

Task 5: RANSAC Plane Fitting (15 points)

Write code to fit at least one 3D plane using RANSAC in the point cloud in **record_00348.pcd**.

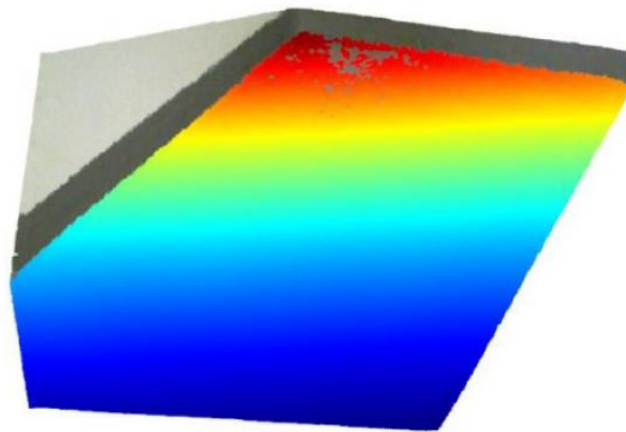
Show your detection results.

Hint: To load the data, you may find these pages useful:

http://www.open3d.org/docs/tutorial/Basic/python_interface.html#install-open3d-from-conda

http://www.open3d.org/docs/tutorial/Basic/file_io.html#point-cloud

Note: If you use RANSAC API in existing libraries instead of your own implementation of RANSAC, you will lose 5 points.



Solution:

To solve this problem, I need to fit a RANSAC Model and test the number on inliers and outliers to the model. The lower the number of Outliers, the better the model is. In addition, the higher the number of Inliers the better the model is. That is with better fitting it continues to add in more points to the model. So in order to execute the solution, a Python code was build and run on the given .pcd file. Therefore, what I need to do in this problem is generate three random points from a set chosen by us and keep iterating the planes formed by them. As inputs, Threshold limit and Success Probability was taken. The threshold limit gives us the value of restricting the distances between every point from the plane. In addition, the Success probability was taken in order to ensure the changing number of inliers kept influencing the total number of points. For calculating Outliers, distance of every point was taken from the plane and was checked if they lie within the threshold limit. This process was repeated until the Number of iterations lie equal to the number of planes considered.

The algorithm then prints out the total number of planes considered. The number of planes is the counter variable, which gets decided based on Threshold limit, predicting number of Inliers and upon the success probability, which is used along with the ratio of Inliers and outliers to produce the new value of total number of points to randomly select my three points from. This goes on until I have my lines, and thus the lines form my plane. Therefore, if the lines are in ground then the model is well fitted, as the plane from my line can overlap more territory, thus making it a better solution. I have kept my starting number of points to select from as 271983. Originally, it should be Infinity. Then after receiving my Lines, I plot them using Open 3D.

These are my results:

```

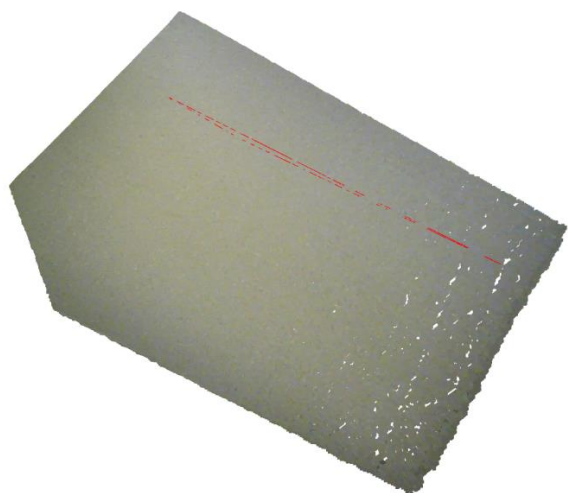
Output Task 5.txt - Notepad
File Edit Format View Help
Format = auto
Extension = pcd
geometry::PointCloud with 271983 points.
[[-0.44703168 -0.30711567 0.79800004]
 [-0.44451565 -0.30634597 0.79600006]
 [-0.44312003 -0.30634597 0.79600006]
 ...
 [ 0.24811688 0.22288465 0.53300005]
 [ 0.24905139 0.22288465 0.53300005]
 [ 0.24998593 0.22288465 0.53300005]]
Threshold:0.01
Success Prob:0.95
Equation: -0.012242897108708184x + -0.09391475118915782y + -0.06976444958220315z = -0.06156739034999383
Equation: -0.03356453963313283x + 0.03648627542685645y + -0.10507389431230504z = -0.09846003723077511
Equation: 0.011108656317687426x + 0.0930475942243929y + 0.0688439051981003z = 0.061000244070503654
Equation: 0.0072885518329464105x + -0.13939735748872195y + -0.10607988331691087z = -0.08911022138185903
Equation: 0.02517269992063076x + 0.016002872274162527y + 0.03288156571692258z = 0.0167285129080946
Equation: -0.09366100313221715x + -0.586577470906672y + -0.4483931624631414z = -0.39750589670292535
Equation: -0.008910998626876387x + -0.042819443215348585y + -0.031231929464144118z = -0.028557469492902048
Equation: -0.059916500029705944x + -0.007208767858168708y + -0.13143716778818176z = -0.08058118562157615
Equation: -0.10332697338466712x + 0.2333238976661547y + 0.11313420495096005z = 0.10363824038141554
Equation: -0.019062737883890346x + -0.1480233492012184y + -0.11003189566146557z = -0.09715404171571673
219726 Inliers 52256 Outliers
10 different planes checked

Format = auto
Extension = pcd
geometry::PointCloud with 271983 points.
[[-0.44703168 -0.30711567 0.79800004]
 [-0.44451565 -0.30634597 0.79600006]
 [-0.44312003 -0.30634597 0.79600006]
 ...
 [ 0.24811688 0.22288465 0.53300005]
 [ 0.24905139 0.22288465 0.53300005]
 [ 0.24998593 0.22288465 0.53300005]]
Threshold:0.1
Success Prob:0.9
Equation: -0.08934753630108982x + 0.007546426179517951y + -0.22043812905631233z = -0.1660912555262419
Equation: 0.0007335156826966394x + 0.009407635275844761y + 0.007209404828371568z = 0.006281253667003967
2
249583 Inliers 22399 Outliers
2 different planes checked

```



Threshold: 0.01 Success Probability: 0.95



Threshold: 0.1 Success Probability: 0.9