Rare event ABC-SMC^2

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Abstract

We propose a new algorithm based on a combination of rare event methods for estimating the ABC likelihood in the case of high-dimensional data (Prangle et al, 2018) and ABC-SMC for exploring the parameter space. The new method has a similar structure to SMC^2 (Chopin et al, 2012). We demonstrate an improvement in performance (in terms of accuracy and efficiency) over the rare-event MCMC algorithm in (Prangle et al 2018) for the same (still high dimensional problem) problems. Moreover, we show that the SMC^2 algorithm retains all the advantages of regular SMC over a general MCMC, while performing extremely well in higher dimensional problems than the ones initially attacked by the rare-event based method. Furthermore, we show a marked increase in efficiency compared to ABC-SMC (and adaptive ABC-SMC) without a large additional computational load due to the nested SMC (the "internal"particle SMC can be fixed to a low number of particles with very little effect on the overall accuracy). We also proposed an adaptive scheme for both the sequence of ABC tolerances in the SMC, and also for the MCMC rejuvenation steps of the external parameter space particle filter. We demonstrate the above on some toy models and a real world example of an epidemic model. This is joint work with Tom Thorne.