Report Assignment 4

1. Creating Stereograms

Right Image Generated

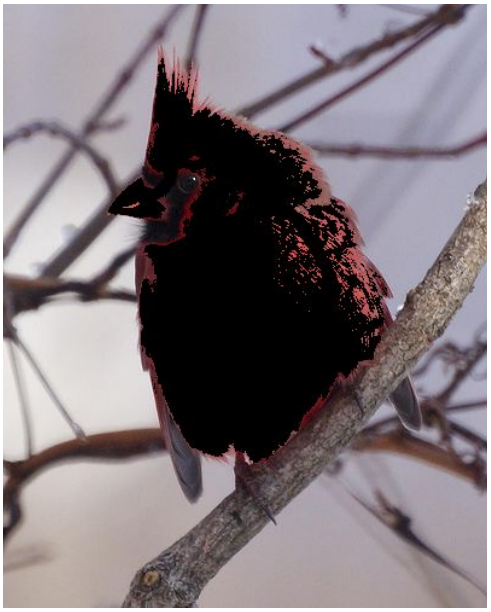
Design Decision :

We find that we have many holes in the images when we subtract the disparity value from right image being generated, as we do not get pixel value for each point in image. So instead of this we subtract the disparity from left image, to reduce the number of holes in the image.

Example of a Stereogram generated by Part 1

If we reduce the shift by dividing the disparity by a larger constant the number of holes are further decreased, however the quality of 3-D image is also decreased after certain threshold

2. Background- foreground Segmentation



Example of Background Image for Naive Segmentation

Example of Foreground Image for Naive Segmentation

Example of Disparity Map from Part 2.1

The disparity map generated in dependent on the value of our fixed constant. It needs to be fine tuned for each image to improve the results.

Stereogram generated from disparity Map

We find that the results are better for most images. This may be because the disparity are more uniform throughout the image as it's either 0 or 255. Thus overall the quality of results increases provided we have some appropriate constant divisor for the disparity.

Part 2 - Disparity Map:
Spatial Coherence
(Using BP to reduce energy function and generate disparity map)

For this approach we start by assuming the image as a MRF and having all assumptions of it. This enables us to minimize the energy function to obtain a disparity map.
The energy function includes three parameters here.

- Cost Function : This is cost function is w.r.t to a label which we send and is evaluated in the same way as we evaluate in part 1. Values for both the labels is retrieved and used in the way explained below.
- Smoothness function : This is just to compare the transition for the neighboring pixel for label. If the labels of the two pixels in consideration are same, it doesn't cost anything to it, but to include the transition we do pay a cost.
- $\sum_{Messages\ excluding\ the\ recieving\ pixel}$ (message values for iteration *t-1*)

Adding the above three terms gives us a energy function which we calculate for each iteration. (this energy function is nothing but messages). We store the values for each message corresponding to each label (0,1) and at the end of the certain number of iterations decided (in our case 3), we compare the m[0] and m[1] value at each pixel + the smoothness function + the cost function of assigning that pixel label-->0 and label-->1 corresponding to the message in consideration. We choose the minimum of the belief values for both and assign that pixel that label.

STEPS TO RUN :

./segment part2/cardinal.png part2/cardinal-seeds.png >> log.txt

Run time -- 2 hours approximately

The disparity map obtained after three iterations is shown below.

Future Updates : There are many future updates which need to be done. I think there is a lot of redundancy in the values being calculated by my code and hence the long running time. I could save a lot of values and make the code faster.

3. **Inferring depth from Stereo**

For this part we implement the similar procedure as in part 2 where try and infer the depth from stereo.Here there is a difference in the cost function when comapred to the previous approach. In this approach we take the sum squared difference between the pixels of the two images passed as parameters to the cost function. In the cost function of the previous part we used to pass the image along with foreground and background pixels but here we pass the two images as parameters. We implement the same smoothness function as in Part 2 but in the energy function we use the cost function with the sum squared distance.The value from the energy function may sometimes be very large hence we divide it with a value based on trial and error. In our approach we divide the energy function by 100.

Steps to run is as follows:

./stereo part3/Aloe/view1.png part3/Aloe/view5.png part3/Aloe/gt.png

The output will appear in part3/Aloe.

Some sample output images are shown below

Above image is the disparity map for the mrf of the Aloe plant.

Above is the disparity map for the Flowerpots.

The best quantitative error with respect to the ground truth that could be achieved was 31854.6 for the Flowerpots with the energy divided by 100 for obtaining the above result.

For the Aloe plant and Baby1 the best quantitative error with respect the ground was 26964 and 29609.4 respectively.