Work Journal

Vaibhav

July 25, 2023

1 May

1.1 8th May

Wrote a function to evolve a network. It is an asynchronus function. I don't know how to deal with a synchronus function yet.

I still have to figure out how rare are osscilatory networks with the given conditions.

1.2 9th May

Have to figure out how to random networks Read about phenotypic plasticity Think about synchronous update of the network

1.3 12th May

I've to understand RACIPE's equations and how it works. Do I have to model euler framework? no not really. I've to implement RACIPE for GHL2 network. Generate the bar plots compare RACIPE and boolean formalism

1.4 May 20th

I need to look into different boolean formalism and reproduce some of the data generated by the teams paper

I also want to look at the distribution of phenotypes with respect to various parameters in racipe and if there is any relationship at all? Why do I suspect that there might be some relationship ? I feel when you've multiple solutions and the more the solutions the more you'r elikely to have hybrid phenotypes?

1.5 June 26th

Now I have a plenty of directions I could explore and I'm constrained by just myself and nothing else. I need to do some analysis with the three state formalism but again I don't want to just rely on that.

That formalism can lead us to several directions about dynamic node knockout and analysis and analysis of behaviour of nodes accross the simluation landscape instead of a static analysis which sounds cool.

The other one is clustering. These are solid questions.

The first one might lead us to investigate dynamic islands in the network.

Although I need to do all this before going back since once I go back I will have much to explore and it's a really bad thing to push stuff for later??

What I've found so far with the three state formalism is that hybrid states in biological networks are caused due to unregulated and loose nodes.

I need to do solid analysis else it'll mean nothing.

And I need to do the analysis on my own.

We can look at various metrics of nodes, the number of positive feedback loops, negative feedbacl loops etc it is part of, dynamic input strength and stuff and I have to do it on my own.

Another thing I would want to do some analysis would be to explore different kinds of robustness aspects like node knockouts and keeping a node on apart from clustering.

I have to try and apply the formalism to toggle triads and see how it works out in artificial networks.

2   28th July

I can classify hybrid states into epithelial kind and mesenchymal kind where there is a clear assymmetry however there might exist hybrids where the epimes score might be 0 then you can probably use the $can_s trength to classify the hybrid noes$

3   10th July

The network can be considered several toggle switches connected with eachother.

Concepts in boolean network modeling: What do they all mean?

Some motif identification with respect to the toggle switches could be done sinc e each and every set of nodes we choose from both teams has a toggle siwtchlike teams structure. So one good possible direction of study is how to connect multiple toggle siwtches together and what is an optimal strategy to connect them.

Assuming negative links are more important we can also study how to connect two strongly connected teams together.

What formalism can highlight the fragilites in the network? Is it possible to cope up with one such formalism? Something which highlights the hybrid nodes or edges

Modularity in these networks remains an open topic to study.

Modularity provides robustness against accidental failures on average.

I could study artificial networks modular and non modular what I mean by non modular is I make some nodes specialized while I let other nodes be unspecialized.

Hybridness is disagreement with how the network wants the nodes to behave therefore it can be thought of as some sort of autonomy of nodes and subgraphs that is a nice direction to think about things but what do I do about it? what do I test what and how can I test things? More specialized nodes must have more hybrid nodes?

It can be shown that biological regulation behaves similarly to canalyzing functions?

Regulatory systems can be seen as information processing units. Each regulatory system is capable of processing a certain amount of information. Hence information theoretic measures are frequent tools to study regulatory mechanism sinside BNs.

Reconstructing BNs from time series of biological data using REVEAL algorithm?

What is the criticality condition?

4   13th July 2023

Paper title: On the effects o modularity of gene regulatory networks on phenotypic variability and its association with robustness.

Modularity and robustness are positively correlated. This should allow for study of outcanlising value.

Many biological networks including gene regulatory networks typically bear a modeular strucutre. This means there are many regulatory interactions within certain groups of genes, modules and few interactions betwee genes in differen tgroups.

A modular GRN implies that the xpression of genes of a module receives little influence from genes external to the module.

Modularity decreases the effect of random mutations.

Robustness can be perceived as something which prevents variability but robustness could also be seen as something which just restricts detrimental mutations and allows only useful mutations?

Modularity and robustness are correlated in many networks.

Selection for robustness can lead to modularity and selection for modularity and vice versa

Modularity offers several other advantages including containing mutations and offering some kind of independence between unrelated genes when it comes to mutations which actually kind of allows for better search for fitter designs

Paper : Stability of linear Boolean networks

It is said that in general, the state space graph can only be computed by exhaustive simulation of boolean network.