
EN.580.694: Statistical Connectomics

Final Project Proposal

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Using a Random Dot Product Model to Approximate the (clustering?) of the C. Elegans Connectome

Opportunity The Paper by [1] contains an analysis of ERMM, SBM, [other two methods] for C. Elegans. There's an opportunity to do the same level analysis comparing ERMM as a baseline to a Random Dot Product Graph Model (RDP) on C. Elegans, and comparing the results. If using this method provides statistically significant results, then it may be a useful tool for connectomics.

Challenge The challenge to this problem is formulating the problem correctly, performing a correct statistical test on the connectome, and validating the results.

Action Random Dot Product Graph Model is a graph model that can be used in place of other models. I will test the Random Dot Product Graph Model using C. Elegans Data.

Resolution We will show whether the Random Dot Product Graph Model is able to cluster the connectome into similar modules as ERMM.

Future Work The results of this paper will give insight to when a Random Dot Product Graph Model could be used in a graph statistical problem.

Statistical Decision Theoretic

Sample Space The sample space is the connectome of C. Elegans.

Model The model is the RDP Graph Model. ERMM will also be used in a separate test as a comparison.

Action Space The Action Space is the distribution of all possible Random Dot Product Graphs.

Decision Rule Class The decision rule is block assignments for each vertex.

Loss Function The loss function is the Integrated Classification Likelihood so we can compare across different blocks. [1] equation (7).

$$ICL(\mathcal{M}_q) = \max \log |\mathcal{L}(x, \tilde{z} | \mathcal{M}_q; \phi) - \frac{1}{2} \frac{Q(Q+1)}{2} \log \left[\frac{n(n-1)}{2} \right] - \frac{Q-1}{2} \log [n]$$

Risk Function The risk function is the expected value of the loss function $R = E[]$.

References

- [1] D. M. Pavlovic, P. E. Vértés, E. T. Bullmore, W. R. Schafer, and T. E. Nichols. Stochastic Blockmodeling of the Modules and Core of the Caenorhabditis elegans Connectome. *PLoS ONE*, 9:97584, July 2014.