Cross Ties in Structural Brain Networks and Alzheimer's Disease

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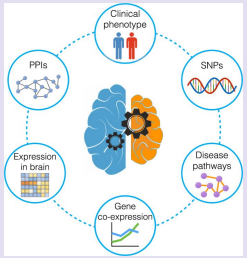
Highlights

- A wellbrain regions that serve the function of memory and cognition are highlighted. Those include the temporal lobe and the Limbic system
- The temporal inferior, the Orbital, the temporal pole, and the circular insula anterior are nodes contribute to the disease
- All regions are related to cognition, memory processing, and decision making. Further research would need to be done before we find out the exact nodes or regions of the brain that explain the onset of the disorder the most

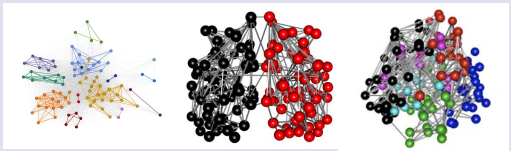
Background

Alzheimer's is the most common cause of dementia, it accounts for **60-80%** of dementia cases. The greatest known risk factor us increasing age, and the majority of people with the disorder are 65 or older. In the early stages, memory loss is mild. But with late-stage Alzheimer's, individuals lose the ability to carry on conversation respond to their environment.



Data

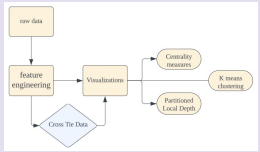
The data we are studying from is provided by Boniha and other contributors in 2015. it is comprised of 120 subjects recruited from a local community in South Carolina with ages between 55-90. The connectivity of 148 brain nodes across both hemispheres was recorded..



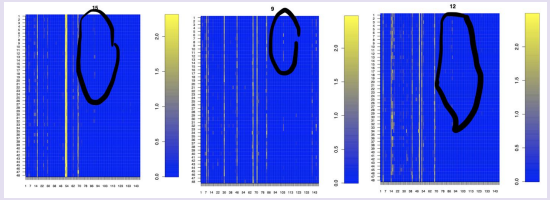
3D plots construct the 3D brain image of the first individual. This gives us a sense on how the weighted edges are connection between each other and across hemispheres. We restricted our focus to only the top 5% greatest edge weights given the enormous number of subtle connections in a structural brain network

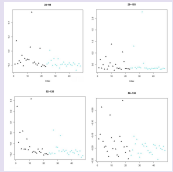
Model

Having examined 148 brain nodes, our first analyzing their connections within an individual's brain. Image plots and scatter plots further validated these findings by highlighting relationships between left and right node pairs. Next, I created informative PaLD graphs for the cognitive normal and Alzheimer's groups, For deeper investigation, we extracted diverse samples from the interconnections and evaluated their assortativity scores.



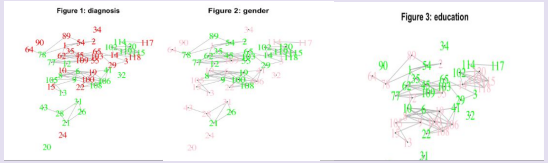
Visualizations



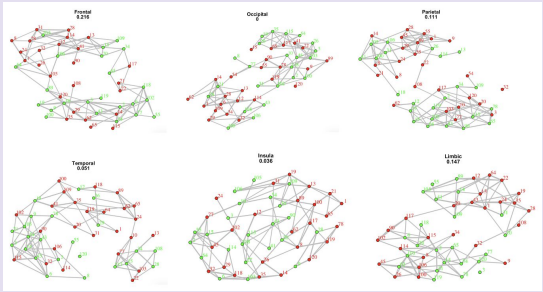


Each plot shows the connection from one place in the brain to the other. We noticed that those light areas are in the cross ties. Looking at the x-axis, we could see that the location of those yellow blocks roughly goes with the region on the cross side of the hemisphere. Those results suggested that something must be happened for the cross.

Partitioned Local Depths Plots



State the main take-away from this graphic succinctly For "figure 1: diagnosis," Green numbers correspond to the good (cognitive normal) and red ones correspond to the bad (Alzheimer's Disorder). The output looks pretty good. It seems that the red ones are kind of in the middle and the green normal ones are at the peripheral. The figure shows that the 43, 23, 31, 26, 21st individuals are similar and 114, 102, 120, 115, 119 are similar. In a good (cognitive normal) way.



The assotativity score for frontal lobe is the highest, about 0.216, then Limbi which is 0.147, then Parietal 0.111, Temporal 0.051, Insula 0.036, and Occipital which is roughly 0.