

Influence of update schemes on gene regulatory networks

Tom Zuidberg
455969



Abstract—In this paper we will introduce boolean networks (BN) and their relevance to gene regulatory networks (GRN). We will have a closer look on update schemes. Specifically, synchronous, sequential and asynchronous update schemes and their effect on the behavior of BN and GRN respectively.

1 INTRODUCTION

2 BOOLEAN NETWORKS

Explain Boolean network and what an update scheme is using the synchronous/parallel scheme.

2.1 Notation

Define clear notation used throughout the paper

3 UPDATE SCHEMES

Explain different update schemes including characteristics for behavior especially chaotic behavior.

3.1 Synchronous scheme

all nodes update at the same time

3.2 Sequential scheme

close to synchronous. the nodes update in a specific order and take into account the updated input node if that node had been updated before/is positioned earlier in the sequence

3.3 Block-sequential scheme

mix of synchronous and sequential. predefined blocks update sequential, inside a block the update follows the synchronous scheme

3.4 Asynchronous deterministic

one node is updated per tick following a specific sequence

3.5 Asynchronous generalized

same as asynchronous deterministic with the slight change that within the sequence nodes may appear multiple times.

4 RELEVANCE FOR GENE REGULATORY NETWORKS

Tie the update schemes and their different outcomes or behavior to GRN.

Emphasizing the drawbacks of asynchronous models when applied to GRN e.g. it takes way to long to update a GRN using asynchronous deterministic for it to have an effect; assuming that one update takes a few minutes, when the whole process can take days to complete.^[1]

5 CONCLUSION

References: ^[1]^[2]^[3]^[4]^[5]

REFERENCES

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Fig. 1. Boolean example. Simple boolean network example; a graph of the network and most likely a table as well for the updated states $x(t) \rightarrow x(t+1)$

Fig. 2. graph of all possible states for a boolean network using a synchronous update scheme

Fig. 3. example graph of boolean network showcasing grouping of specific nodes.