TP 5: Modeling

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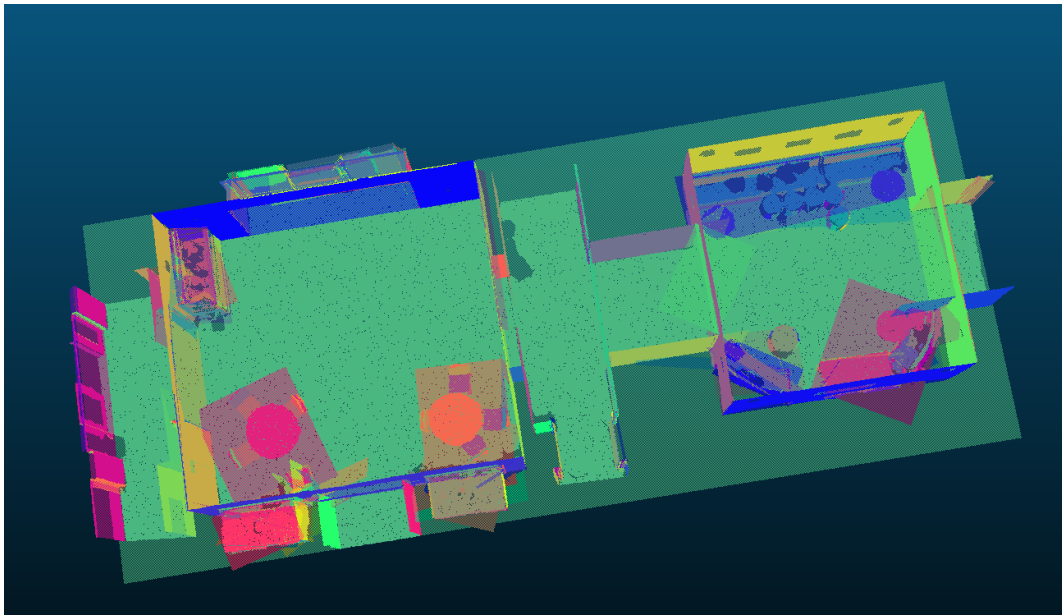
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1 Question 1

Figure 1: "Best" segmentation with RANSAC on CloudCompare (Run 1)

This "best" results was obtained with the following parameters in the RANSAC Shape Detection plugin:

- Min support points per primitive: 500

- Max distance to primitive: 0.06

- Sampling resolution: 0.201

- Max normal deviation: 15.00°
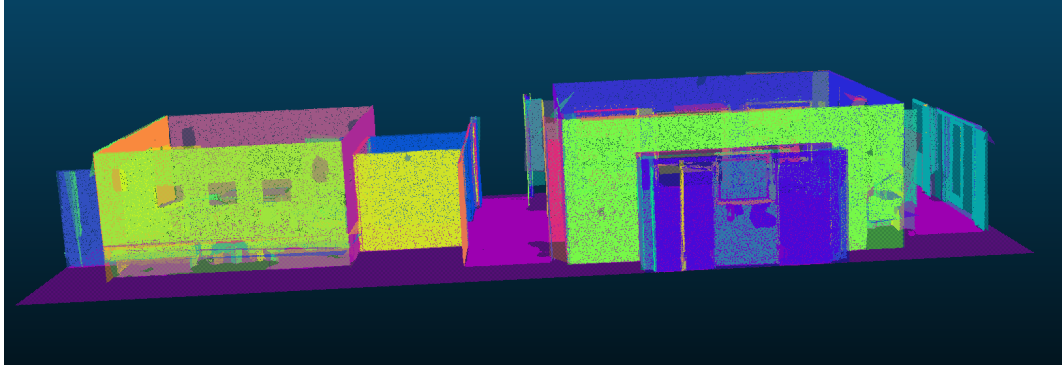
- Overlooking probability: 0.05

Figure 2: "Best" segmentation with RANSAC on CloudCompare (Run 2)

During my attempt to find the best segmentation, I observed that choosing a little value for the *Min support points per primitive*, will generate a high number of planes. Therefore, I chose to keep the default value of 500. I also decide to reduce a bit the *Max distance to primitive* and the *Max normal deviation* values to 0.06 and 15° such that the points are really close to their respective planes.

For that "best" segmentation, I obtain a segmentation with 202 planes, which seems to be correct qualitatively. The first plane correspond to big planes from the 3D scenes like the floor, walls etc.
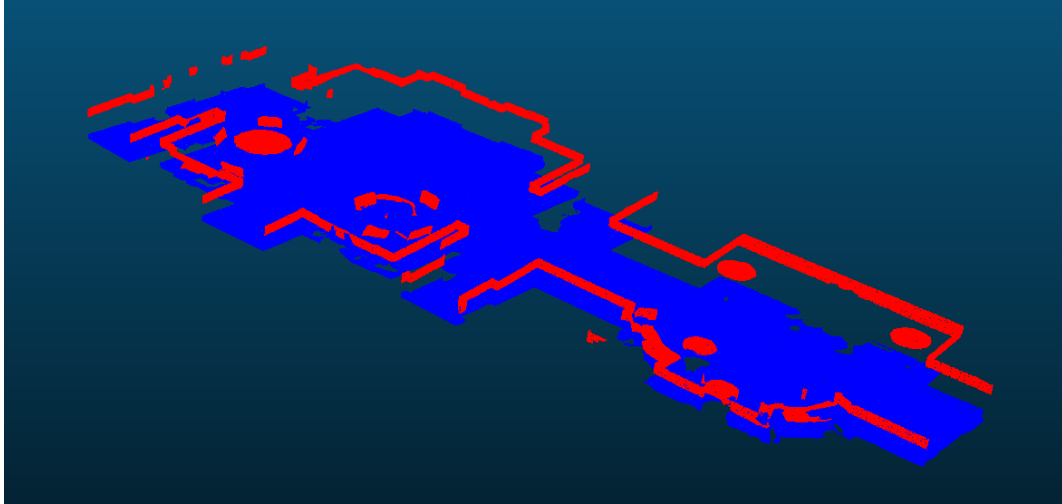
2   Question 2

Figure 3: Two planes extracted consecutively by RANSAC

The first plane is exactly what we want: the floor of the 3D point cloud scene. However, for the second extracted plane, there is a problem, indeed, we extract a parallel plane to floor, which doesn't corresponds to a real plane of the 3D scene. Moreover, this second extracted plane is not a connected component as we should have obtained. We would have

extracted another plane like a wall for example which corresponds to a real plane of the 3D scene and which is a connected component. The biggest problem for the second extracted plane is that it is not really a plane, indeed, the points extracted doesn't have all the same normals. Therefore, we should use normals of the points in RANSAC to solve this issue.
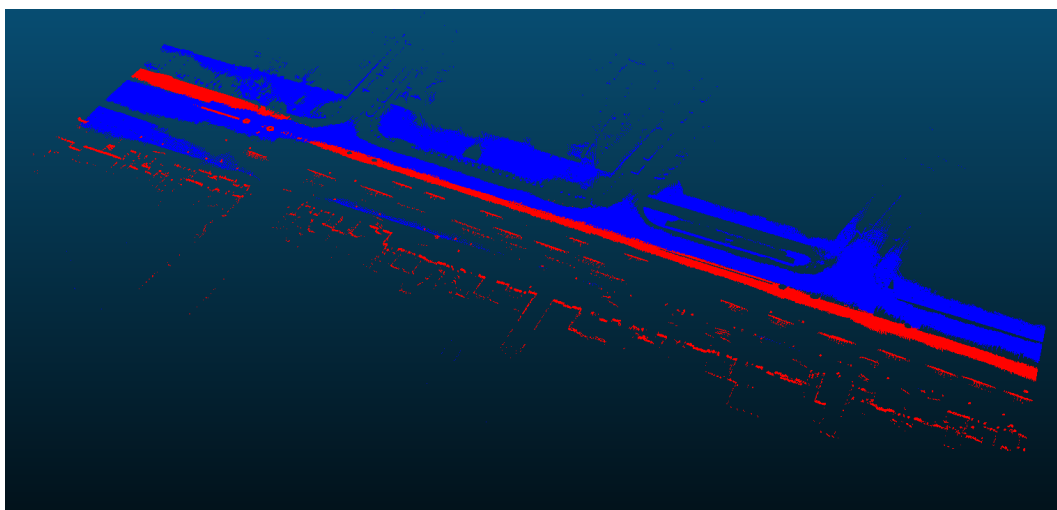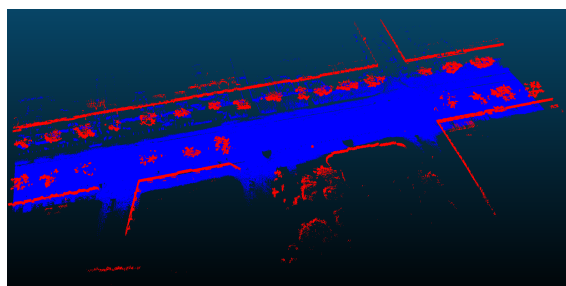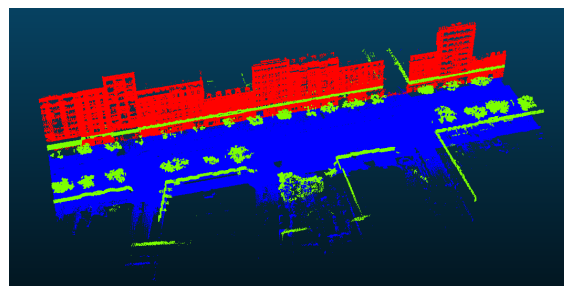
3   Question 3

Figure 4: Notre_Dame_Des_Champs.ply

For the Notre_Dame_Des_Champs.ply file, we should obtain a plane corresponding to the road and another one to the facade of the building along the street. However, it's not the case. This screenshot was done with the same parameters as in question 2: nb_draws = 100, threshold_in = 0.1 and nb_planes = 2.

Then, if we choose to relax the threshold by choosing: threshold_in = 0.5 for the left image and threshold_in = 0.7 for the right image, we obtain:

nb_planes = 2   nb_planes = 3

Figure 5: Notre_Dame_Des_Champs.ply

This seems to works a bit better (especially for the right image) even if we have the same issue as in question 2, we have a problem with normals due to the vegetation.
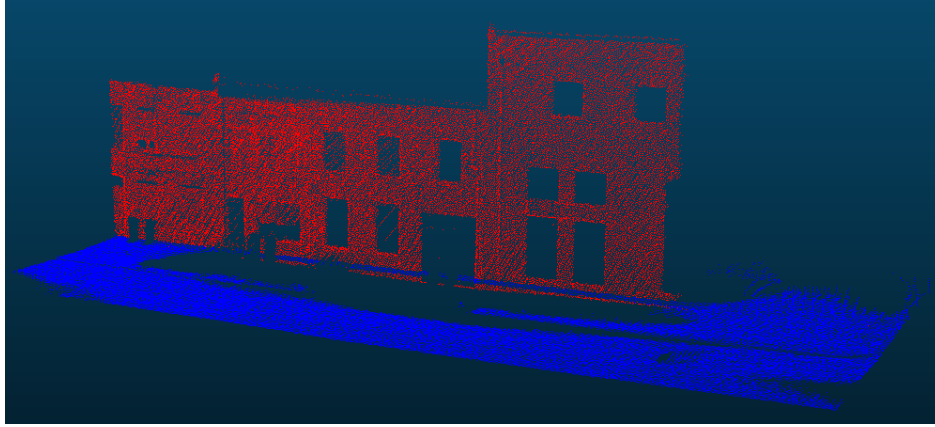
Figure 6: Lille_street_small.ply

For the Lille_street_small.ply file, this time, this works! We have a plane for the road and another for the facade of the building. The parameters are the same as in question 2: nb_draws = 100, threshold_in = 0.1 and nb_planes = 2.

4   Question 4

This time we implement a variant of RANSAC using the normal of the points. To do so, we modified the *in_plane* function in the code. In the original RANSAC implementation we were only selecting the points that were on a specific plane (with a threshold), now for this variant of RANSAC we are also selecting the points that are on a specific plane (with a threshold), but we are also selecting points that have almost the same normal as the plane (with a threshold). This enable us to not obtain results as in question 2.

We can see here some segmentation of 5 planes of the point cloud *indoor_scan.ply*:
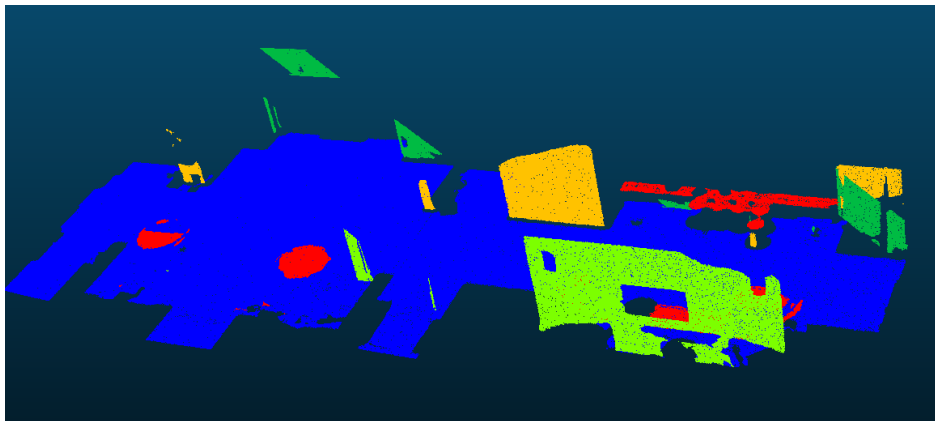

Figure 7: 200 draws

To obtain these segmentation, we used the same default threshold_in = 0.1 value, for the angle threshold of the normals, I used 0.25 radians which corresponds to 14°. The
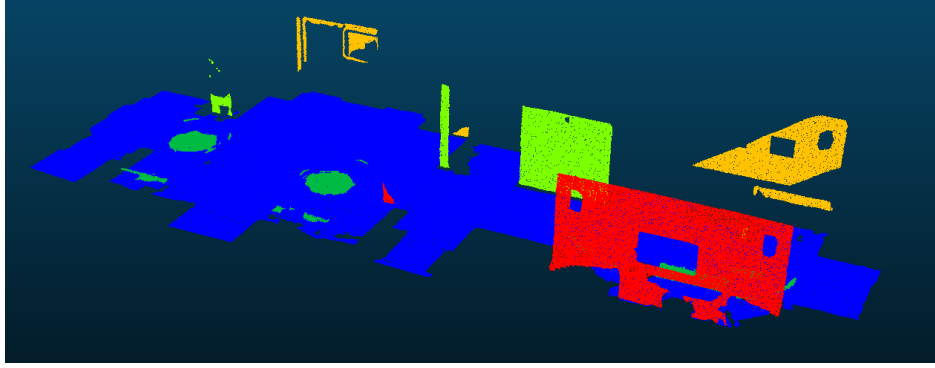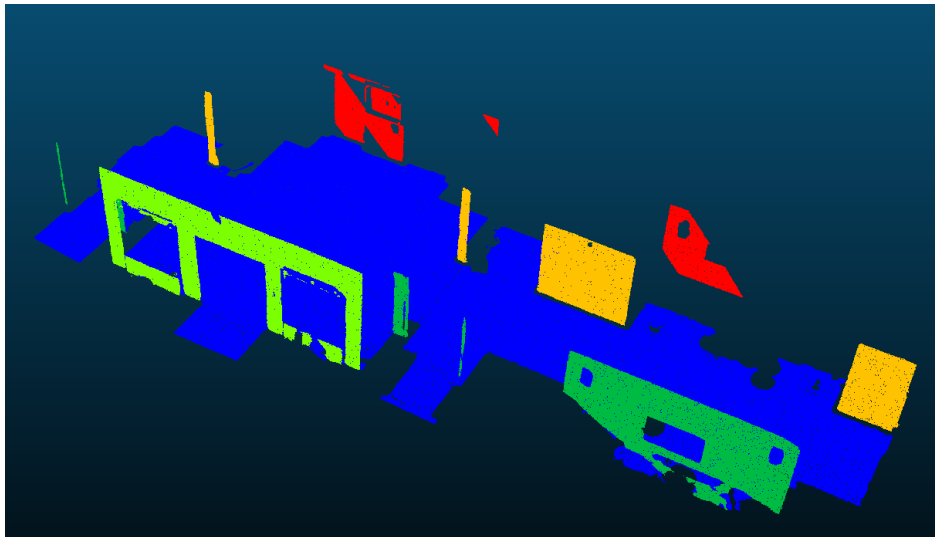
Figure 8: 300 draws

Figure 9: 500 draws

"best" segmentation corresponds to the figure 9, we can see 5 planes that have constant normal values. This exactly what we wanted. However some of the planes are not connected components. This new RANSAC variant seems also to be more sensible to the choice of the number of draws. Indeed, as there are more constraints on the selection of points in a plane, we have to do more draws to obtain good results.