Correction

STATISTICS

Correction for "Sequential Monte Carlo without likelihoods," by S. A. Sisson, Y. Fan, and Mark M. Tanaka, which appeared in issue 6, February 6, 2007, of *Proc Natl Acad Sci USA* (104:1760–1765; first published January 30, 2007; 10.1073/pnas.0607208104).

The authors note the following: It has been brought to our attention that the algorithm introduced in our paper (ABC-PRC) can produce a biased posterior sample, most noticeably through underestimation in distributional tails. This result occurs as the likelihood ratio in the sequential Monte Carlo incremental weights is approximated by using two unbiased Monte Carlo estimates. One way to avoid a biased posterior sample in the ABC-PRC algorithm is to directly evaluate the importance sampling distribution using a near-optimal backwards kernel. Hence the need for the Monte Carlo estimate in the denominator of the likelihood ratio is circumvented, and an unbiased sampler is obtained. As such, a corrected ABC-PRC algorithm would be:

ABC-PRC Algorithm (corrected):

PRC1 Initialize $\epsilon_1, \ldots, \epsilon_T$, and specify initial sampling distribution μ_1.
Set population indicator $t = 1$.

PRC2 Set particle indicator $i = 1$.

PRC2.1 If $t = 1$ sample $\theta^{**} \sim \mu_1(\theta)$ independently from μ_1.
If $t > 1$ sample θ^* from the previous population $\{\theta_{t-1}^{(i)}\}$ with weights $\{W_{t-1}^{(i)}\}$, and perturb the particle to $\theta^{**} \sim K_t(\theta \mid \theta^*)$ according to a transition kernel K_t.

Generate a data set $x^{**} \sim f(x \mid \theta^{**})$.
If $\rho(S(x^{**}), S(x_0)) \geq \epsilon_t$ then go to PRC2.1.

PRC2.2 Set

$$\theta_t^{(i)} = \theta^{**} \qquad \text{and} \qquad W_t^{(i)} = \begin{cases} \pi\left(\theta_t^{(i)}\right) / \mu_1\left(\theta_t^{(i)}\right) & \text{if} \quad t = 1 \\ \pi\left(\theta_t^{(i)}\right) / \sum_{j=1}^{N} W_{t-1}\left(\theta_{t-1}^{(j)}\right) K_t\left(\theta_t^{(i)} | \theta_{t-1}^{(j)}\right) & \text{if} \quad t > 1 \end{cases}$$

where $\pi(\theta)$ denotes the prior distribution for θ.
If $i < N$, increment $i = i + 1$ and go to PRC2.1.

PRC3 Normalize the weights so that $\sum_{i=1}^{N} W_t^{(i)} = 1$.
If $ESS = \left[\sum_{i=1}^{N} (W_t^{(i)})^2\right]^{-1} < E$ then resample with replacement, the particles $\{\theta_t^{(i)}\}$ with weights $\{W_t^{(i)}\}$ to obtain a new population $\{\theta_t^{(i)}\}$, and set weights $\{W_t^{(i)} = 1/N\}$.

PRC4 If $t < T$, increment $t = t + 1$ and go to PRC2.

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