Introduction to Connectomics

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Graph Analysis Write-Up

The first step we took was to run the scienceinthe.cloud docker demo. Although we were initially confused by the long runtime, the program worked as intended, and after looking back noticed that there was a comment above explaining the long computation time. The other issue we encountered was some trouble connecting and a lack of instruction around replacing 'localhost' with our ip address. Overall however, the code was fully reproducible, well documented, and easy to run.

Next we computed the mean connectomes for the entire sample population, and the male and female subpopulations. This was done by converting from a graph to a matrix, averaging the matrices, and displaying them to the screen. Unfortunately, this did not give us any considerable insight into what covariates may be helpful in distinguishing male from female brains.

The five covariates implemented to help distinguish male from female connectomes were: (1) degree centrality of nodes, (2) the shortest path between a node, (3) average node clustering, (4) the closeness centrality, and (5) the eigenvector centrality. These covariates provide insight on the types of connections in the human connectome. For example, it is known that there are more connections across the hemispheres of female brains than male brains. Thus, measures for the density of connections, quantity, and placement of nodes can help glean useful information into sex related neuronal differences. After adding these covariates to the feature vector, an accuracy of 0.62 was obtained, which suggests that these factors helped to distinguish the two brains.

Lastly, we used a different classifier to distinguish male and female connectomes. Specifically, we used a convolution neural network implemented with tensorflow. The base convolution neural network code was the same as that which Ronan submitted for the prior project. However, modifications were made in order to train the network on the connectome data and to evaluate its accuracy. Using this tensorflow classifier, we were able to obtain an accuracy of 0.69.