Reinforcement Learning for Control of Bioreactors

TECHNISCHE UNIVERSITÄT DARMSTADT

Master's Thesis

Optimizing and controlling bioprocesses is often challenging because of the intrinsic complexity of cells. In many cases, we only have oversimplified or incomplete models, often hindering the applicability of model-based optimization and control. Reinforcement learning provides a way to apply *model-free* control strategies to bioreactors. Here, an agent (the controller) interacts with its environment (the process) through appropriate actions (inputs). The agent *observes* the output states via available sensors and uses them to compute a *reward*. Maximizing this reward over time, the agent *learns* an optimal input policy. With the help of the learned input policy, we aim to achieve specific tasks, e.g., increase production or maintain a set point. Your tasks will be:

1. Literature review on reinforcement learning methods for (bio)process control
2. Implementation of a control scheme based on reinforcement learning in HILO-MPC[1]
3. Study the described strategy in simulations using a model of a process relevant to biotechnology (to be provided)

Experience with / knowledge about:	Reinforcement learning, dynamical systems
Programming skills:	Python (good to very good skills required)
Language:	English

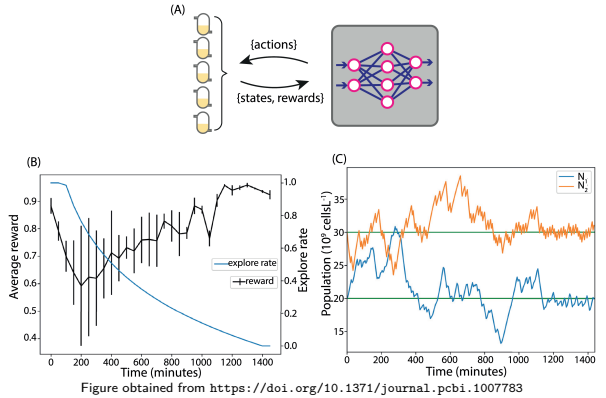

Figure obtained from https://doi.org/10.1371/journal.pcbi.1007783

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[1] https://www.ccps.tu-darmstadt.de/research_ccps/hilo_mpc/index.en.jsp

CCPS Control and Cyber-Physical Systems