Smoothed Particle Filter

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The particle filter provides an effective solution to nonlinear/non-Gaussian tracking problems. These filters represent the posterior distribution of the state variables by a set of particles which evolves and adapts recursively as new information becomes available. In practice, large numbers of particles may be required to provide adequate approximations and for certain applications, after a sequence of updates, the particle system will often collapse to a single point. It is thus necessary to have some effective way to avoid the sample impoverishment problem. We introduce an improved particle filtering method termed as smoothed particle filter which essentially is an improved SIR particle filter with a smoothing step. At the beginning of each filtering process, the proposed filter runs firstly a smoothing step that simulates particles from particles at previous time step, and then uses generated particles to reweight (in backward direction) the particles at previous time step. The remaining procedures are similar to that in SIR filter. The original of our proposal is that, via reweighting with the knowledge from current observation, the samples at previous time step will be more close to the true posterior distribution, and subsequently boost the generated particles into those regions which will be of high-probability of the observation model in next time step. Thus sample impoverishment can be efficiently avoided. We compare the proposed filter with other existing SIS, SIR, ASIR filters in terms of a classic nonlinear tracking problem. The simulation results show that the performance of the proposed filter outperformed other competitors in several problem setting.