Description:

Point-cloud is an important representation for objects, scenes, medical data and much more. Images are dense representations, since all coordinates in an image is associated with defined value(s), such as gray-scale levels. Unlike an image, point-cloud is a sparse representation, which means that not all the coordinates are defined with a value. It shows it has potentially higher compression ratios. In this project, you will be provided with front views of four objects, whose surfaces are generally continuous in space. Please use the methods that you have learnt in this lecture to compress the raw point-cloud data, such as sampling, DCT, quantization, coder design etc. In the report, you need to show an in depth comparison among all the methods you have used in terms of, but not limited to, compression ratio, bit-rate, MSE, complexity etc.

Data and visualization:

Figure 1 Dataset

You will be given four data sets (Chef, Kangaroo, T-rex and Chicken) as shown in Figure 1. They are all in the form of "x y z" coordinates of points. As an example, you can easily visualize the Chef data in Matlab (similar in Python) via:

```
>>> load chef.dat
>>> figure;scatter3(chef(:,1), chef(:,2), chef(:,3), 1, chef(:,3),'.'); axis equal;
```

You will get the output plot in 3D as shown in Figure 2. Please be careful that it can be quite slow on your laptop due to the large number of points. For an overview, you can also replace scatter3() with plot3() and remove the complementary parameters.

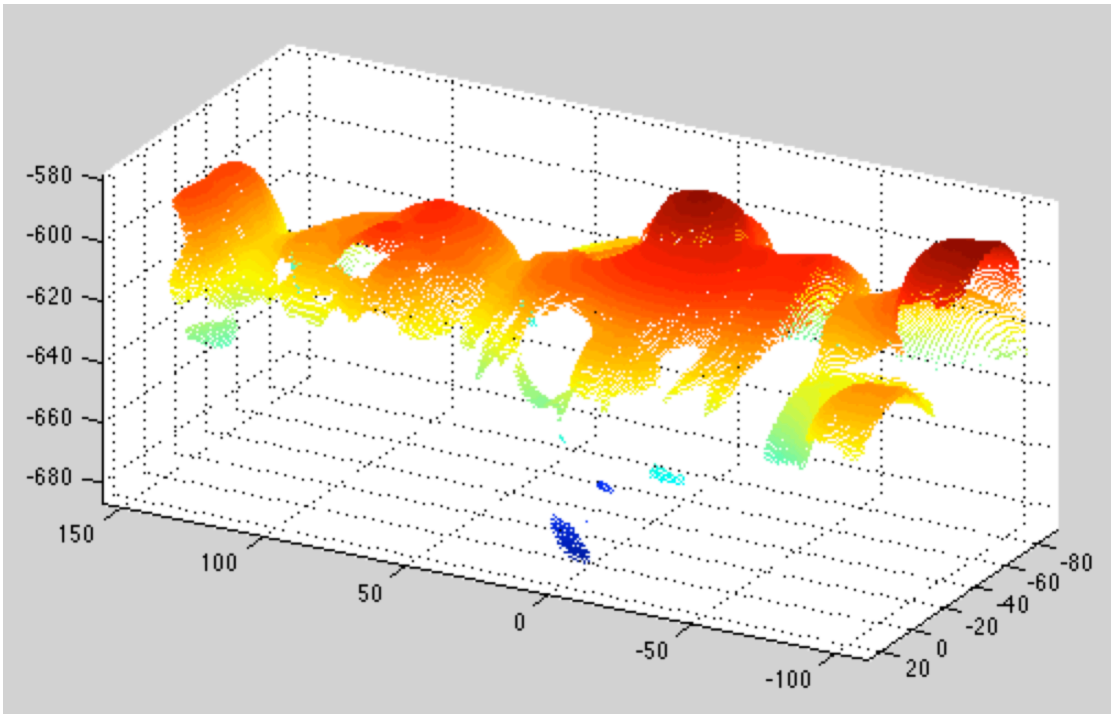

Figure 2 Dataset "Chef" plotted in 3D

Hint:
Several ways can be considered. Hereby, I just name few:

1. After sampling, 3d-DCT can be used to compress the data.
2. Inspired by predictive coding, you can find the local derivatives of 3D points, such as their normal directions are different. Keep in mind that this local difference is homogenous in space, just as that for images the neighboring pixels are usually equal.

Grading:
By finishing this project, you have to compare at least two different approaches on all the given datasets. Additionally, if work on more methods, with **complete** comparison to each extra approach (up to 5 in total), you will get extra 10% points. Besides, please highlight extra results you achieved to gain extra points.

The basic rules for grading will be announced at lecture.