

Point Cloud Learning Assignment (Day 10-12)

Q1. Voxel & Uniform Downsampling

1. Load a sample .pcd file
2. Apply:
 - a. Voxel Downsampling (voxel size = 0.05)
 - b. Uniform Downsampling (every 10th point)
3. Compare:
 - a. Point count before and after
 - b. Visual difference
4. Submit: 2 screenshots + comparison

Q2. Understand and Explain Voxelization

1. In 2–3 lines, explain:
 - a. What is a voxel in point clouds?
 - b. What does voxel grid filtering do?
2. Why do we use voxelization before filtering or segmentation?
3. Submit:
 - a. One screenshot showing voxel-downsampled cloud
 - b. Short answers for the above

Q3. Estimate Normals (Radius vs KNN)

1. Estimate normals using:
 - a. **KNN** (k=30)
 - b. **Radius** (r=0.1)
2. Visualize normals Using :

`draw_geometries([pcd], point_show_normal=True)`

3. Submit:
 - a. 1 screenshot
 - b. Which method looked better and why?

Q4. Normal Vectors – Interpretation

1. Print 3 sample normal vectors
2. Explain what each might indicate (flat, edge, noise, etc.)
3. In 2–3 lines, explain why normals matter in point cloud processing
4. Submit: Printed normals + your interpretation

Q5. Apply a 4×4 Transformation Matrix

1. Create a matrix that:
 - a. Rotates 45° around Z
 - b. Translates +2 in X, +1 in Z
2. Apply it using `pcd.transform(T)`
3. Submit:
 - a. Matrix used
 - b. Screenshot of transformed cloud

Q6. View Transformed Cloud in RViz

1. Save transformed .pcd
2. Publish it using:

```
roslaunch pcl_ros pcd_to_pointcloud transformed_sample.pcd 1.0 _frame_id:=map
```

3. Visualize in RViz (/cloud_pcd, frame: map)
4. Submit:
 - a. RViz screenshot
 - b. Was the change visible?

Q7. Apply Scaling to a Point Cloud

1. Apply scaling using:

```
pcd.scale(0.5, center=pcd.get_center())
```

2. Visualize before and after
3. Try scaling **without centering** — what changes?
4. Submit:
 - a. Screenshot of scaled cloud
 - b. 1–2 lines on your observation