HACETTEPE UNIVERSITY

GEOMATICS ENGINEERING

GMT 431 PHOTOGRAMMETRIC IMAGE ANALYSIS

FINAL HOMEWORK

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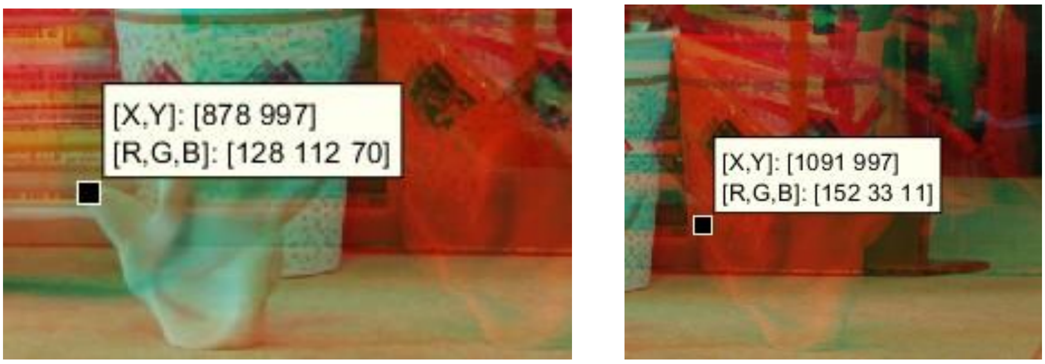
Part – 1 Creating Disparity Images:

In this task I generate two different disparity image. One of is between image 1 to 2 and the other is from image 2 to 1. My user defined parameters are Block (Kernel Size) and disparity range. I use other parameters as default of the disparity function.

Finding Disparity Range:

I select disparity range is 0 to 224. When I try to increase maximum disparity range value (224) the image looks better but it loses too much data from images. My maximum disparity range (224) so it loses 224 column data from left side of the image for first disparity calculation. But If I try to make it smaller then the image will be not correct because we miss some disparities. I found this optimal 224 value from stereoAnaglyph function which is used in “Disparity_Range_Checker.m” as my matlab code. Selecting same point on this anaglyph show how many pixels offsetted. The highest disparity on the foremost object and this object is the white little statue in this image pair and its disparity is approximatly 215 so my disparity range must be higher than this. Also my (maximum disparity range – minimum disparity) differences must be a multiple of 16. I tried some python (opencv2) and matlab function and it always need multiple of 16. So closest higher value from 215 and multiple of 16 is 224. In the second disparity image which is calculated from image 2 to 1 I use (-224 to 0) disparity range because we are approaching images reverse and this time data lose from image will be on right side of the disparity image.



The same point offset 213 pixel according to above figure.

Finding Block Size:

I tried different block sizes like 7-9-15.. and 7 looks good. This options not effected too much the results like disparity range inputs. If I make kernel size bigger then the image looks smoother but lose the detail quality. Visually I decide 7 is optimal for those images.

Important: Also I convert the disparity images uint8 so pixel values always will be integer.

Results:

Image 1 to 2 disparity image:

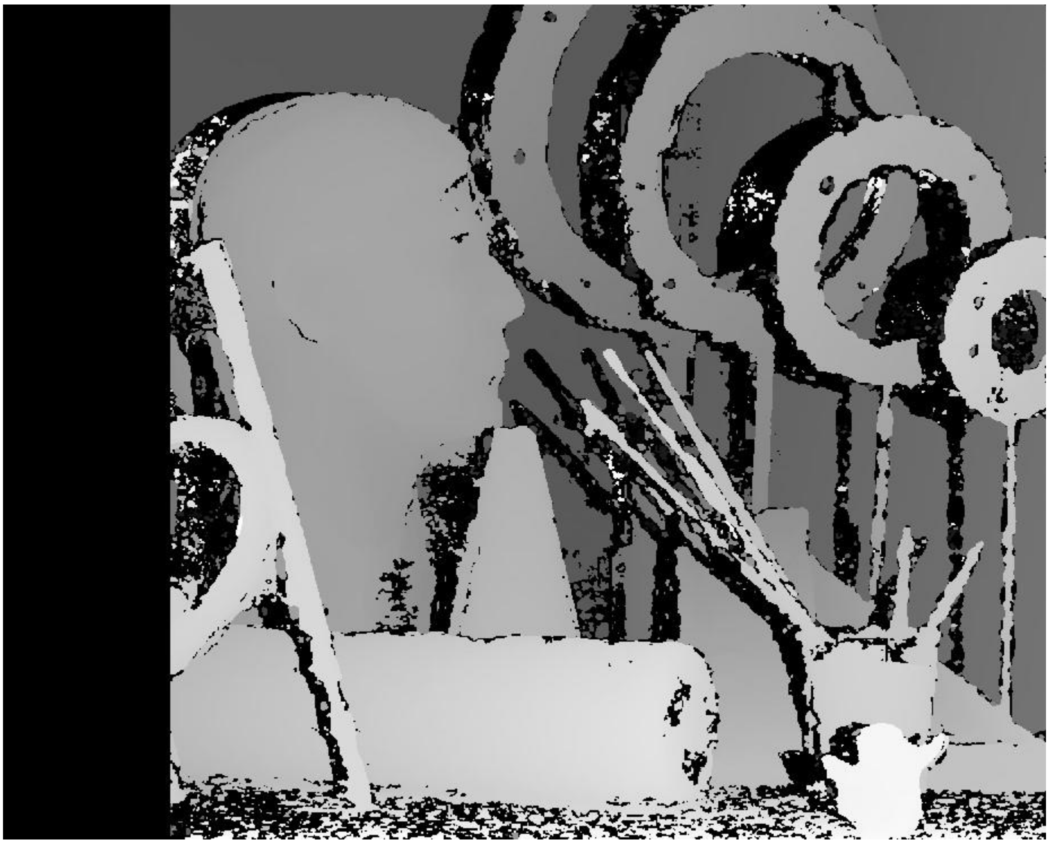
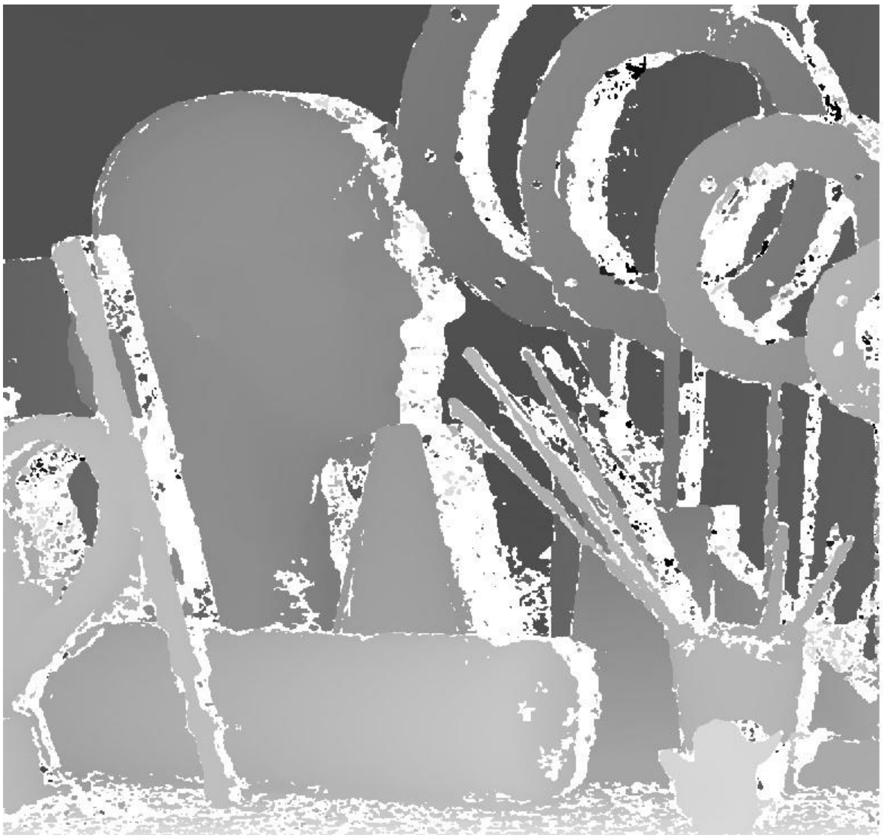


Image 2 to 1 disparity image:



Part 2 Implementing a function which is calculate differency percentage:

Disparity1_2.m function:

I implement a function which is calculate similarity between generated disparity1_2 image and ground truth image_1.

1-The algorithm does not count the most left 224 column’s pixels so we eliminate the lost pixels.

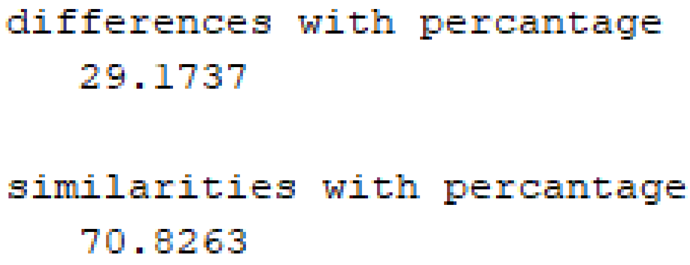
2-Algoritm checking the non black pixels in ground truth image so it does not implement anything on the black pixels. We eliminate it to.

3-The algorithm check the pixel value differences and if the difference is more than 1 we count it as different pixel. Also I use double function on images because when we try to take difference and If result will be negative the code make it 0 and it was wrong. The double fix this problem. For example 75-79 will be -4 and absolute of -4 will be 4. Without double function 75-79’s result will be 0.

4-Also the function counts amount of black pixels in ground truth image so with this information we won’t count black pixels in percentage calculation.

5-We calculate the ratio between difference pixels and amount of total pixels but in the amount of total pixels I don’t count black pixels and first 224 column of the image. Than we calculate the difference percentage rate. If we make 100-difference percentage we found is similarity percantage between disparty and ground truth image.

Result of Disparit1_2.m:



```
differences with percantage
   29.1737

similarities with percantage
   70.8263
```

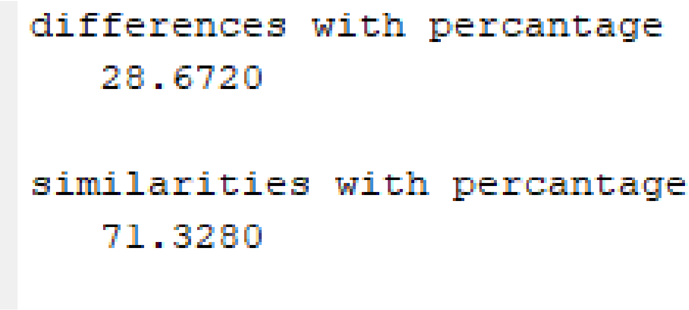
Disparity2_1.m function:

It does the almost same thing with the function given above. The differences from function “Disparity1_2.m” are;

1-The algorithm does not count the most right 224 columns pixels instead of most left so we eliminate the lost pixels from most right.

2- The algoritm convert the negative of the pixel values into positive from the disparity image. Because calculated disparity pixel values are negative in this time.

Result of Disparit2_1.m:

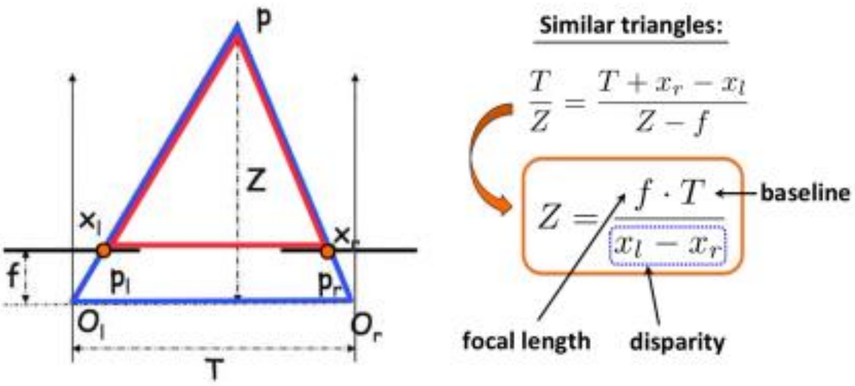


```
differences with percantage
   28.6720

similarities with percantage
   71.3280
```

Part - 3) Can you compute depth information from your disparity result? If this computation is possible the how?

Yes It is possible to compute depth information if we know the interior orientation parameters like focal lenght. The formula is depth=baseline (in meters) * focal lenght (in pixels) / disparity (in pixels). So unit of depth is meter * pixel / pixel = meter.


p
Z
x_l
x_r
f
p_l
p_r
O_l
O_r
T
Similar triangles:
$\frac{T}{Z} = \frac{T + x_r - x_l}{Z - f}$
$Z = \frac{f \cdot T}{x_l - x_r}$
baseline
focal length
disparity