Discussion on “Quasi-stationary Monte Carlo methods and the ScaLE algorithm”

Monte Carlo Fusion

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Divide-and-Conquer

- Target:

$$\pi(\boldsymbol{x}) \propto \prod_{c=1}^{C} f_c(\boldsymbol{x}) \tag{1}$$

where each *sub-posterior*, $f_c(\boldsymbol{x})$, is a density representing one of the C distributed inferences we wish to unify

- Advantage: inference on each smaller dataset can be conducted independently in parallel

Divide-and-Conquer

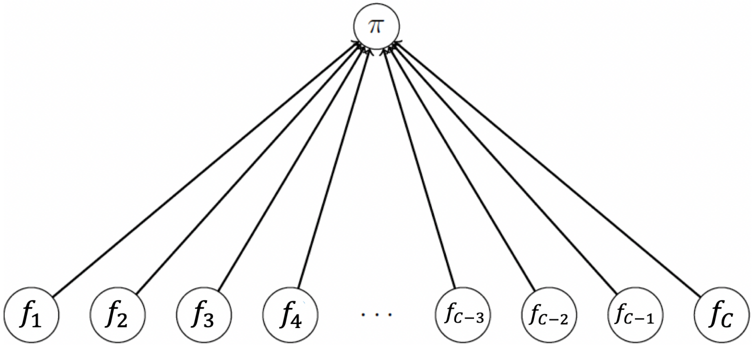

Figure 1: Visual representation of the Monte Carlo Fusion approach

Divide-and-Conquer

- Several divide-and-conquer methods were mentioned in the paper: e.g. Neiswanger et al. [2013], Weierstrass sampler [Wang and Dunson, 2013], Consensus Monte Carlo [Scott et al., 2016]
- However, a primary weakness of these methods is that the recombination is inexact

Monte Carlo Fusion

- Monte Carlo Fusion [Dai et al., 2019] is the first exact fusion inference method that allows sampling from (1)
- Achieved by constructing a rejection sampler on an extended space

Connections to ScaLE

- Both algorithms use the Langevin diffusion in their mathematical construction
- Both algorithms utilise methodology for the exact simulation of diffusions (Beskos et al. [2005], Beskos et al. [2006], Pollock et al. [2016])
- Monte Carlo Fusion uses the function $\phi : \mathbb{R}^d \to \mathbb{R}$ defined by (3) in Section 2

References

Beskos, A., Papaspiliopoulos, O., Roberts, G. O., and Fearnhead, P. (2006). Exact and computationally efficient likelihood-based estimation for discretely observed diffusion processes (with discussion). *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 68(3):333–382.

Beskos, A., Roberts, G. O., et al. (2005). Exact simulation of diffusions. *The Annals of Applied Probability*, 15(4):2422–2444.

Dai, H., Pollock, M., and Roberts, G. (2019). Monte Carlo Fusion. *Journal of Applied Probability*, 56(1):174–191.

Neiswanger, W., Wang, C., and Xing, E. (2013). Asymptotically exact, embarrassingly parallel MCMC. *arXiv preprint arXiv:1311.4780*.

Pollock, M., Johansen, A. M., Roberts, G. O., et al. (2016). On the exact and ε-strong simulation of (jump) diffusions. *Bernoulli*, 22(2):794–856.

Scott, S. L., Blocker, A. W., Bonassi, F. V., Chipman, H. A., George, E. I., and McCulloch, R. E. (2016). Bayes and big data: The consensus Monte Carlo algorithm. *International Journal of Management Science and Engineering Management*, 11(2):78–88.

Wang, X. and Dunson, D. B. (2013). Parallelizing MCMC via Weierstrass Sampler. *arXiv e-prints*, page arXiv:1312.4605.