

Efficient Importance Sampling for Rare Event Simulation with Applications

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Abstract

Importance sampling has been known as a powerful tool to reduce the variance of Monte Carlo estimator for rare event simulation. Based on the criterion of minimizing the variance of Monte Carlo estimator, we propose a simple general account for finding the optimal tilting measure. To this end, we first obtain an explicit expression of the optimal alternative distribution, and then propose a recursive approximation algorithm for the tilting measure. The proposed algorithm is quite general to cover many interesting examples and can also be applied to a locally asymptotically normal (LAN) family around the original distribution. To illustrate the broad applicability of our method, we study value-at-risk (VaR) computation in financial risk management, and bootstrap confidence regions in statistical inferences.

Keywords: Bootstrap; Confidence region; Exponential tilting; Local asymptotic normal; Moderate deviation; Value at Risk.