Robot Eyes Report

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Abstract

The team was given the task of creating a disparity map from a pair of stereo images using techniques that were talked about in class.

1 Introduction

The assignment required the team to acquire new experiences in computer vison by using matlab. We were encouraged to experiment with variables and publish our results of the findings. This report details the experiments that the team performed and the notable results that were acquired from them.

2 Background

A disparity map [4] is used to show the difference between a pair of stereo images. The disparity is used to calculate depth information from a combination of the images.

The disparity value is the value of the shift required to get the minimum sum of squared differences [1] for that pixel or section of the image.

Stereo pairs are images typically taken with only a slight difference in the distance of the cameras. Preferably the camera settings should be the same and the hardware should be the same as well to ensure that the images are similar.

Another reason that this image was selected for testing was due to their not being many pixels present to test.

3 Description of Algorithm

The team used a brute force method to gain their results using this method meant that the run time was extremely high due the fact that a disparity value had to be calculated for every pixel of the image.

This was a problem when the team was testing their algorithm. Also since we were learning at the same time it didn't help as a simple error could take in excess of 10 minutes to produce a result even on a 100 x 100 image.

4 Description of Images Used

The team used the stereo images provided on the VLE to create their program. The pair that was mainly used was the bookcase image shown in figure 1. It was selected as there are clear levels of depth between the different books and the team thought that they would produce a noteworthy result.

Figure 1: Bookcase

The other pair that the team used was the "Scene" pair which we had seen used a lot in the computer vision community [5] [3] for various benchmark tests including disparity maps. We believe that this is due to

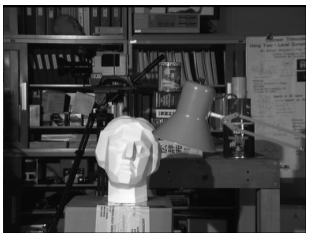

Figure 2: Scene

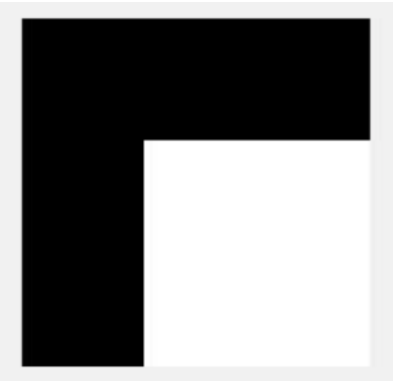

Figure 4: Second Result

5 Results and Comments

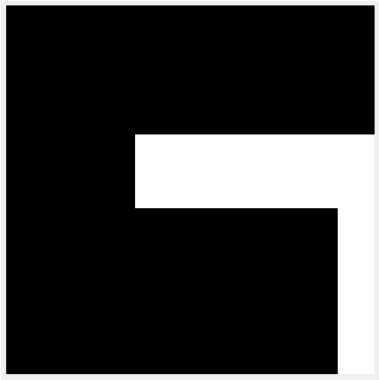

Figure 3: First Result

The result shown in figure 3 is the result of running the test on the bookcases image taking the top 20 x 20 pixels of the image.

The team found that the SSD values were not correctly working since it was either producing a value of 0 or 255 as the final output this was confirmed when the image in figure 4 was produced.

We believe that the black band shown in figure 4 is due to the padding that was added to image.

We discovered that the displacement values had to be converted into an 8 bit unsigned integer to be correctly displayed as a greyscale image. This then resulted in figure 5 being produced.

Figure 5: Third Result

After figure 5 was produced the team then ran a test using a 200 x 200 image. This test took over an hour to run on a modern laptop.

6 Conclusion

The team had never worked with matlab before and were pleased with what they were able to achieve within this short space of time.

The full source code for the teams work can be found in a git hub repository [2].

7 Future Work

If the team had more time available we would like to have been able to perform research on 3D imaging techniques and work on a way of creating an optimised algorithm that minimises computation.

Acknowledgements

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References

[1] Alessandro Verri Emanuele Trucco. 1998. *Introductory techniques for 3D - Computer Vision*. Prentice Hall.

[2] Jamie Kerr. 2016. Matlabrobot. (2016). **https://github.com/jkerr123/matlabrobot**

[3] Shawn Lankton Online. 2007. 3D Vision with Stereo Disparity. (2007). **http://www.shawnlankton.com/2007/12/3d-vision-with-stereo-disparity/**

[4] Jay Rambhia. 2013. Disparity Map. (2013). **http://www.jayrambhia.com/blog/disparity-maps/**

[5] Stanford. 2016. Correlation-Based stereo. (2016). **http://ai.stanford.edu/~mitul/cs223b/dp.html**