Hijacking Simulators with Universal Probabilistic Programming

Paper ID: 1010

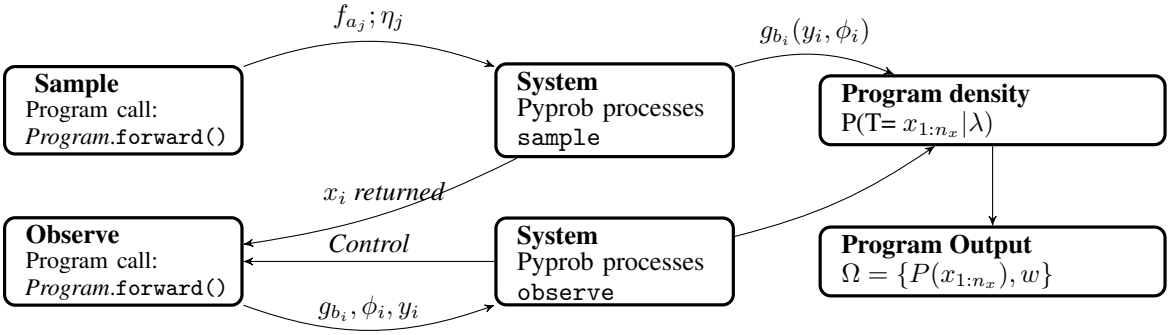
Abstract

Notes on how to develop a formalism to perform inference in population based simulators.

1 Introduction

One challenge in performing inference in such models is the combinatorial increase in traces, *paths* that can be taken within the given probabilistic model. This is because each member of the population has a bounded, but large number of decisions to make. In addition to this, each member of the population can interact with other members of the population. To model a single population member particle-based methods such as sequential monte carlo (SMC) provide an ability to explore multiple paths

As updates are made sequentially MCMC methods typically are not-well suited this type of recusrive estimation problem. As each time we get a new data point y_{t+1} we have to run new MCMC simulations for $P(x_{0:t_1}|y_{0:t+1})$, we also cannot directly reuse the samples $\{x^i_{0:t}\}$. Likewise, importance sampling is not well suited either, as we cannot reuse the samples and weights for a time t $\{x^i_{0:t}, \tilde{w}^i_t\}_{i=1}^N$ to sample from $(x_{0:t_1}|y_{0:t+1})$.



2 Limitations with different inference engines

2.1 Prior based sampling

2.2 Importance Sampling

2.3 Sequential Monte Carlo

2.4 Random-walk Metropolis Hastings

Preprint. Under review.