The Quality of Disparity Maps

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***Abstract* - Disparity calculation based on stereo vision is an important issue in computer vision research as it has applications in several areas of image processing in general. In this dissertation, a stereo matching based on segmentation is presented. Quality of disparity map is an important and challenging problem in stereo matching. Hence, We proposed a disparity estimation method considering hybrid approach to generate improved disparity map, based on k-means and refine disparity map of image by SSD (sum of squared difference) cost function. Lastly, we applied quality measurement matrix RMSE (root mean square error) to measures the quality of disparity map.**

***Keywords* – Stereo matching algorithm, Sum of squared difference, Disparity map, RMSE, k-means segmentation**

I. INTRODUCTION

Stereo matching is one of the most active areas in computer vision because it is the basis for the accurate acquiring of image depth, which is important to applications in vision systems, such as obstacle avoidance, object recognition, and aerial photography, etc.[2] The main challenge here is to generate accurate depth information of a scene by comparing the pixels of the left and right image of that scene.[1].

Stereo matching calculation is primarily arranged into two classes: global and local method. Global methods are based on schemes that minimize the window cost. These methods have highly accuracy in computation of the disparity map. Local method are also called area based method, it calculate the disparity at each pixel on the basis of the neighbor pixel, the disparity map quality of the local method is less than global method. To find the disparity of a pixel, we must first decide on a cost function to calculate the similarity between pixels of the left and right images of a stereo image pair. Then, we calculate its disparity by the relative displacement of pixels.

II. LITERATURE REVIEW

In[3] method work on two step stereo algorithm based on combination of feature matching and region matching.First they use Harris corner method and feature matching method to corner extraction and higher accuracy respectively.second they find dense disparity map. They calculate error energy for weak texture area and blocked area to reduce wrong matching rate. advantage of [3] is harris corner method and feature matching gives good result than traditional methods. In[1] used the combination of two already existing method of block based & region based stereo matching. They used segmentation, k-means cluster and for refinement of boundaries used morphological filter, used SAD cost function for finding disparity value. Advantage of [1] Method performs better than the traditional NCC and SAD method due to morphological refinement. In [4] hierarchical bilateral disparity structure (HBDS) algorithm in which the efficiency of graph cut method is improved [4] use global method for disparity map generation with energy minimization. [5]used optimization based on modified constant space belief propagation, a low complexity algorithm for detecting occlusion and used cross check constraint and wrapping constraint for occlusion handling. Advantage of [5] Proposed method provides near ground truth occlusion and a good disparity map compare to other methods.

III. PROPOSED METHOD

Step:1 Input images

- In this step two stereo images are taken as input information in proposed flow.

Step:2 RGB to colour space[1]

- Most imaging hardware store images in the RGB format, the models that does not properly approximate human vision should be formatted for the output of physical devices.
- Human eyes are more delicate to changes in shine than shading.
- The L segment of the Lab colour space closely matches the human view of brightness.
- We change over the left and right images from RGB to the Lab colour space and hold just the L estimations of its pixels for further handling.

Step:3 Segmentation [1][2]

- We perform segmentation on the L estimations of the left image pixels utilizing a quick implementation of the K-Means clustering calculation.
- We are simply able to recognize the cluster to which the pixel has been allocated by the cluster to which its related box has been allocated.

Step :4 Boundary detection and refinement

- Segment limit location is accomplished by comparing the cluster task of every pixel with that of its 8-joined pixels.
- If some of them are found to appear as something else, we check the pixel as "1" (fitting in with a segment limit), else we check it as "0" (not having a place with any segment limit).
- After that we generate boundary map of left image.
- However, the above methodology likewise erroneously recognizes numerous pixels as having a place with fragment limits because of certain limitations.
- Thus, we apply two morphological filters to refine the boundary map by eliminate such noisy pixels, in the following order
  Fill: Fills lonely interior pixels like individual 0's that are surrounded by 1's.
  Remove: Removes inside pixels like sets a pixel to "0" if all its 4-joined neighbours are "1".
- Further, we utilize associated segments analysis and remove little defect in the boundary map due to segmentation errors.

Step: 5 Disparity Measurements

- In this step we use the known SSD(Sum of Square Differences) cost function to determine the disparities.[5]

$$SD = \left(I_1(x,y) - I_2(x+u_x, y+u_y)\right)^2$$

- Thus, from such sparse disparity estimations, we process an incomplete disparity map, from which we will make the full unique disparity map remaking strategy.

Step: 6 Disparity map remaking (reconstruction)

- Our disparity map recreation calculation look over every row of the part of the way processed disparity map and calculate the remaining disparities based on disparities that have already been computed.

1. Fill stage : In the first stage, we filter the disparity map row wise, left to right—at whatever point we continuously occur two boundary pixels with exact disparity values, we "fill" the moderate pixels of that line falling between the fragment boundary with that disparity value.
2. Peek stage : In the second stage, for all pixels whose disparities have not yet been resolved, we assess their disparities by 'peek'- ing at the disparity value of their neighbouring pixels.

Step 7: Quality measurement of disparity map [2]

- Quality measures are calculated with known ground truth information: RMS (root-mean-squared) error (measured in uniqueness units) between the calculated disparity map and the ground truth map.

$$RMS\ Error = \left(\frac{1}{N}\sum_{(x,y)} |d_c(x,y) - d_t(x,y)|^2\right)^{\frac{1}{2}}$$

Step 8: Final output

- After performing quality measurement technique final disparity map generated which we want to generate.

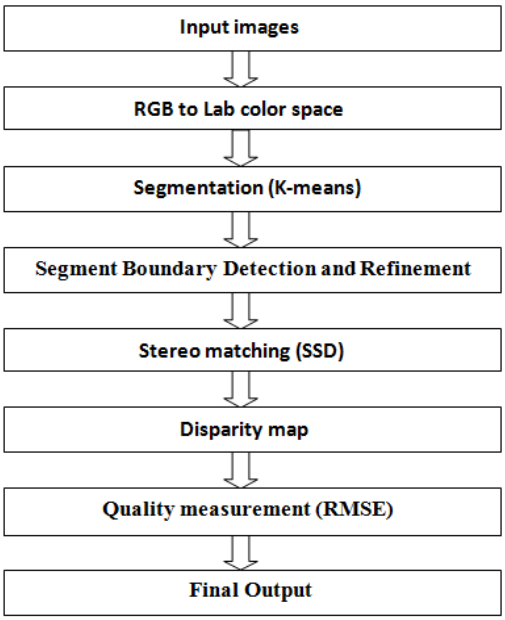
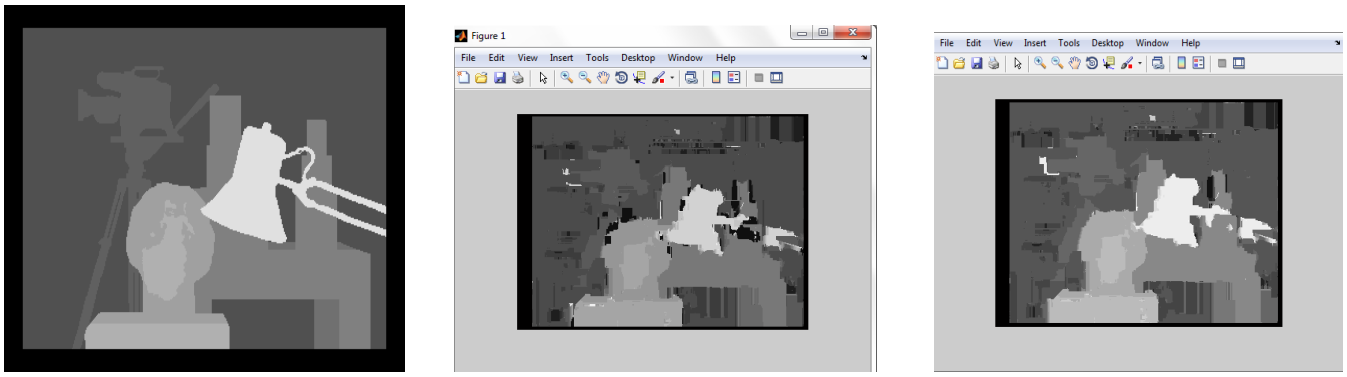


Figure1. Proposed work flow

IV. EXPERIMENTAL RESULTS

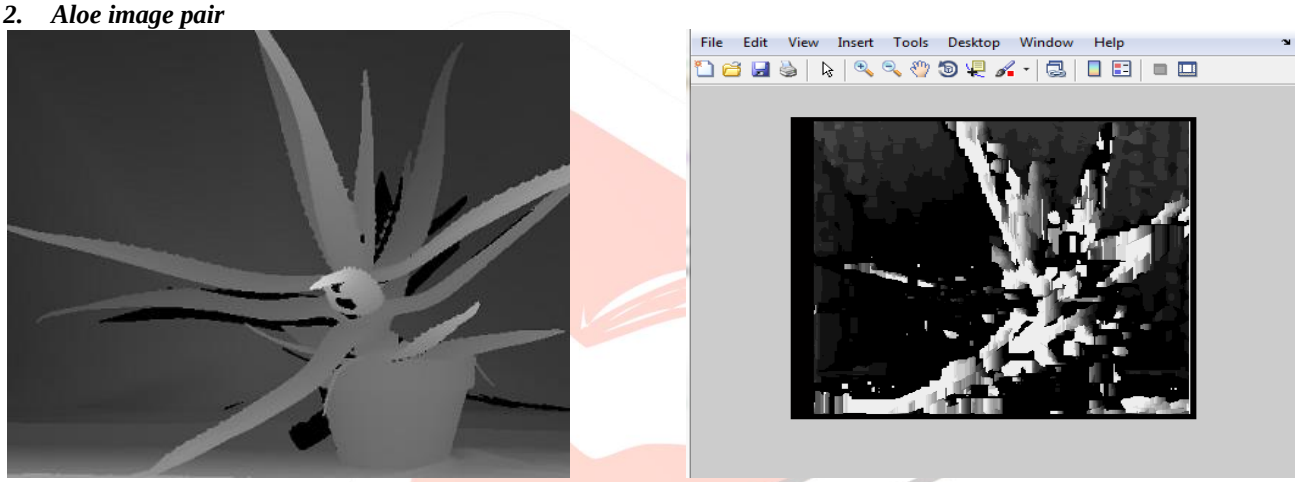
1. Tsukuba image dataset



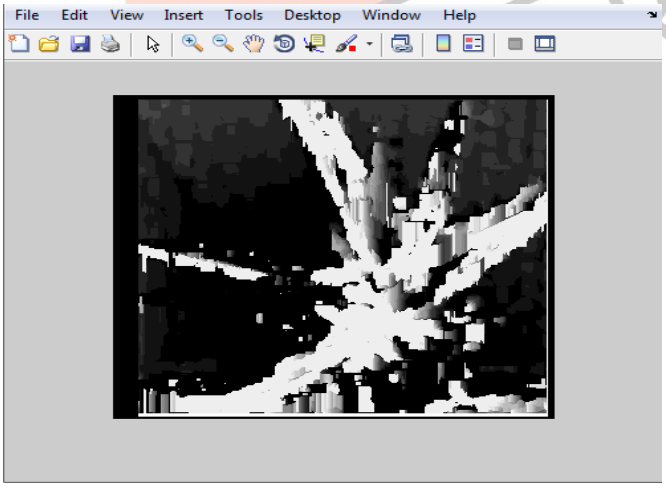
(a) (b) (c)

Figure 2 (a) tsukuba image pair ground truth map,(b) disparity map of existing method ,(c) disparity map of proposed method

2. Aloe image pair



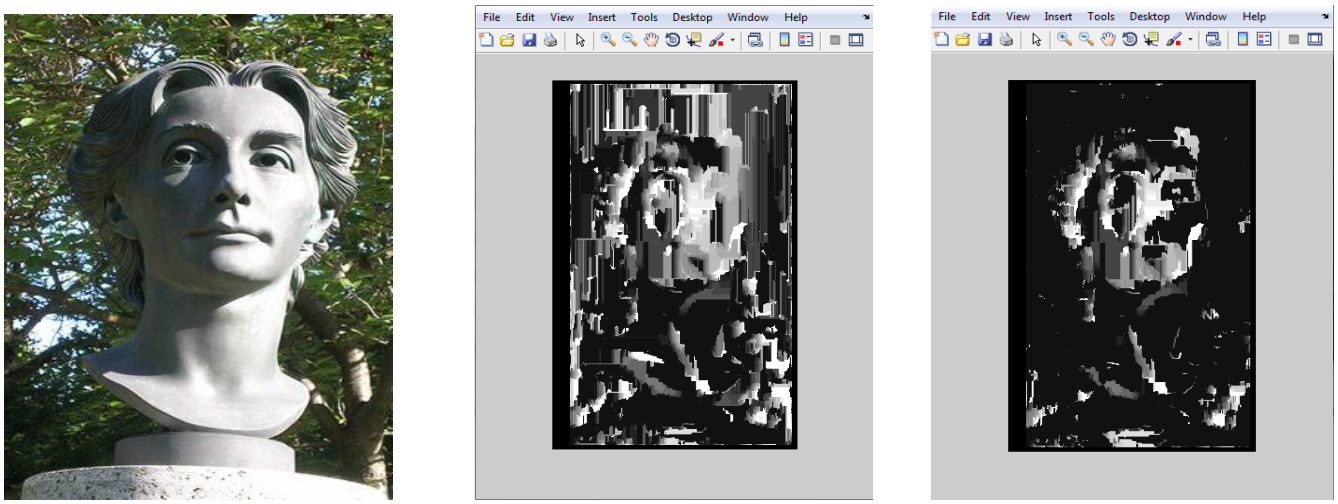
(a) (b)



(c)

Figure 3(a) Aloe image pair ground truth map,(b) disparity map of existing method ,(c) disparity map of proposed method

3. Statue image pair



(a) (b) (c)

Figure 3(a) Statue image ,(b) disparity map of existing method ,(c) disparity map of proposed method

V. RESULT COMPARISON

Table.1 RMSE parameter value result for different window size

Image	Window Size	Base paper approach	Proposed Approach
Tsukuba	5	0.582	0.551
	7	0.594	0.562
	9	0.584	0.554
Aloe	5	0.3101	0.2808
	7	0.3206	0.3076
	9	0.3698	0.3589
Statue	5	0.2879	0.2777
	7	0.2879	0.2777
	9	0.2998	0.2859

VI. CONCLUSION

A disparity map or depth map represent the mapping of each pixel of a image to its corresponding disparity. Quality of disparity map is an important and challenging problem in stereo matching. In this paper, we proposed a disparity estimation method considering hybrid approach to generate improved disparity map. Each algorithm has its own typical features and none is absolutely the best. Hybrid approach provides better result than single one. We implement a hybrid approach, which is integration of two different methods. The performance comparison of proposed method with integrating method is done via implementation results. This gives displacement between two images used to estimate disparity.

Future work will be targeting on overcoming the limitations of our proposed work, mainly by occlusion problem, map reformation technique, and any other configuration setup like shape and camera characteristics.

VII. REFERENCES

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