1 Shape from Stereo

In this practical you will develop and compare methods to measure disparity in a pair of calibrated (or rectified) images shown in Figure 1. The ground truth disparity map is given in Figure 2. Two approaches are to be used: (i) area based, and (ii) feature based.

1.1 Starting the session

For this practical you must first download file "stereoprakt.zip" from Nestor to your work directory, and type

```
unzip stereoprakt.zip
```

Then type:

```
cd stereoprakt
```

and start MatLab. You can load the stereo pair, files tsukuba1.png and tsukuba2.png in the usual way, and start developing code to process them.

In all the following exercises, please motivate the choices you make in your experimental set-up. Review and discuss the results critically.

1.2 Exercises

Exercise 1.

Try to find suitable feature points purely manually and compute the disparities for those points. How accurate are you compared to the ground truth? What influences the accuracy of manual selection? From your experiments, can you derive a sensible range if disparities to check?

Exercise 2.

Develop a matlab function to compute the disparity based on a windowing method. Take a patch around each pixel of certain size in image tsukuba1, and shift this across tsukuba2, computing some goodness of fit score between shifted window, and current content in tsukuba2. Try to see what measures work well: Sum of squared differences or sum of absolute differences can be used, but normalized cross-correlation is also a good candidate. Note that some goodness of fit measures should be maximized, whereas others should be minimized.

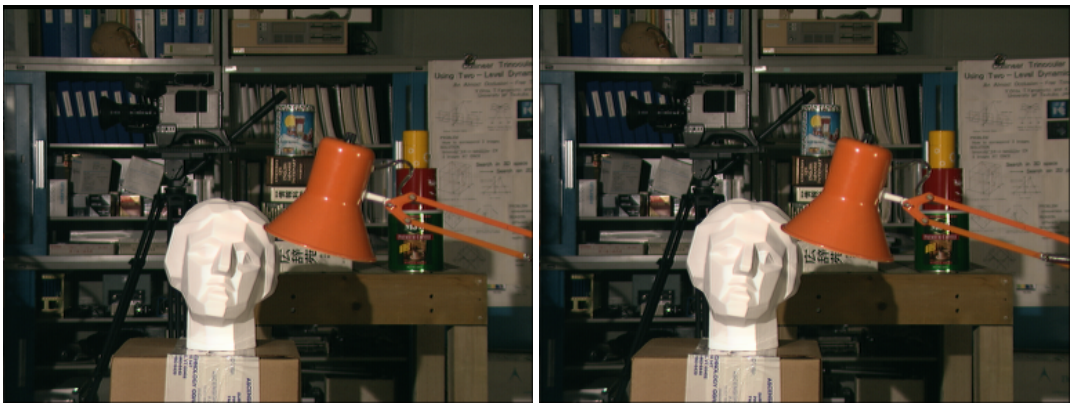

Figure 1: The Tsukuba stereo pair

Figure 2: The Tsukuba stereo pair ground-truth disparity map

Exercise 3.

Apart from the measure of goodness of fit, the window size and shape is a critical parameter in this work. Explore a number of different window shapes and sizes, and see how this influences results, compared to the ground truth.

Exercise 4.

Use the SIFT code from a previous practical to extract feature points in both images. Match these, and compute disparities for them. How do these compare to the windowing based methods? Are matching feature points always on the same image row? If not, how far are can they be apart.

Exercise 5. (optional)

If time allows, try to find other rectified image pairs on-line, and test your methods on them.