

# Finding the Volume of a Sphere using Monte Carlo Method

## 1 Introduction

We will use the Monte Carlo Method to approximate the volume of a Sphere. This method is a computational technique that involves generating random samples repeatedly to obtain numerical outcomes. We will use the MC method to calculate the volume of both inside outside regions. Then we will multiply the ratio by 8 ; following  $2^n$  where n is 3.

## 2 Python Script

```
1 import random
2 import matplotlib.pyplot as plt
3 from mpl_toolkits import mplot3d
4
5 inside_sphere = 0
6 outer_sphere = 0
7
8 x_list = []
9 y_list = []
10 z_list = []
11
12
13 for i in range (10000):
14     x = random.uniform(0,1)
15     y = random.uniform(0,1)
16     z = random.uniform(0,1)
17
18     s = x**2+y**2+z**2
19
20     if s<=1:
21         inside_sphere = inside_sphere + 1
22
23         x_list.append(x)
24         y_list.append(y)
25         z_list.append(z)
26
27     outer_sphere = outer_sphere + 1
28
29     volume = 8*(inside_sphere / outer_sphere)
30
31 print(volume)
32
33 fig = plt.figure()
34 ax = plt.axes(projection='3d')
35
36 ax.scatter(x_list, y_list, z_list)
37 ax.set_xlabel('X')
38 ax.set_ylabel('Y')
39 ax.set_zlabel('Z')
40 ax.view_init(30,70)
41
42 plt.show()
```

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