A CENTRAL LIMIT TYPE THEOREM FOR A CLASS OF PARTICLE FILTERS

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Abstract: The optimal filter $\pi = \{\pi_t, t \geq 0\}$ for a general observation model is approximated by a probability measure valued process $\pi^n = \{\pi_t^n, t \geq 0\}$. The process π^n is the empirical measure of a system of weighted particles that at time 0 consists of n particles. The particles branch at equally spaced time instances $jn^{-2\alpha}$ where $j = 1, 2, ...$ and $0 < \alpha < 1$. We prove the convergence of the process π^n to π and derive sharp upper bounds for the mean square error. We also prove a central limit theorem to characterize the convergence rate of the approximate filter. A similar result is obtained for the unweighted, unnormalized version introduced in Crisan-Gains-Lyons (1998). As a corollary, we show that $\alpha = \frac{1}{3}$ is the optimal exponent for that version. This talk is based on a joint paper with Crisan.