

ECE 6310
Introduction to Computer Vision
Fall 2022

Lab 8

Range Image Segmentation

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Introduction

This lab is concerned with range image segmentation. Range Image Segmentation is the procedure of segmenting surfaces in an Image that are at different depths. For this exercise, the students were provided with a range image.

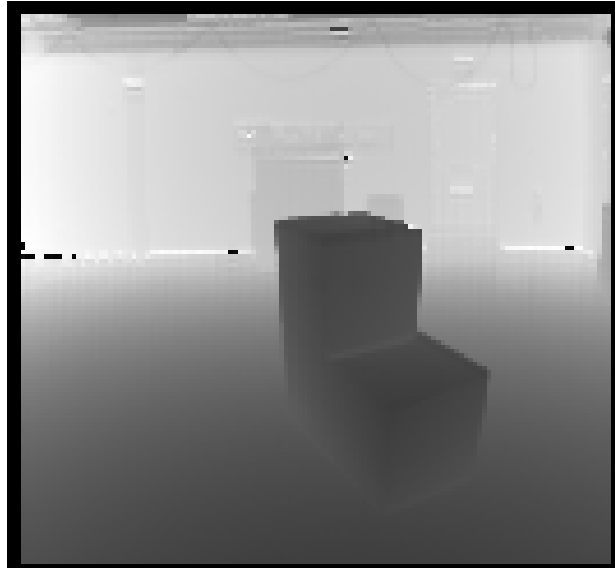


Fig 1 – Range Image of a Chair

Implementation / Methods

At first, the given greyscale image was thresholded. The different values for thresholding were tried. Too low of a value did not show the object clearly for labeling. Too high of a value had the same effect. The results remained consistent for the threshold values of 130 to 150. **The threshold that I chose for the final result was 135.**



Fig 2 – Thresholded Image

After thresholding, the original non-thresholded image was used to calculate the X, Y, and Z coordinates using the code provided during class. These coordinates were used to calculate the surface normal. Then for each pixel, I looked at a pixel to the right of the current pixel, which was a certain distance away from the current pixel. Similarly, the pixel below the current pixel was also considered. **The distance chosen between pixels was 2.** Lower values resulted in peculiar results. Again, higher values resulted in the strange colored image at the end. To calculate the surface normal, it was assumed that the current pixel and the pixel below it would form one vector, and the pixel to the right would form another vector. The Cross product of these two vectors gives us the surface normal.

After this region growing code from the previous assignment was modified and used. The region predicate was the orientation of a pixel. If the orientation of the pixel was within the threshold, then it joined the region. In other words, the predicate was the angle between the current surface normal and the average surface normal, calculated by the dot product between them. For this, I looked at a 5 by 5 window around every pixel. If the pixel was not labeled or thresholded, then it was used as a seed for region growing. I ran the loop and printed out all the angle values. Then I chose the lowest value as the threshold limit. **The angle threshold thus obtained was 0.55. The value is in radians.** It must also be noted that if the region was smaller than 40 pixels, it was erased.

The output is the image below.

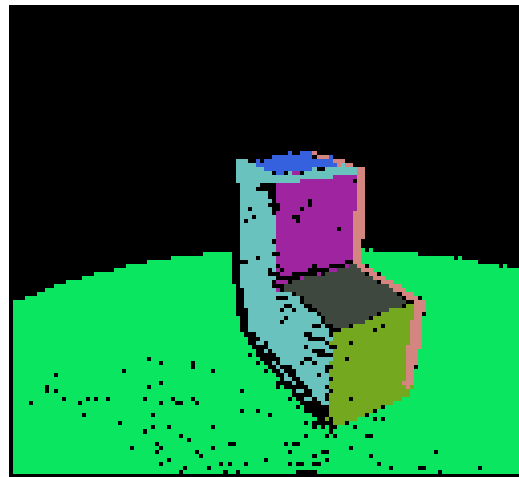


Fig 3 – Segmented Output

Region	Average Surface Normal X	Average Surface Normal Y	Average Surface Normal Z	No. of Pixels
1	-2.196932	-8.129424	3.089341	67
2	7.709159	4.996569	1.893407	615
3	-1.759277	0.999099	2.229386	426
4	-20.114067	6.104018	4.876374	149
5	0.753497	-15.457486	3.719050	4987
6	0.943041	-3.857175	1.121216	262
7	-0.860572	0.839218	2.074386	439

Table 1 : Region, its size in pixels, and average surface normal X,Y and Z for that region