Segment Point Cloud by Using Sequential Labeling and RANSAC Algorithms

Xiaoke Shen

The Graduate Center, City University of New York

Abstract

This report is the submission of the project 1 of the 3d computer vision course provided by the Graduate Center of CUNY. The project is required to do the segmentation based on the raw cloud point data. Sequential labelling and RANSAC algorithms are used to explore the different segmentation results. The code of this project is shared on github: `https://github.com/liketheflower/3d_vision.git`

1 Project description

One of the earlier stages in range image analysis is segmentation. The input to this module is a range image acquired from a specified viewpoint. This range image is expressed as a two-dimensional array of 3-D points. 3-D points that are neighbors in this array are probably neighbors in the actual 3-D surface, unless the points lie on a shape discontinuity. Each 3-D point is expressed with four coordinates. The first three are the Cartesian x, y, z coordinates expressed in the local coordinate system of the range scan. The fourth is a number that encodes the power of the returned laser beam.

The segmentation module groups 3-D points that are part of the same surface by giving them the same label. One way to do this is to override the fourth coordinate of each point with the point?s label.

Given a range image R acquired from one particular viewpoint segment this image into planar components. Visualize the result by displaying each segment (i.e. set of points that lie on the same surface) with different colors. Test the following algorithms:

(a) Compute normals for all points and apply a region-growing algorithm using the grid structure of the range images. (b) Apply a RANSAC algorithm by selecting 3 points to define a plane and then score it. (c) Apply a RANSAC algorithm by selecting 1 point and its normal to define a plane.
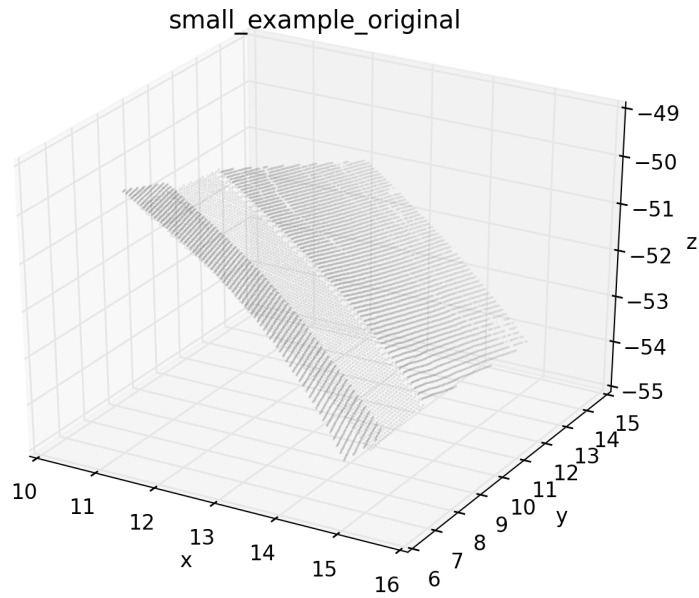
2 Original cloud point data visualization

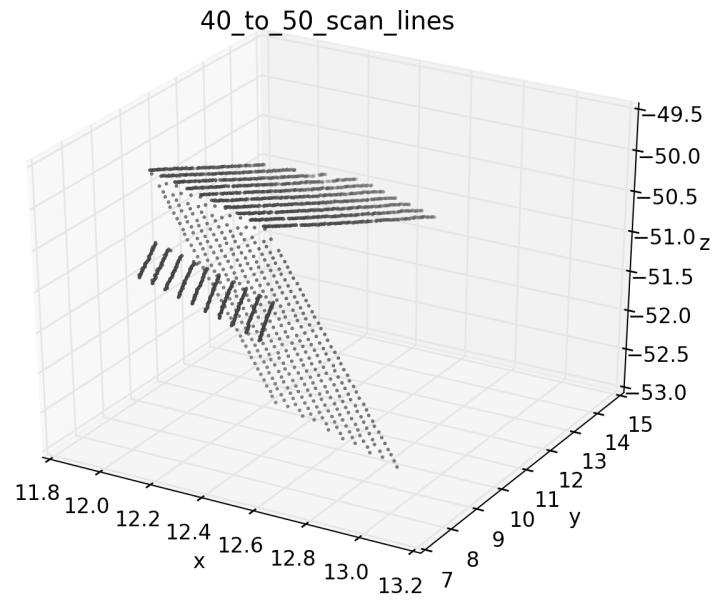Figure 1: The original point cloud of the small example.

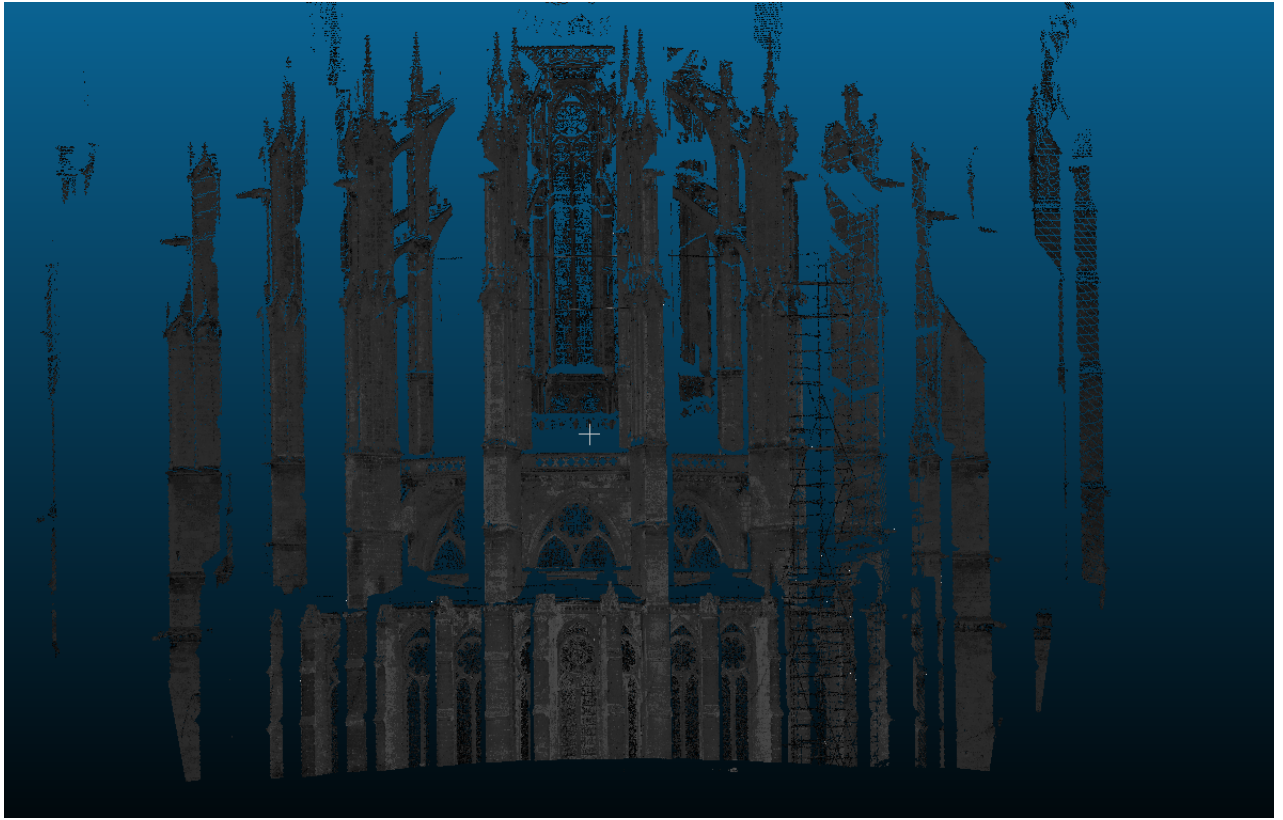Figure 2: The 40 to 50 scan line of the point cloud of small example.

Figure 3: The point cloud of big example.

3 Sequential labelling: submission of part (a)

3.1 get the Norm for each point

3.2 Sequential labelling method A

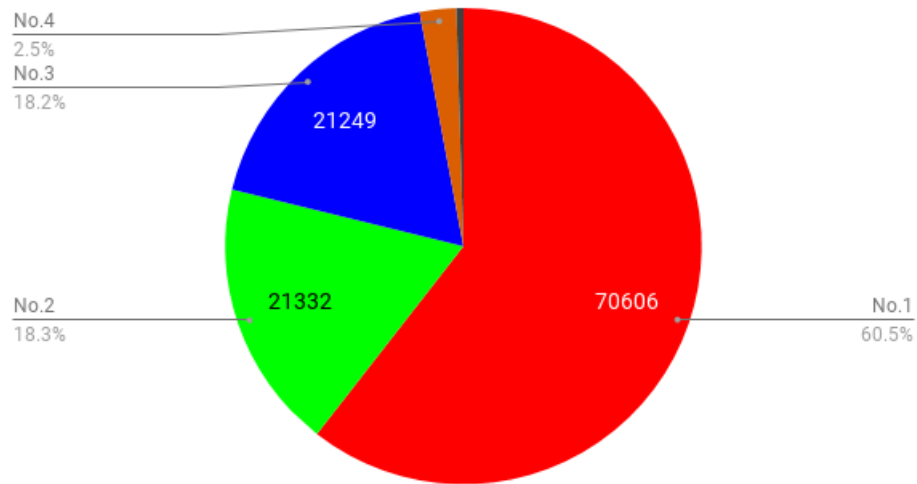#points of the top 4 categories of sequential labelling A
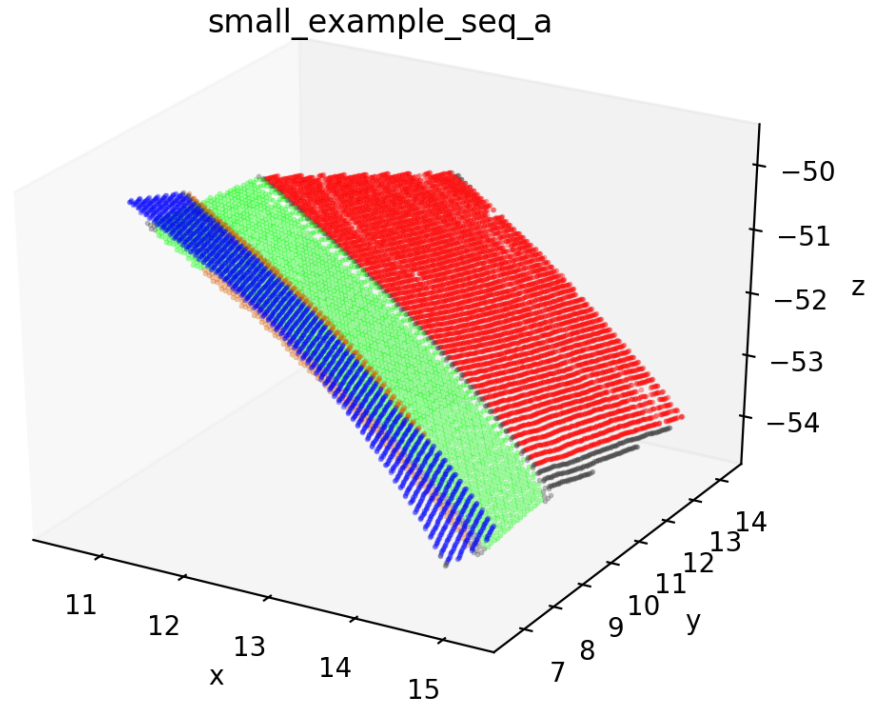
No.4
2.5%
No.3
18.2%

21249

No.2
18.3%

21332

70606

No.1
60.5%

Figure 4: The original point cloud of the small example.

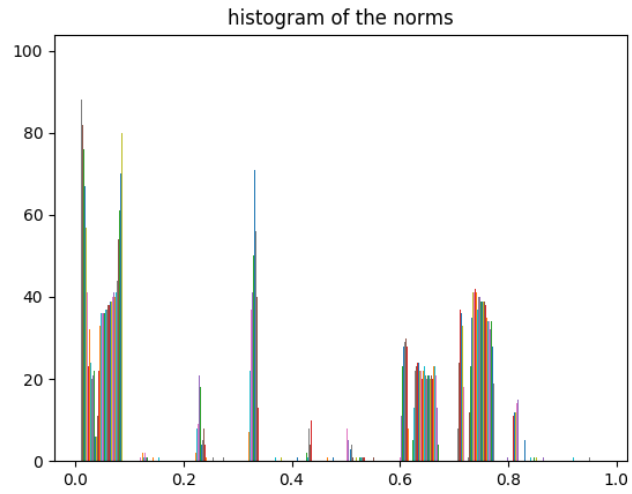Figure 5: The original point cloud of the small example.

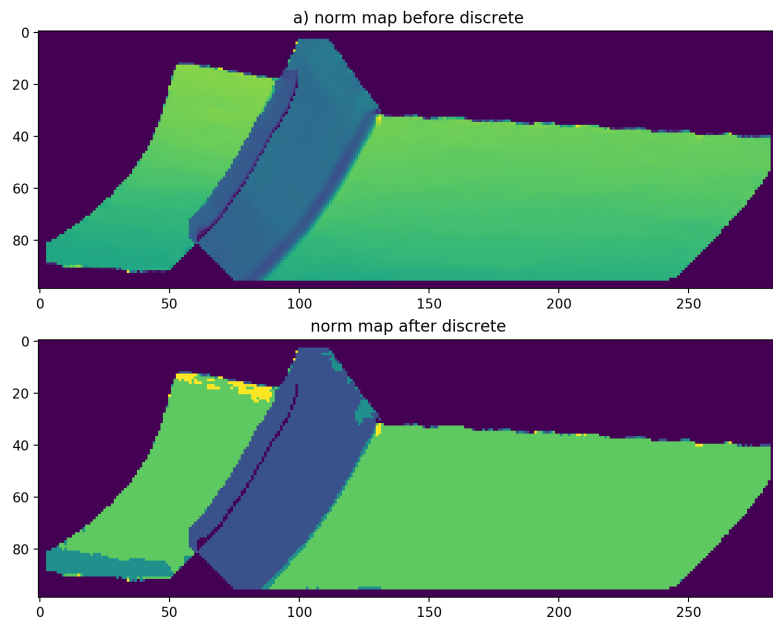Figure 6: The original point cloud of the small example.

Figure 7: The 40 to 50 scan line of the point cloud of small example.

#points of the top 4 categories of sequential labelling B

No.4
2.0%
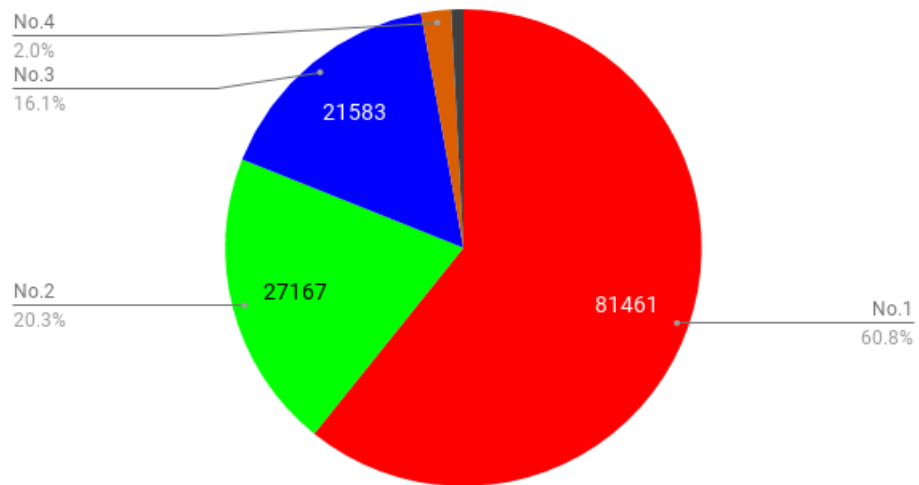No.3
16.1%
21583
No.2
20.3%
27167
81461
No.1
60.8%

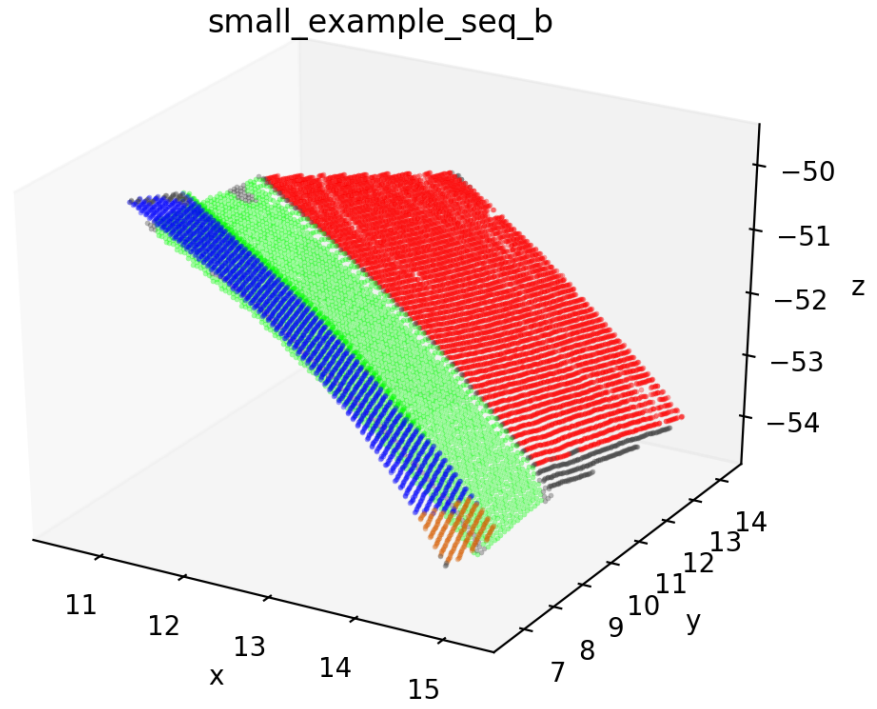Figure 8: The 40 to 50 scan line of the point cloud of small example.

Figure 9: The 40 to 50 scan line of the point cloud of small example.