

Application for KRMP

Student name: Trevor Pentzien, UNO-Mathematics

Project start date: December 18, 2017 Project end date: June 30, 2018

Title of project: Modeling effects of viral infection on cellular fate using probabilistic Boolean networks

Abstract: To replicate inside of a host cell, viruses must make changes to cellular signal transduction networks. These changes are accomplished in a myriad of ways. For example, changing the expression patterns of genes/gene products. In this study, we will attempt to model these changes by implementing probabilistic Boolean networks. A probabilistic Boolean network is a Boolean network in which each node in the network has the potential to have multiple rules that govern them. We will look at a few properties of interest for this study including fixed points/cyclic attractors, effects on the stability of the network, and how the flow of information is changed in these networks.

Purposes of the project:

1. Identify the best format for network data to be used for simulations.
2. Review the mathematical algorithm for finding the determinative power of nodes, fixed points/cyclic attractors, and determining the stability of the network. Develop appropriate analytic models.
3. Prepare Matlab/python codes to be used with actual network data. Fine tune the codes along the way, and possibly add new codes as needed.
4. Generate random PBN data in suitable format and run simulations. This is the most time-consuming part of the project.
5. Collect results for all network simulations.
6. Data analysis of the results. This task may involve further aspects that we cannot foresee now and that are dependent on the actual network properties.
7. Writing the KRMP report.

Timetable:

Month	Purpose items
December 2017 – January 2018	1, 2, 3, 4, 5
January - March 2018	4,5,6
April - May 2018	6
June 2018	7
July 2018-forward	Preparing results for publication.