

# 3D Point Cloud and Modeling (NPM3D)

## TP 1: Basic operations and structures on point clouds

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### Question 1

Figure 1 is a screenshot showing the original bunny and bunny after transformations.

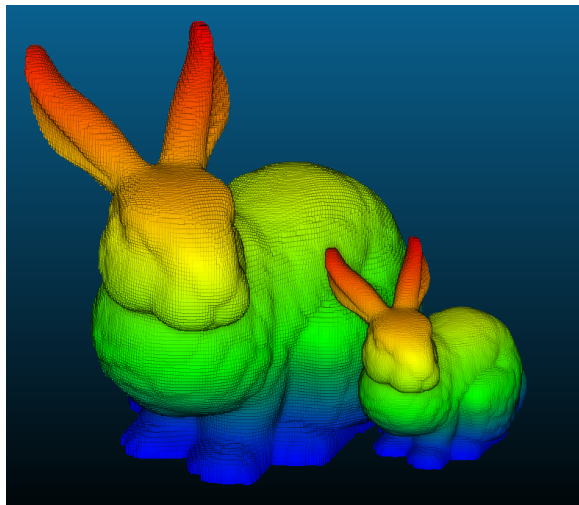


Figure 1: Original and transformed bunnies

### Question 2

Figure 2 shows a comparison between the original point cloud of an indoor scan and the same point cloud after decimation.

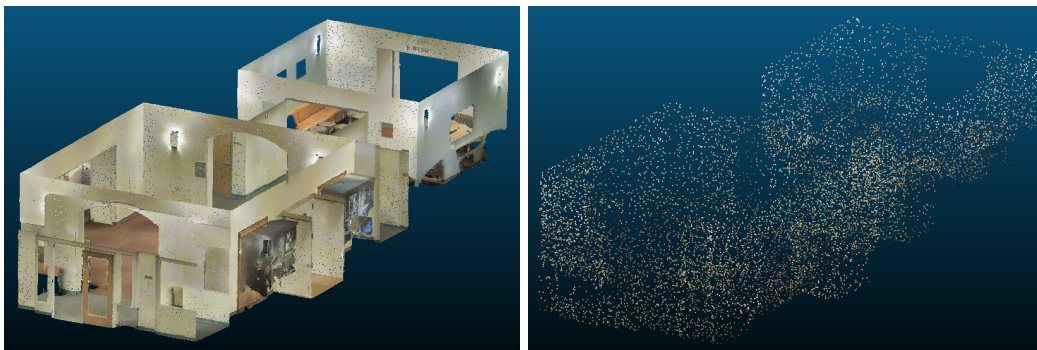


Figure 2: Left: original point cloud of an indoor scan. Right: the same point cloud after decimation with subsampling factor  $k = 300$

### Question 3

Time spent searching the neighborhoods for 10 random queries on the indoor scan with:

- Spherical neighborhood: 0.805 seconds
- K-nearest neighbors: 6.383 seconds

With these times, to search the neighborhoods for all points in the cloud, it would take:

- Spherical neighborhood: 68 hours
- K-nearest neighbors: 539 hours

### Question 4a

Values of `leaf_size` of 1, 2, 5, 10, 50, 100 and 200 were tested with `KDTree` that did spherical neighborhood search for 1000 random queries on the indoor scan. Based on figure 3, the fastest search occurs when `leaf_size` = 50.

`leaf_size` = 1 is not optimal because when the `leaf_size` is small, more points exist in each leaf and therefore, more time is required to iterate.

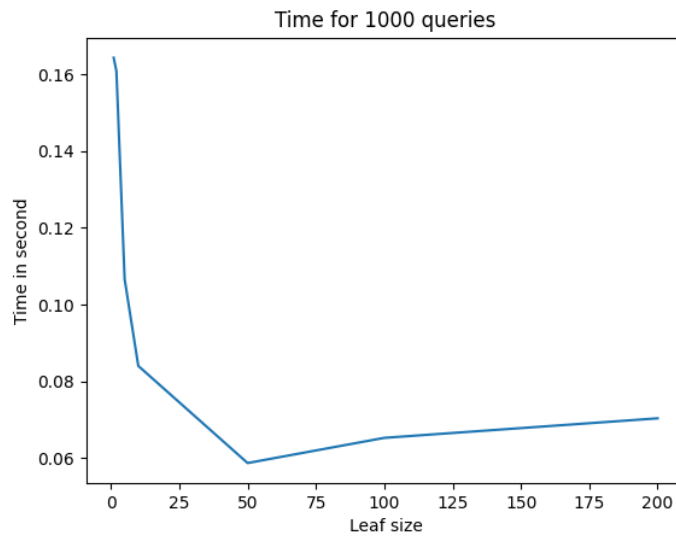


Figure 3: Time spent on spherical neighborhood search with respect to `leaf_size`

### Question 4b

With `leaf_size` = 50, radius of 0.1, 0.2, 0.5, 0.75, 1, 1.2 and 1.5 were tested with `KDTree` that did spherical neighborhood search for 1000 random queries on the indoor scan. According to the result obtained in figure 4, it can be seen that the longer the radius, the more time is spent searching. Furthermore, it would take 187 seconds to search 20cm neighborhoods for all points in the cloud.

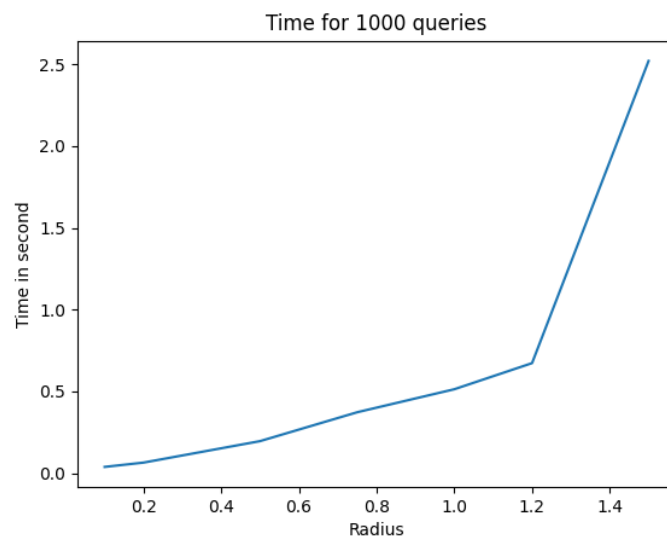


Figure 4: Time spent on spherical neighborhood search with respect to radius