

OPTIMALITY OF THE AUXILIARY PARTICLE FILTER

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Abstract: In this article we study asymptotic properties of weighted samples produced by the auxiliary particle filter (APF) proposed by Pitt and Shephard [17]. Besides establishing a central limit theorem (CLT) for smoothed particle estimates, we also derive bounds on the L^p error and bias of the same for a finite particle sample size. By examining the recursive formula for the asymptotic variance of the CLT we identify first-stage importance weights for which the increase of asymptotic variance at a single iteration of the algorithm is minimal. In the light of these findings, we discuss and demonstrate on several examples how the APF algorithm can be improved.

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Keywords and phrases: Auxiliary particle filter, central limit theorem, adjustment multiplier weight, sequential Monte Carlo, state space model, stratified sampling, two-stage sampling.

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