# Variance estimation in the particle filter

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**Abstract**

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Particle filters provide sampling based approximations of marginal likelihoods and filtering expectations in hidden Markov models. However, estimating the Monte Carlo variance of these approximations, without generating multiple independent realizations of the approximations themselves, is not straightforward. We present an unbiased estimator of the variance of the marginal likelihood approximation, and consistent estimators of the asymptotic variance of the approximations of the marginal likelihood and filtering expectations. These estimators are byproducts of a single run of a particle filter and have no added computational complexity or storage requirements. With additional storage requirements, one can also consistently estimate higher-order terms in the non-asymptotic variance. This is information can be used to approximate the variance-optimal allocation of particle numbers.

Joint work with Anthony Lee, University of Warwick.

http://arxiv.org/abs/1509.00394

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