

Boolean networks

A boolean network is a graph $G(V, F)$ consisting of a set of vertices V (genes) and a list of boolean functions $F = f_1, f_2, \dots, f_n$ where $f_i = v_{k1}, v_{k2}, \dots, v_{kn}$.

An expression pattern is a function $\psi : V \rightarrow \{0, 1\}$

One can define dynamics on a boolean network by the following scheme.

$$\psi_{t+1}(v_i) = f_i(\psi_t(v_{i1}), \psi_t(v_{i2}), \dots, \psi_t(v_{ik}))$$

Consider a dataset of the form

$$D = (I_1, O_1), (I_2, O_2), \dots, (I_m, O_m)$$

where I_k and O_k are expression profiles.

Definitions

1. We say that a node v_i in a boolean network is consistent with (I_j, O_j) if

$$O_j(v_i) = f_i(I_j(v_{i1}), \dots, I_j(v_{ik}))$$

2. We say $G(V, F)$ is consistent with (I_j, O_j) if all nodes are consistent

Given n (the number of genes) and data D , decide whether or not there exists a boolean network $G(F, V)$ consistent with D , and output one if it exists