Nuages de Points et Modélisation 3D (NPM3D) TP5

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1 Question1

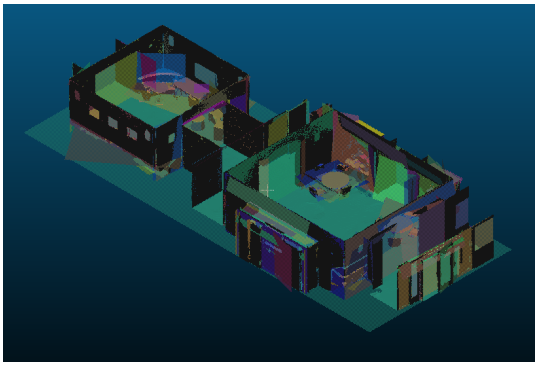

Figure 1: The planes extracted by RANSAC of indoor_scan.ply in CloudCompare

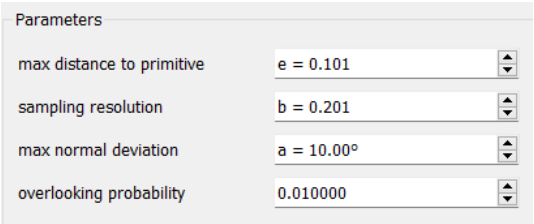

Figure 2: The parameters that lead to this result

As shown in the figure 1, the multitude of colors illustrates the segmentation algorithm's capability to dissect the space into individual components, such as walls, floors, ceilings, and potentially furniture or other interior elements.

However, I got **183** planes. The high number of planes suggests that there may be over-segmentation, which could include noise, minor surface irregularities, or non-significant features being identified as separate planes.

2 Question2

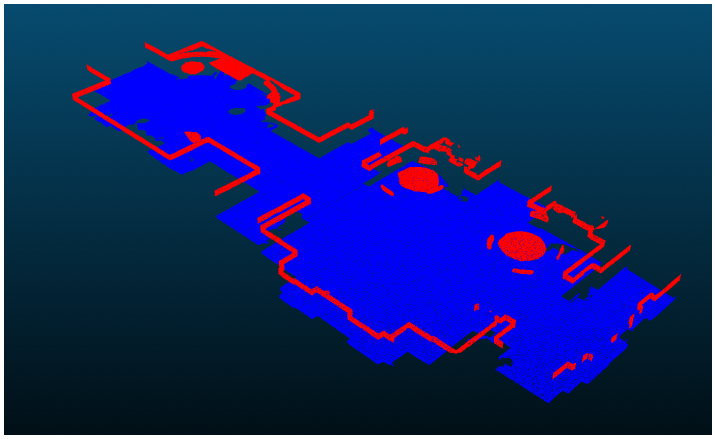

Figure 3: The two planes extracted consecutively by RANSAC

The figure 3 shows two planes extracted from a point cloud using the RANSAC algorithm, with apparent intersections and overlaps, suggesting that the algorithm may have inaccurately segmented a single plane into two or failed to capture the full extent of each plane.

This could stem from RANSAC's method of segregating data points to construct planes, where it randomly samples subsets and seeks fitting models. A plane is expected to be supported by a dense cluster of inliers; however, if the point cloud exhibits non-uniform distributions or misleading clusters, RANSAC might result in disjointed planes or recognize multiple planes where there should be a contiguous one.

Moreover, the randomness intrinsic to RANSAC's sampling process means different iterations could produce varying outcomes, especially in point clouds with complex geometries or proximal planar surfaces. RANSAC may not consistently differentiate between adjacent planar regions, leading to the segmented plane appearance observed.

3 Question3

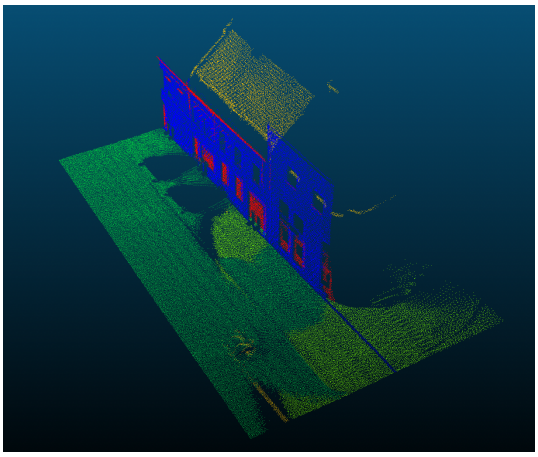

Figure 4: The five planes extracted consecutively by RANSAC of Lille_street_small.ply

```
nb_draws = 100
threshold_in = 0.10
nb_planes = 5
```

Figure 5: The parameters that lead to this result

The figure 4 depicts a point cloud of a building and its surroundings, where plane segmentation has been performed to highlight different structural elements. The building's façade is distinctly colored, indicating a successful segmentation of vertical planes, while the ground plane is also clearly delineated. The segmentation seems precise, with the algorithm effectively discriminating between the building and the ground, although there is some noise around the edges. This suggests that while the segmentation has mostly identified the larger planes accurately, smaller details or less prominent features may require further refinement or a different approach to be segmented with the same level of accuracy.

4 Question4

In standard RANSAC for plane detection, the algorithm typically only considers the positional information of points. It randomly selects sets of points and attempts to find a plane that fits as many points as possible within a certain threshold distance from the plane.

When we use the normals of points, the algorithm not only considers how close the points are to the plane but also how aligned their normals are to the plane's normal. This means that a point is considered an inlier not just based on its proximity to the candidate plane but also based on the angular difference between its normal and the plane's normal.

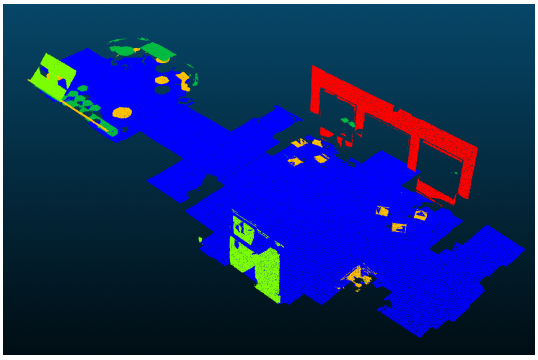

Figure 6: The five planes extracted consecutively by RANSAC using normal on points

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nb_draws = 100
threshold_in = 0.10
threshold_angle=np.deg2rad(10)
nb_planes = 5
```

Figure 7: The parameters that lead to this result

The figure 6 shows a segmented point cloud with multiple planes detected. The large blue regions suggest successful identification of major planar surfaces, while the presence of smaller colored patches could indicate either finer structural details or noise. The clear distinction between the planes suggests effective use of normal vectors in the segmentation process, enhancing the algorithm's ability to discern between different surfaces. However, the smaller patches may require further investigation to determine whether they represent actual objects, noise, or over-segmentation due to algorithm sensitivity.