

CMPUT 307 - Lab 8

Clustering of Large Point Cloud Models

In this lab you will be given a number of 3D models on which you are going to apply PCA followed by clustering. The purpose will be to choose the initial cluster centers in a more scientific and systematic manner. The skeleton code for this exercise will not be provided and you need to implement the complete code (in [Matlab](#)) satisfying the following requirements:

- (a) Download [Materials.zip](#) file and decompress it in your Matlab directory. Open and run the [lab8.m](#) file to read and load the dragon.ply model into your program. The points of the model will be stored in the variable X. After running the code you will see a dragon as shown in Figure 1.

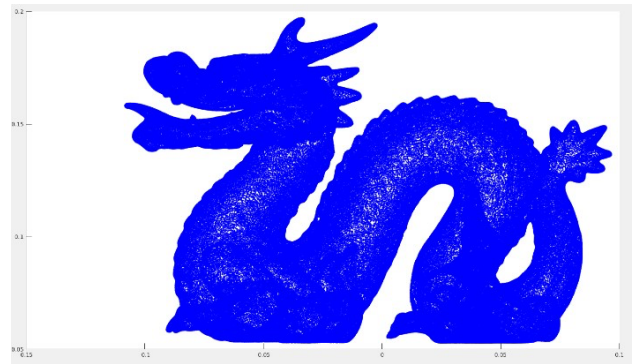


Figure 1

- (b) Determine N, the number of points in the model in Part (a).
- (c) Perform a PCA on the N points of the model. Determine the First Eigen Vector. **For this step, you can directly call `pca()` function from the library. You do not need to write the `pca` algorithm.**
- (d) Transform the points of your model by a rotation, so that the First Eigen Vector becomes the New X-axis.
- (e) Sort the transformed points following Part (d), based on the new X values.
- (f) Determine the Minimum X value MinX, and Maximum X value MaxX, following Part (e).
- (g) Divide the interval (MinX, MaxX) into 100 parts (X_i, X_{i+1}) , $i = 0, \dots, 100$; such that each part contains about the same number of points.
- (h) For each interval in Part (g) do the following:
- Create N/100 clusters from all the points in the interval. Comment on how you chose the initial cluster centers.
 - Do the clustering. **You can directly call the `k-means` function from the library. You do not need to write the `k-means` algorithm.**
 - Store the final cluster centers and the distance of each cluster center to a point on the boundary of this cluster. We will call this distance the radius of a cluster.
- (i) Write a new data file containing each cluster center and its radius, considering all the intervals in Part (h).

- (j) Display the new data file in Part (i) as a collection of transparent spheres; where each sphere represents a cluster center having a radius equal to the radius of this cluster. Then draw all the points in Part (d) on the same figure.

Submit a zip file with all your code used during these exercises, and a pdf file containing all the plots.