EN.580.694: Statistical Connectomics
Final Project Proposal

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Evaluation of Clustering Algorithms Using Mouse Connectomic Data *TODO: D*RAFT

Opportunity Recent advances in increasingly higher resolution axon tracing techniques have enabled the compilation of whole connectomes at an unprecedented level (Zingg and Hintiryan, et al. 2014). The Mouse Connectome Project assembled a complete cortico-cortical mesoscale connectome for the mouse cortex. The data gleaned from this has far-reaching implications in how the brain communicates with itself and processes information.

Challenge Identifying subnetworks of the connectome is not a straight-forward task. There are many different ways to cluster data and what information is meaningful and/or useful can change hugely based on the clustering algorithm used. For this connectivity data, it makes sense to compare a variety of methods and see what performs the best, based on anatomical data.

Action First, I seek to imitate the same clustering algorithm used in the Zingg and Hintiryan paper (connectivity based clustering). Then, I will run a separate technique using a proximity based clustering algorithm. This can be compared against data from the Allen Brain atlas to check for accuracy.

Resolution

Future Work

Statistical Decision Theoretic

Sample Space $(A, P) \in \mathcal{A}_N \times \mathcal{P}_N = \mathscr{G}_N$, where Adjacency Matrices: $A = \{0,1\}^{N \times N}$ and Vertex Positions: $P = \{P_i\}$, where $P_i = (x_i, y_i, z_i) \in \mathbb{R}^3$.

Model $\{SBM_N^{k_i}(\rho, \beta) : \rho \in \Delta_{k_i}\ \beta \in (0,1)^{k_i \times k_i}\}$

Action Space $\mathcal{W}_n \times \mathcal{W}_n$, where $W \in \mathscr{Z}^{n \times n}$, $\forall$ n corresponding to three different atlases, $\{Desikan, Destrieux, DKT\}$, and $\mathscr{Z} = \{0, 1, 2, ...\}$. In words, W is a weighted adjacency matrix.

Decision Rule Class $f : \mathcal{A}_N \to \mathcal{W}_n$

Loss Function $\ell(\hat{W}_i^k, \hat{W}_j^k) = ||\hat{W}_i^k - \hat{W}_j^k||_F^2$

Risk Function

$$R = E[L] = \sum_j^{\mathscr{G}} L(G, G_j) \cdot p(G)\ /\ |\mathscr{G}|$$