

# Influence of update schemes on gene regulatory networks

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**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

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### 1.1 Notation

## 2 BOOLEAN NETWORKS

## 3 UPDATE SCHEMES

Explain different update schemes:

- Synchronous scheme - all nodes update at the same time
- Sequential - 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
- block sequential - mix of synchronous and sequential. predefined blocks update sequentially, inside a block the update follows the synchronous scheme
- asynchronous deterministic - one node is updated per tick following a specific sequence
- 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.

## 5 CONCLUSION

## REFERENCES

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- [2] Julio Aracena, Eric Goles, Andrés Moreira, and Luis Salinas. On the robustness of update schedules in boolean networks. *Biosystems*, 97(1):1–8, 2009.
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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.