

Programming Assignment 1
Visual Computing (Fall 2008)
Due: November 3, 2008

The goals of this assignment are to calibrate the camera positions and extract the unknown geometry. You can work in groups of 2 or 3, whatever suits your time and temperament.

You have been provided with the calibration pattern data, essentially the 3D coordinates of the points whose 2D images you see in the image that is provided. This data is in <http://www.ics.uci.edu/~gopi/CS114/IMAGES/CalibrationData.html>

You have been provided with images taken from multiple view points of a horse and the calibration pattern. You will be using the images from <http://www.ics.uci.edu/~gopi/CS114/IMAGES/Horse>

However, you will run the following two steps of finding the camera calibration matrix and the depth extraction using 2 subsets of these 24 images – each comprising of 3-6 images. Make sure that each of these sets is chosen such that every part of the horse is viewed by at least 2 images. You can choose more images if you want – an efficient implementation could only improve results with increasing number of images.

Finding the camera calibration matrix

Use the calibration pattern data to generate the 3D to 2D correspondences for each image. The 3D coordinates and their corresponding 2D pixel correspondence for each image should be stored in an Excel spreadsheet (file name : <image-file-name>-calibdata.xls) with column names as X, Y, Z, u, v.

Use this data to find the camera calibration matrix from each image. The calibration matrix for each image should be stored as a single comma separated row, in a file named <image-file-name>-calibmatrix.txt

Finding Depth

You can hand-pick corresponding points across the different images for now. Use a multi-view formulation for the depth reconstruction process. You may not find the same 3D point in all the images in your set of images, so you may have to select the views where the particular point is visible. The correspondence information should be stored in single Excel spread sheet (file name : corresdata<i>.xls) with column names as <image1-file-name>-u, <image1-file-name>-v, <image2-file-name>-u, <image2-file-name>-v, ...for all the images in the set. <i> in the file name denotes the i-th images across which correspondences are extracted.

We are working on getting a software package which will make the manual correspondence search semi-automatic, but I will upload it in a couple of days.

We would like to extract at least 200 data points (if the semi-automatic process works) for the horse which would give a nice 3D mesh representation. When using manual picking, try to pick about 50 points for a coarse 3D mesh. Final results of geometry points should be stored in a single txt file (file name : Horse.pts) with the following format

```
<#-of-points>  
x1 y1 z1  
x2 y2 z2  
...  
xn yn zn
```

Comparing between the results from the two subsets of images

Once you have estimated the 3D mesh of the horse, compare the results visually by plotting the 3D points extracted from each set in a different color.

Compare the camera calibration matrices by showing the location and the orientation of the camera estimated from the two sets using different colors.