An overview of Monte Carlo methods, from importance sampling to MCMC, to ABC

C.P. Robert (Université Paris Dauphine)

Computational methods based on simulations are now an essential part of statistical computing. They have contributed quite significantly to the broadening of our discipline into many applied fields and the on-going "Big Data" revolution could not have taken place without those tools. This talk will retrace the history of Monte Carlo methods from the early days of Ulam and von Neumann to the current challenges of highly complex stochastic systems. In particular, we will trace the development of Markov chain Monte Carlo (MCMC) from its early inception in the late 1940's to a fusion between importance sampling and Markovian techniques, with recent solutions like pMCMC and SMC$^2$. We will also address the special case of "likelihood-free" methods like ABC, which draw a bridge between traditional usages of simulation and non-parametric inference.