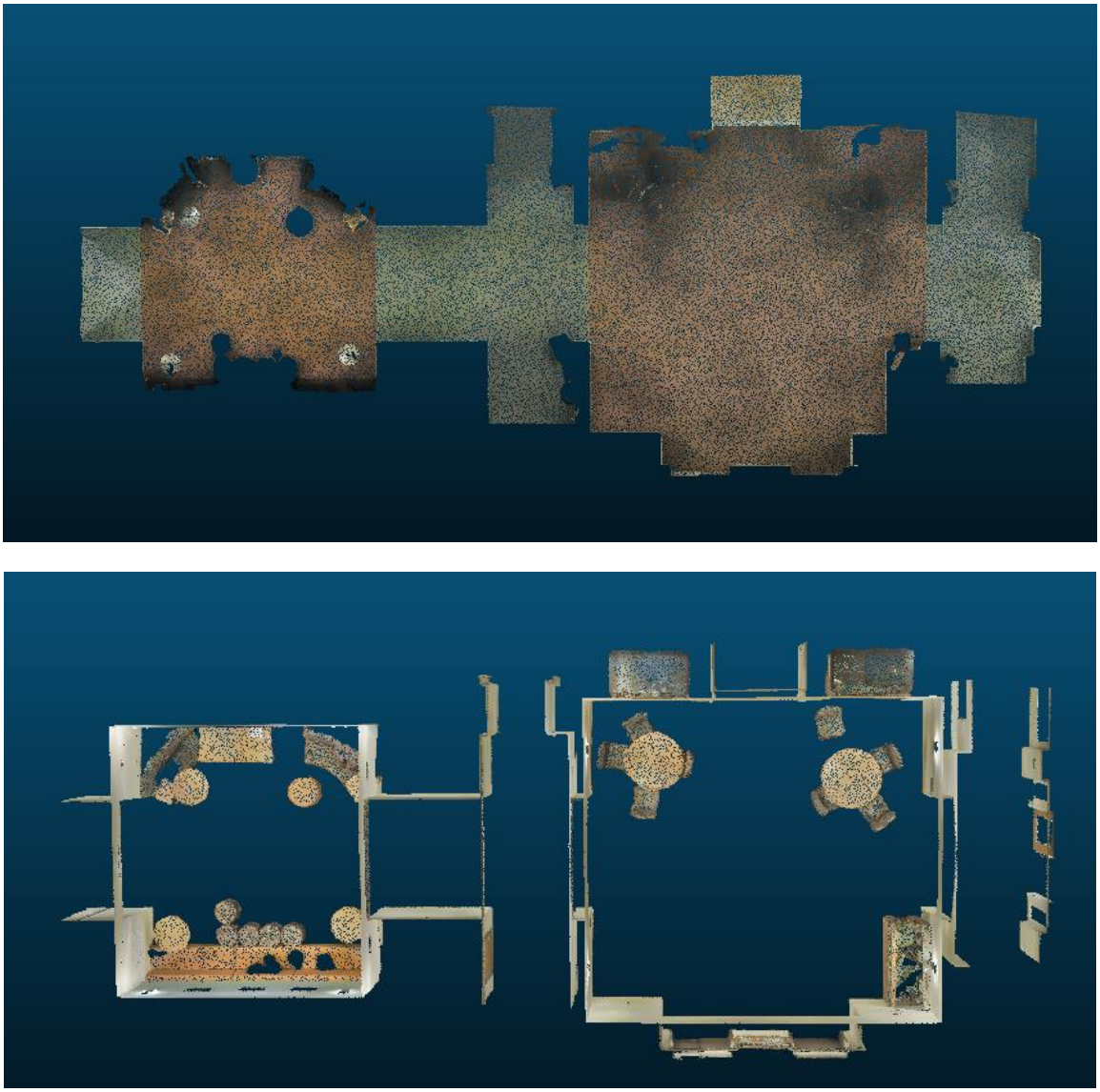
NPM3D – TP6: Modelling

YANG Antoine, MVA2019-2020, antoineyang3@gmail.com

A. RANdom SAmple Consensus

Question 1:

For the example of the indoor scan data, the most prominent plane corresponds to the floor and counts 135,233 points with default parameters. Results on CloudCompare are shown below.



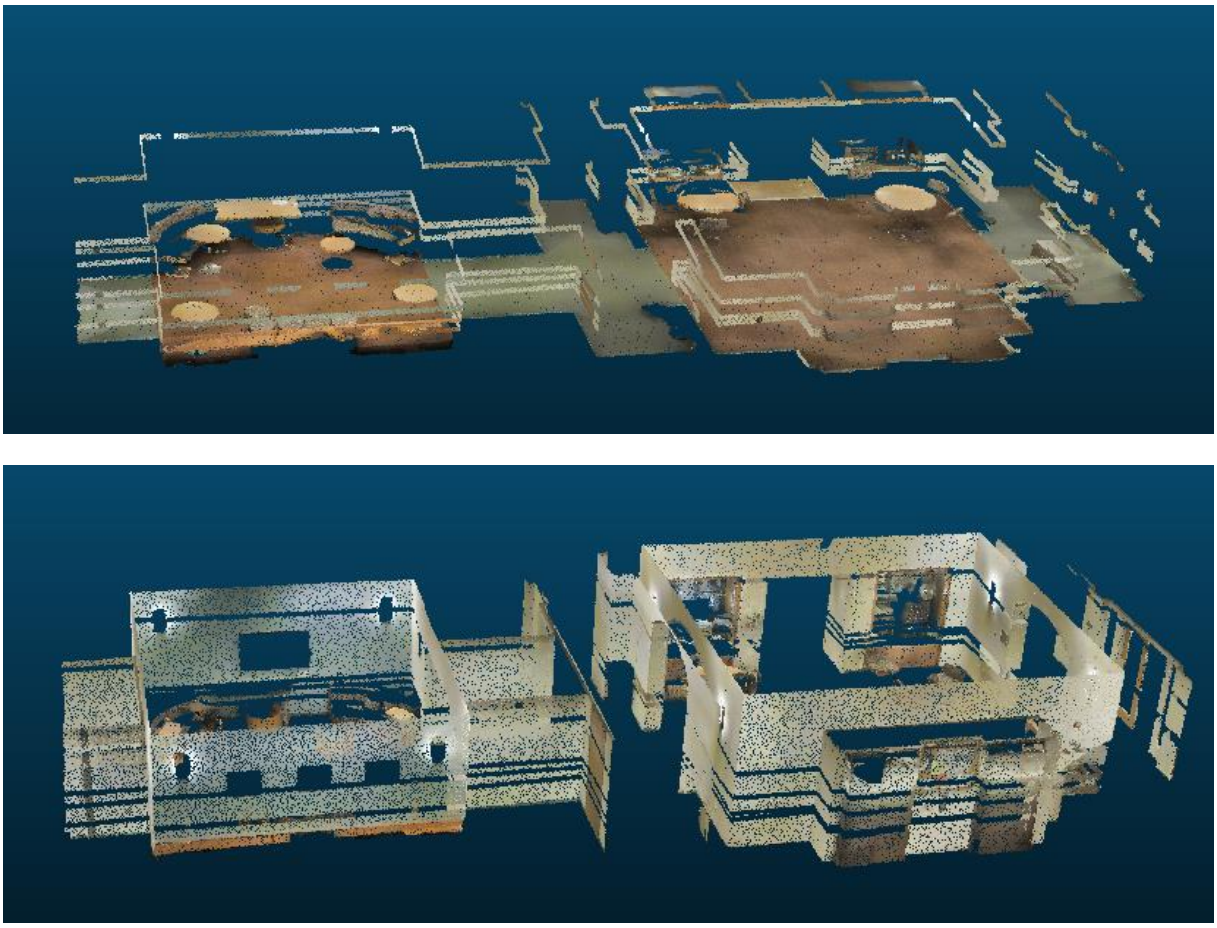
Best plane (top) and corresponding remaining points (bottom) with RANSAC

Question 2:

The probability of finding this plane is superior to 99% if and only if the probability of not finding it is below 1% i.e. $(1\text{-}(\frac{135,233}{412,756})^3)^{\text{nb\_trials}} \leq 0.01$ i.e. $\text{nb\_trials} \geq 129$.

Question 3:

For the example of the indoor scan data, Multi-RANSAC outputs a set of non-connected planes parallel to each other. The thing is that we compute 5 times the plane that explains best the remaining points, without any other constraint. Results on CloudCompare are shown below.



Best planes (top) and corresponding remaining points (bottom) with Multi-RANSAC

B. Region Growing

Question 4:

The three thresholds and the growing radius respectively control:

- **Distance Criterion (0.1 experimentally):** maximum distance to the plane for a point to be accepted in the region (the larger, the more extended the plane will be).
- **Angle Criterion (10 experimentally):** maximum angle between the reference normal and the normal for a point to be accepted in the region (the larger, the higher the risk to consider points from another plane in the plane).
- **Planarity Criterion (0.8 experimentally):** minimum planarity for a point to be added in the queue (the larger, the less flat the plane will be).
- **Growing Radius (0.2 experimentally):** controls the initial computation of normals (as seen in TP3, for instance if set too small, they vary a lot from a point to another in the same plane).

Question 5:

To maximize the chances of finding a plane, we can choose the point with highest planarity.

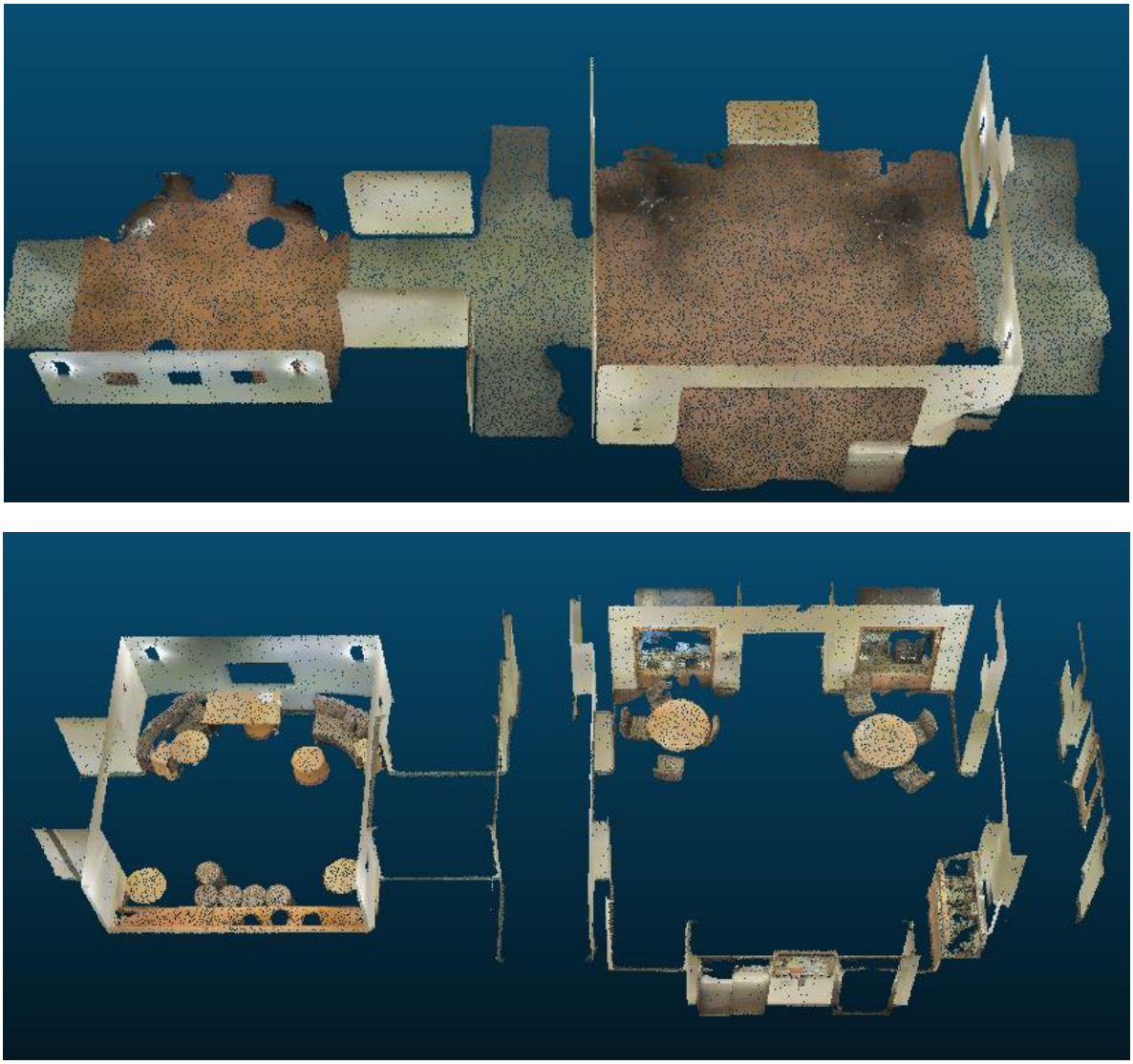
Question 6:

Results on CloudCompare with previously cited hyperparameters are shown below. To me, Region Growing advantages over RANSAC are:

- The preservation of connectivity
- Its adaptability: we can choose the criterion and the seed we want

Its drawbacks are:

- A significantly higher computational cost (more than 10 times for this TP)
- It is essentially a local method without any global view
- It can be very sensitive to noise
- The requirement of hyperparameter tuning (e.g. for the thresholds discussed previously)



Best planes (top) and corresponding remaining points (bottom) with Multi-Region Growing