UNBIASED ESTIMATION OF SMOOTH FUNCTIONS

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Given a smooth function f , we develop a general approach to turn Monte Carlo samples with expectation m into an unbiased estimate of f (m). Specifically, we develop estimators that are based on randomly truncating the Taylor series expansion of , and estimating the coefficients of the truncated series. We derive their properties, and propose a strategy to set their tuning parameters – which depend on m – automatically, with a view to make the whole approach simple to use. We develop our methods for the specific functions f (x) = log x and f (x) = 1/x, as they arise in several statistical applications, such as maximum likelihood estimation of latent variable models, and Bayesian inference for un-normalised models. Detailed numerical studies are performed for a range of applications, to determine how competitive and reliable the proposed approach is.

In one application, SMC (Sequential Monte Carlo) is used to generate unbiaised estimates of the normalising constant of an un-normalised likelihood.