

# Multilevel Monte Carlo for Bayesian inverse problems

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For half a century computational scientists have been numerically simulating complex systems. Uncertainty is recently becoming a requisite consideration in complex applications which have been classically treated deterministically. This has led to an increasing interest in recent years in uncertainty quantification (UQ). Another recent trend is the explosion of available data. Bayesian inference provides a principled and well-defined approach to the integration of data into an a priori known distribution. The posterior distribution, however, is known only point-wise (possibly with an intractable likelihood) and up to a normalizing constant. Monte Carlo methods have been designed to sample such distributions, such as Markov chain Monte Carlo (MCMC) and sequential Monte Carlo (SMC) samplers. Recently, the multilevel Monte Carlo (MLMC) framework has been extended to some of these cases, so that approximation error can be optimally balanced with statistical sampling error, and ultimately the Bayesian inverse problem can be solved for the same asymptotic cost as solving the deterministic forward problem. This talk will concern the recent development of some methods for utilizing the MLMC framework in Monte Carlo methods for inverse problems, which will be presented within the context of general strategies.