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Víctor Elvira received his B.S., M.S., and Ph.D. degrees in electrical engineering from the Universidad de Cantabria, Spain, in 2007, 2008, and 2011, respectively. Currently, he is an associate professor in Statistics and Data Science at the School of Mathematics, University of Edinburgh, United Kingdom. He is a Senior Member of the IEEE.

His research interests are in statistical signal processing and computational statistics. His work covers diverse topics in these areas, including Monte Carlo methods, Bayesian inference in static and dynamical models, signal processing for biomedical applications, and wireless communications. Most of his recent work is in importance sampling methodology, e.g. multiple importance sampling, adaptive importance sampling, or sequential Monte Carlo (particle filtering).

Adaptive importance sampling: the exploitation-exploration tradeoff in statistics and optimization

In many problems of artificial intelligence, signal processing, and statistics, the interest is in estimating unknown static variables given a set of observations. The hidden parameters and the available data are usually related through a specific model. Under the probabilistic Bayesian framework, the objective is more ambitious than simply calculating point-wise estimates of the unknowns and amounts to obtaining their posterior distributions. While for simple models, the posterior distributions can be characterized in a closed-form expression, however, in most practical scenarios they cannot be computed. Importance sampling (IS) is an elegant, theoretically sound, and simple-to-understand methodology for approximation of moments of distributions. The only condition relates to the capability of the point-wise evaluation of the targeted distribution. The basic mechanism of IS consists of (a) drawing samples from simple proposal densities, (b) weighting the samples by accounting for the mismatch between the targeted and the proposal densities, and (c) approximating the moments of interest with the weighted samples. The performance of IS methods directly depends on the choice of the proposal functions. For that reason, the proposals have to be updated and improved with iterations so that samples are generated in regions of interest.