

Structural and Stationary Intervention in Gene Regulatory Networks

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FROM a translational-genomic perspective, perhaps no problem is more basic than intervention in gene regulatory networks with the aim of altering cell behavior by altering regulation. No matter the dynamical model, the most important aspect of intervention is its effect on the steady-state distribution. This talk treats two basic intervention paradigms: structural and stationary. Structural intervention involves a one-time alteration of the regulatory apparatus, which means a permanent change to the regulatory logic. Stationary intervention involves a time-invariant control policy whose action at any time point depends on feedback from the system. The long-run goal of both kinds of intervention is to beneficially move the steady-state distribution – for instance, by increasing the probability of apoptosis for tumor cells. Structural intervention is framed in the context of Markov-chain perturbation theory. Stationary intervention is framed in terms of Markov decision processes for both synchronous and asynchronous networks.