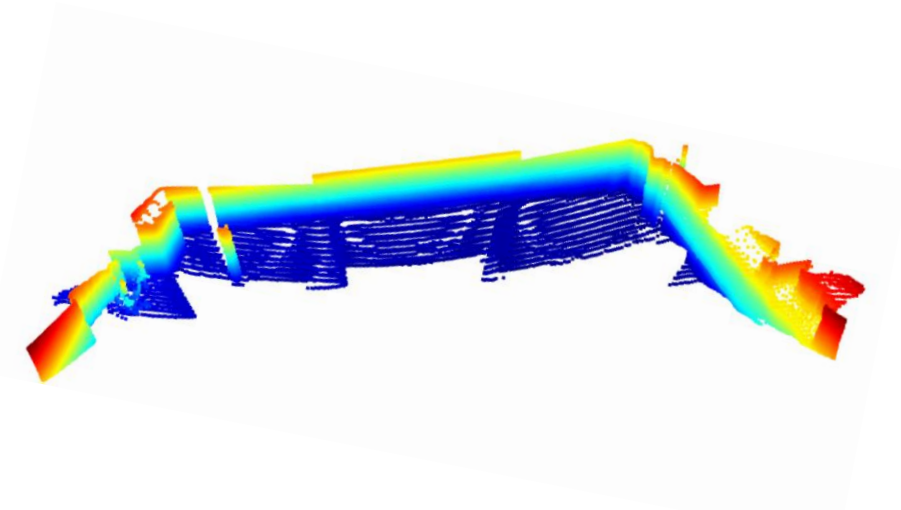


## Trainee homework for aiMotive

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### Visualization of „hazi\_feladat (Frame 0000).csv”



**Task 2:** Parse the CSVs. (Use Point\_X, Point\_Y and Point\_Z fields as coordinates) Do you find any error in the point-cloud data?

I created a class „**CSV\_Data**”, which has two methods. Their purpose is to look for different errors in the given csv files. On the one hand, method „**read\_csv**” reads in only one csv file which is specified by the user previously. On the other hand, method „**check\_all\_csv**” enables to run through all of the given CSV files and to look for specific errors in them. Furthermore, in the „**visualize**” method of class „**SensorVisualizer**” it will be verified whether the point cloud of interest is available for the visualization.

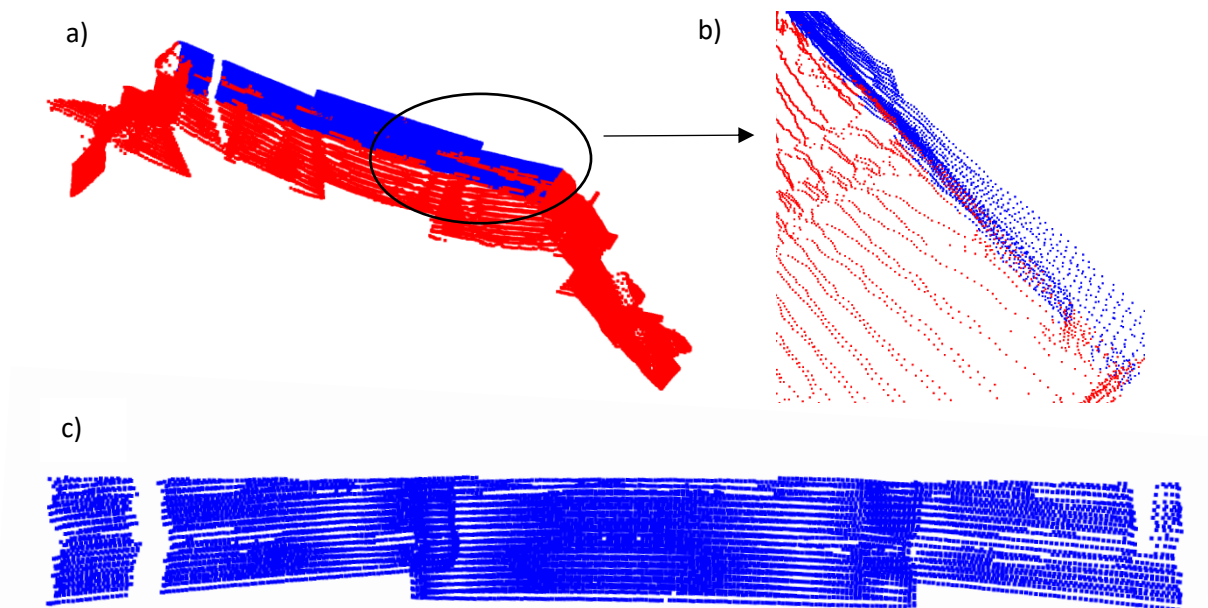
According to my solution, I did not find any error in the files or the point cloud data.

**Task3:** Select the wall from one of the frames. Assume that the wall is flat. Analyse the selected pointcloud and create an opinion about how well it is detected by the LiDAR.

For selecting the wall I used the „**segment\_plane**” function of Open3D library. This function is used to segment a plane in the point cloud using the RANSAC algorithm. It has 3 parameter:

- **Distance\_threshold(float):** Max distance a point can be from the plane model and still be considered an inlier.
- **Ransac\_n(int):** Number of initial points to be considered inliers in each iteration.
- **Num\_iterations(int):** Number of iterations.

With parameters set to: distance\_threshold=0.045, ransac\_n=3, num\_iterations=1000, I got the following figures:



Blue symbolises the selected wall (inliers) and color red symbolises every other point that is further than 0.045 from the plane (outliers).

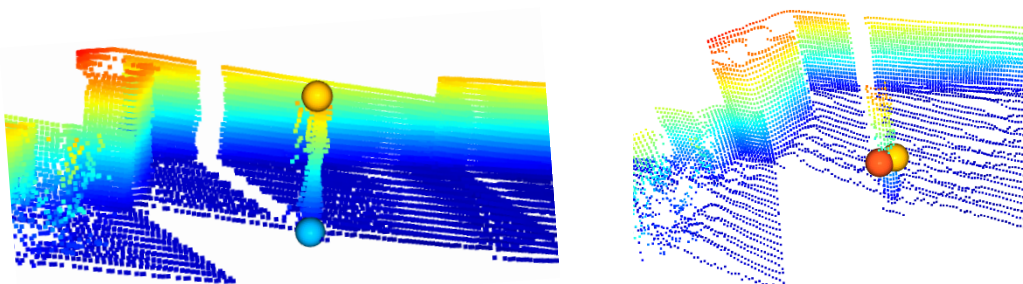
On figure a) it can be seen that even with a distance threshold of 0.045 (meaning 4.5 cm from the segmentation plane) there are still red segments on the selected (blue) wall, which theoretically are part of the wall, but they weren't selected. In addition to this, from a different view angle (figure b.)) we can see that the points of the wall are not in line perfectly.

Figure c) shows the cropped out wall segment from the whole point cloud. On this figure the density of the color blue varies, which means that some parts of the selected points were closer to the segmentation plane, and some areas were further from it.

As a result of my analysis I would suggest that the lidar sensor could detect the wall of the room, however not precisely, not as a completely flat surface, because the points of the wall should be in a plane/ in a line, but their z coordinates vary. In conclusion the sensor often detected points of the wall that should be further away in reality.

**Task 4:** A target is marked in the last picture. It is a cartoon cylinder with a diameter of 10 cm and a height of 1 m. What is your opinion regarding the detection accuracy of this target?

For measuring approximately the height and diameter of the cylinder object you have to select 2-2 points manually on the 3D figure.



As a result the program prints out:

```
[Open3D INFO] No point has been picked.  
[Open3D INFO] Picked point #731 (4.3, 2.3, -0.19) to add in queue.  
[Open3D INFO] Picked point #29006 (4.3, 2.3, -0.93) to add in queue.  
[731, 29006]  
The selected points:  
[-0.18743675]  
[-0.9338412]  
The height of the object is: [0.74640445]
```

```
Pick the points for the cylinder object in this order: left and right (for diameter)!  
[Open3D INFO] No point has been picked.  
[Open3D INFO] Picked point #18226 (4.3, 2.3, -0.61) to add in queue.  
[Open3D INFO] No point has been picked.  
[Open3D INFO] Picked point #15246 (4.4, 2.3, -0.62) to add in queue.  
[18226, 15246]  
The selected points:  
[4.32366252]  
[4.39602204]  
The diameter of the object is: [0.07235952]
```

The height of the object: 0.746 -> **74.6 cm**

The diameter of the object: 0.0724 -> **7.24 cm**

Accuracy of the detection according to my solution:

**74.6 % for the height**

**72.4% for the diameter**

A measuring accuracy around 70% for LiDAR is not generally considered to be a good accuracy. A 70% measuring accuracy implies that the distance measurements made by the sensor have an error rate of 30%, which could be significant in many applications.