

Internship proposal:

Observe locally, control globally

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Spring 2021

Supervisory control of partially observable Petri nets has been studied in the literature mostly under a sequential and centralized perspective. With new application challenges from systems biology, it is time to create a framework for supervisory control of partially observable Petri nets, under the constraints of concurrency of the supervised processes (which are intrinsically non-sequential) and decentralization of observation and intervention.

The objectives targeted by the control must include reachability objectives in safe Petri nets; ideally, the results exceed this domain, to include reprogramming of long-term behaviors of models arising in cell regulation. In this setting, the stakes are to steer the cell fate into a desired attractor or phenotype, while staying clear of fatal pathways (cancerous mutation, etc.)

The strengths of the well-known unfolding technique for safe Petri nets are expected to be instrumental in this work. The controller's knowledge is a decentralized and asynchronous observation coming from a distributed set of observers. The tasks include: - establish the semantics of supervisory control under these circumstances; - determine an adequate game theoretic setting, and - develop efficient techniques for synthesizing controllers.