The Accept-Reject Method: Anthony Gusman, Nicholas Sullivan

Table of Contents

Introduction

The process of generating pseudo random numbers using a given density function of a random variable is easy if the inverse of the CDF is known or quick to find. However, the general method breaks down when there does not exist a happy way to find the inverse of the CDF. This is why we will be exploring something called the *Acceptance-Rejection Method*.

Overview of Method

The Acceptance-Rejection Method is actually quite simple. We implement the method with our `acceptReject` function as described in plain English below:

1. Given a probability density function (**PDF**) f_X of a random variable X with compact support find its maximum over its range (call it c).

2. Generate a pair of random numbers (X, Y) such that $X \sim U[$ support of $f_X]$ and $Y \sim U[0, c]$.

3. For each point (x_i, y_i) if $0 \leq y_i \leq f_X(x_i)$ then it is "accepted" otherwise it is "rejected."

As you can see this is essentially the same process used in Monte-Carlo integration.

The Functions

We provide two functions in this paper, acceptReject.m and acceptRejectPlot.m with the following outputs and arguments:

[X,Y] = acceptReject(f,a,b,n)

- **Output:** [X,Y], random numbers defined as above split into a cell with the first row as the accepted values and the second row as the rejected values

- **Input:** f, PDF function f_X

- a, lower bound of f's range

- b, upper bound of f's range

- n, number of (x_i, y_i) pairs (increase this for higher accuracy)

acceptRejectPlot(fun,a,b,Xc,Yc)

- **Output:** plots, one of the pdf with a histogram of the accepted number generated and one of the pdf along with all accepted and rejected points.

- **Input:** fun, PDF function fx

- a, lower bound of fun's range

- b, upper bound of fun's range

- Xc, the X returned by acceptReject

- Yc, the Y returned by acceptReject

Accept Reject and Plotter function code

here is the full code of both functions with comments and syntax high lighting: **acceptReject.m**

include>acceptReject.m</include

acceptRejectPlot.m

include>acceptRejectPlot.m</include

Examples

Lets do the beta and someother unhappy distribution

Full function code

Published with MATLAB® R2013a