DS 298: Work Assignment - 3

Due April 11, 2023

The goal of this work is to estimate the expected value of a function $g(x)$ over a cubic domain centred at origin with side a=2 using two approaches (1) and (2). Let the dimensions of the space vary as d=2, 4, and 16, for the following functions.

a) $g(x) = |x_1|$; where $X = [x_1, x_2, \ldots x_d]$ is any random point in the domain.

b) $g(x) = (\frac{d}{2} - r^2)$; where r is the Euclidean distance of the random point X from the origin.

1. **Uniform sampling**: sample the domain with a uniform probability density to estimate $E[g(x)]$.

2. **Importance sampling**: sample the domain with a probability density $q(x)$, and reweight the function at any point as $g(x)/q(x)$ to estimate $E[g(x)]$. For better convergence, you can choose a $q(x) = c\|x\|_1$ for function (a), and $q(x) = c|g(x)|$ for function (b), where constants c can be determined. You may use Gibbs sampling with a grid size of 0.01 in the domain and compare the convergence of the expected value with the number of samples, in cases (1) and (2).

Note : Submit the responses, plots, and the code as separate files, all zipped into a single folder identified by your name in full, to *abhijeetj@iisc.ac.in*