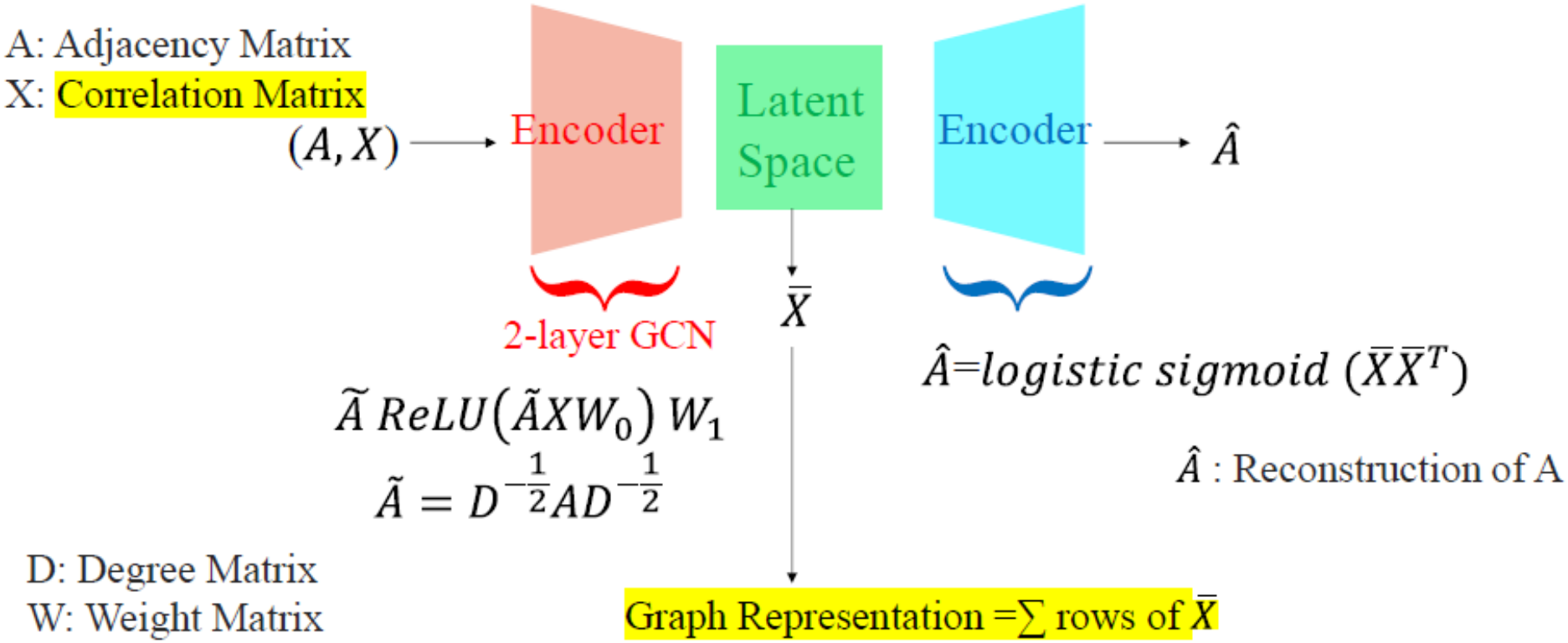


Clustering Analysis

1. Represent graphs as points in 13D space using Graph Autoencoder
2. Find clusters on this set of points using K-means Clustering

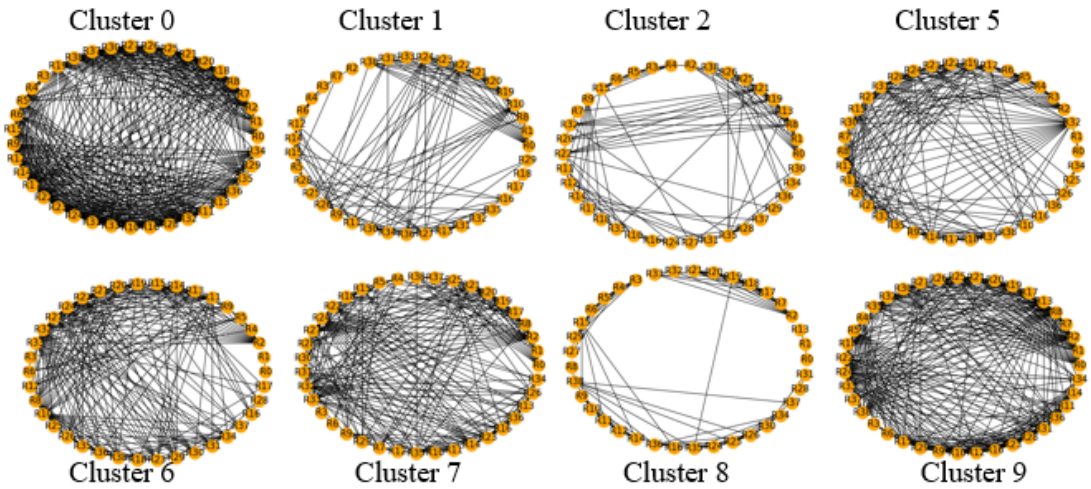


Latent space representation



Compare Networks

For each point closest to the centroid for each cluster, graphs are inverted. 8 big clusters were found (K=10)



- Only 8 (out of 107) subjects with changepoints have their three graphs in the same cluster
- Only 17 subjects with changepoints do not have a change in how dense their graphs are

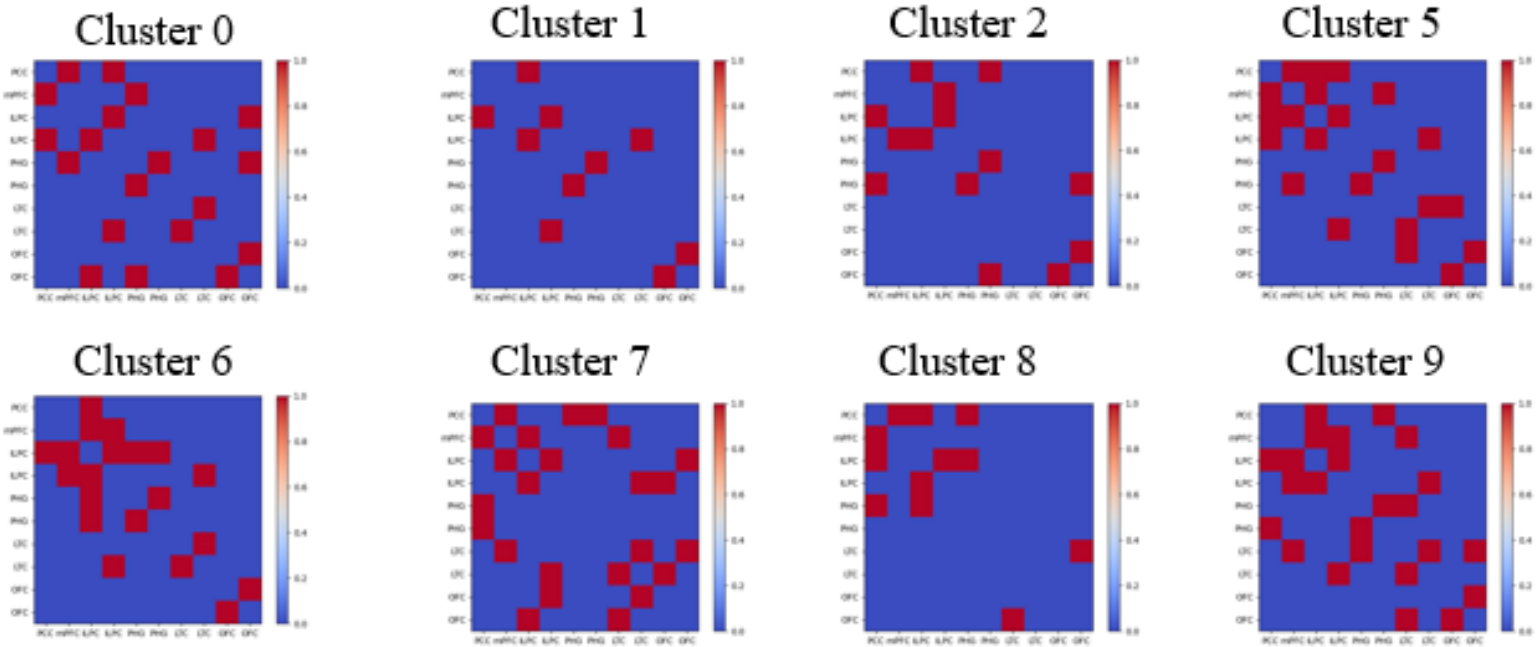
Details of clusters

Each cluster has a higher proportion of graphs of some type.

	No change points	1st time segment	2nd time segment	3rd time segment	Total
Cluster 0	14	7	12	21	54
Cluster 1	4	6	5	9	24
Cluster 2	8	20	15	18	61
Cluster 3	0	1	1	0	2
Cluster 4	1	1	1	3	6
Cluster 5	14	19	13	10	56
Cluster 6	11	13	13	8	45
Cluster 7	8	14	20	15	57
Cluster 8	12	8	16	14	50
Cluster 9	18	18	11	9	56
Total	90	107	107	107	411

Compare networks with DMN

Clusters 5 and 6 show a strong connection between regions related to the Default Mode Network



Compare networks with DMN

Clusters 1. 6, 2, 7, and 8 look like the Default Mode Network.
Clusters 0 and 9 do not show the features of the Default Mode Network.