

Data-Driven Mechanistic Models -- Design and Inference

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Mechanistic models provide a flexible framework for modeling heterogeneous and dynamic systems in ways that enable prediction and control. In this talk, we focus on the application of mechanistic models for investigating dynamic biological systems. We show that by embedding these models in a hierarchical Bayesian framework, we can account for the underlying structure and stochasticity of the system. Further, we discuss how to use a Bayesian utility theory in order to find the optimal experimental design for studying biological systems. While our proposed approach could be quite flexible and powerful, its computational complexity could hinder its feasibility. To alleviate this issue, we propose a class of scalable Bayesian inference methods that utilize deep learning algorithms for fast approximation of the likelihood function and its gradient.