

Range Image Processing Project

Advanced Digital Image Processing and Computer Vision Lab

Jhala Divyarajsinh Hanubha (19CS60R47)
rajajhala@gmail.com

Indian Institute of Technology, Kharagpur

April 19, 2020

1 Introduction

We are given a data set containing both optical and range images of the visible surface for the same scenes (provided in the folder RGBD data).

Firstly, we compute principal, mean and gaussian curvatures for the range data of any particular image.

Using that data, we carry out image segmentation in range dimension for object separation based on Principal Curvatures, Mean and Gaussian Curvatures and NPS.

We then compare the results with ground truth optical images.

2 Packages Used

The following packages were used in this assignment. Please install them before running the project.

cv2, math, pylab, scipy, matplotlib, mpl_toolkits.mplot3d, numpy, sklearn.

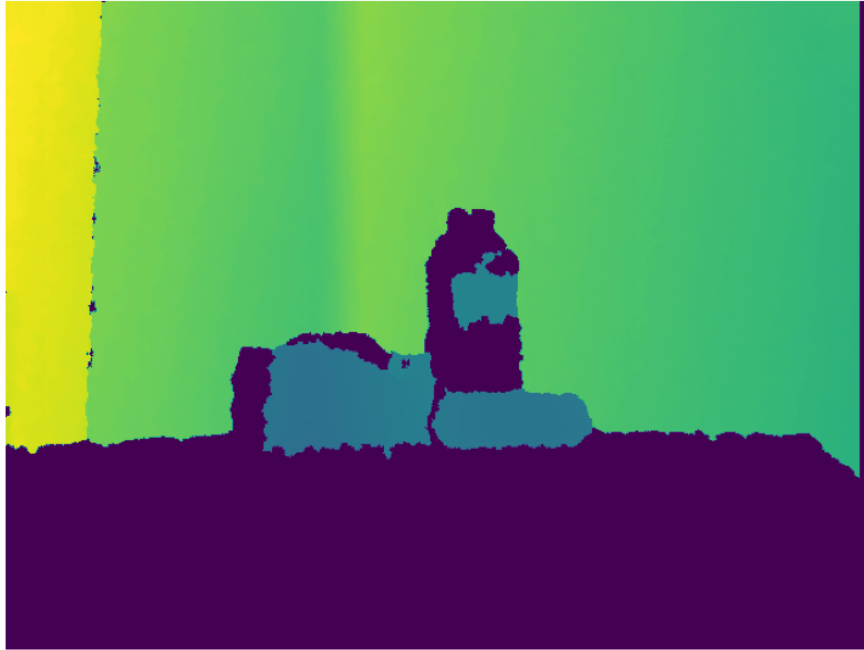
Project also expects a folder named RGBD_dataset in its directory.

3 Experiments and Results

Here we show various intermediate results as well as comparison between different methods on the quality of image segmentation.

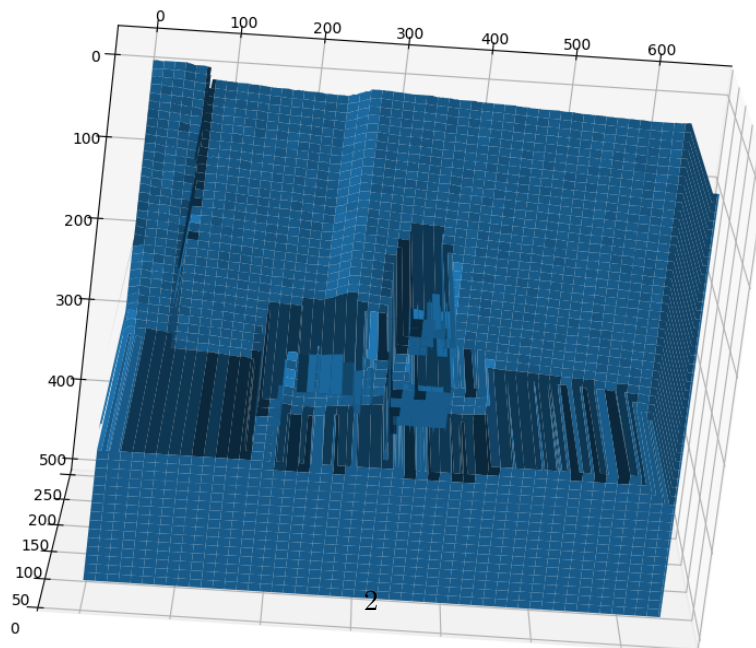
Range Image (2.png):

Range Image:



3D representation of range image:

3D Representation (please rotate):



Calculation of topology from Principal Curvatures:
Given are two representative results out of 9 maps. Find others in Output folder.

Flat Map:

Flat Map:



Peak Map:

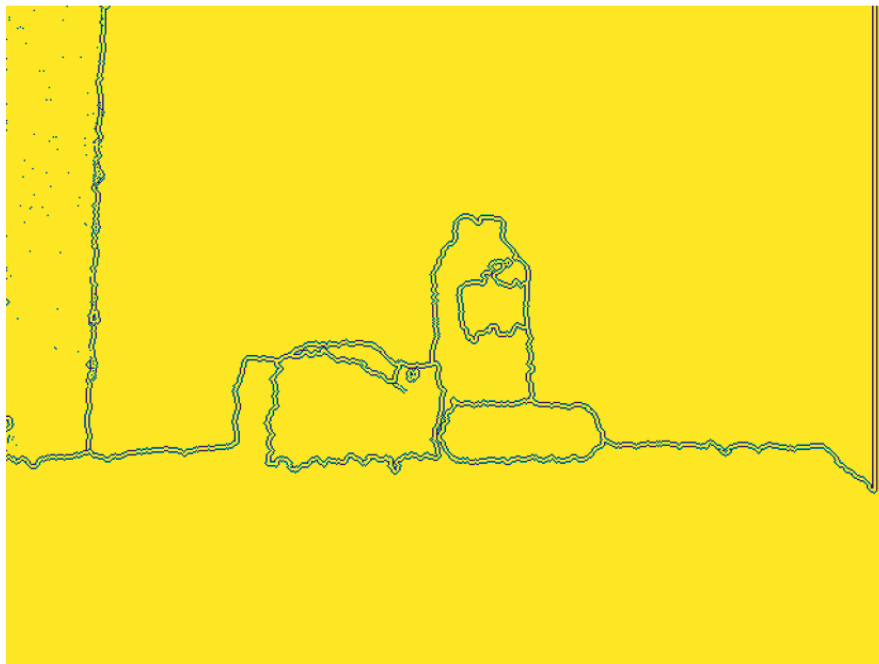
Peak Map:



Calculation of topology from Gaussian and Mean Curvatures:
Given are two representative results out of 9 maps. Find others in Output folder.

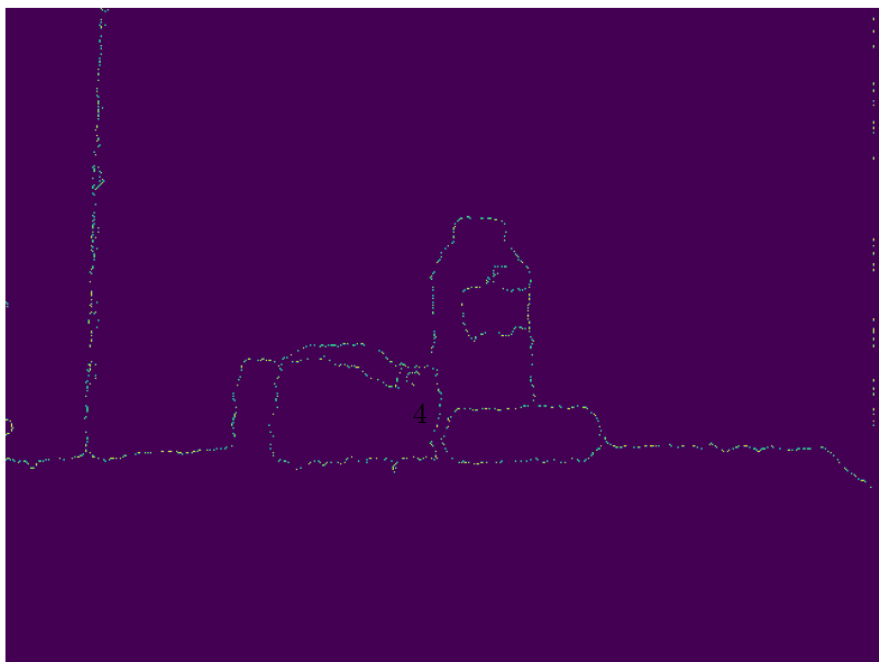
Flat Map:

Flat Map:



Peak Map:

Peak Map:



Segmentation Results using Region Growing:

Optical Image



Segmentation Result

Segmentation based on NPS:

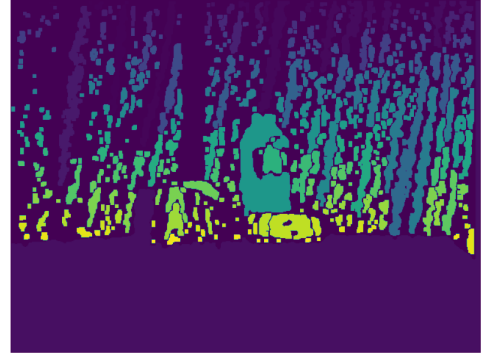


Figure 1: NPS Segmentation

Here, there segmentation is done using only the NPS data for pixels. Table, Bottle and some items are successfully seperated, but there is a lot of noise in the result.

Optical Image



Segmentation Result

Segmentation based on Principal Curvatures:

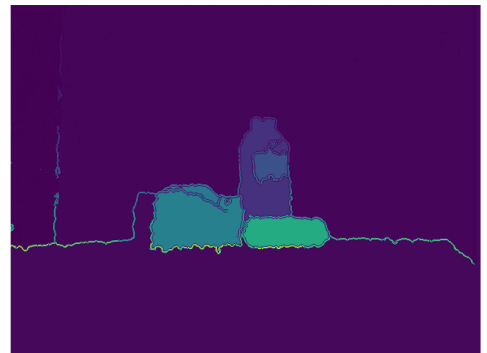


Figure 2: Principal Curvatures Segmentation

Here, there segmentation is done using the Principal Curvatures data for pixels. Table, Wall, and all the items are totally seperate in the result, with some noise at a few places.

Optical Image



Segmentation Result

Segmentation based on Gaussian Curvatures:



Figure 3: Gaussian and Mean Curvatures Segmentation

Here, there segmentation is done using the Gaussian and Mean Curvatures data for pixels. Table, Wall, and all the items are totally separate in the result, with absence of any noise. Results are similar to that of those calculated using principal curvatures, with fewer noise.

Although segmentation results from gaussian and mean curvatures has low noise, on some images (such as 1.jpg), principal curvature based segmentation gives better result.

Comparing segmentation results of various methods:

Neighborhood Plane Set < Gaussian and Mean Curvatures <= Principal Curvatures

All intermediate outputs and Final Segmented output of various images using all the methods can be found in "Results" directory.