A Fully Bayesian Approach to the Efficient Global Optimization Algorithm

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Abstract

Finding the global optimum(s) of a non-convex function is of great importance in numerous applications in science and engineering where the function takes the form of an expensive computer code and its inputs are the independent variables. For this type of problem, Jones et al. [12] proposed the idea of expected improvement (EI) and embedded it in an algorithm called efficient global optimization, or EGO. Neither EI nor EGO consider the uncertainty in the parameter estimates. One way to account for these uncertainties is to use Bootstrapping. In this paper, instead, we formulate the expected improvement method from a fully Bayesian perspective which results in a corresponding Bayesian EGO method. The performance of the proposed Bayesian EGO is illustrated and compared with the standard EGO method of Jones et al. and the bootstrapped EGO of Kleijnen et al. [13]. Furthermore, we apply the Bayesian EGO algorithm for the optimization of a stochastic inventory simulation model.

Keywords: Global optimum, geostatistics, hierarchical model, expected improvement

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