Experimental Design for the estimation of ODE: A Multi-Armed Bandit Approach

Type of talk

PhD Seminar

Speaker

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Abstract

Quantitative models are commonly used to understand and predict the behaviour of complex system. In biology, ordinary differential equations are particularly suitable for modelling the dynamics of gene regulatory networks. Parameter estimation of such systems can be hampered by experimental difficulties: often, only partial observations in noisy conditions are available and model over-parameterization raises identifiability problems. In that context, perturbing the regulatory network can provide additional data but these kinds of experiments are costly. We propose here to work within a realistic setting in which only a limited budget is available to buy observations of the system; hence the sequence of experiments to perform has to be carefully selected.
Our objective is therefore to develop novel tools based on machine learning, game theory and dynamical systems theory to automatically define a sequential experimental design strategy to acquire data that allow to get a more precise estimation of the underlying system. High computational capacities will allow to use intensively simulation tools to optimize this strategy.
In this talk I present a bandit-based algorithm to automatically select the most informative experiment for efficient experimental design. The algorithm tests the combination of multiple experiences and uses the UCB criterion to efficiently explore the tree of sequences of experiments.