Sequential quasi-Monte Carlo

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Abstract

We derive and study SQMC (Sequential Quasi-Monte Carlo), a class of algorithms obtained by introducing QMC point sets in particle filtering. The complexity of SQMC is O(NlogN), where N is the number of simulations at each iteration, and its error rate is smaller than the Monte Carlo rate OP(N–1/2). The only requirement to implement SQMC is the ability to write the simulation of particle xnt given xnt–1 as a deterministic function of xnt–1 and a fixed number of uniform variates. We show that SQMC is amenable to the same extensions as standard SMC, such as forward smoothing, backward smoothing, unbiased likelihood evaluation, and so on. In particular, SQMC may replace SMC within a PMCMC (particle Markov chain Monte Carlo) algorithm. We establish several convergence results. We provide numerical evidence that SQMC may significantly outperform SMC in practical scenarios.

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