

Project 4: Camera Calibration and Stereo Matching

ESE 358/CSE 327 Computer Vision, Fall 2000

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Due in two weeks, Thu. 12/14/00

In this homework, generalize your stereo matching algorithms to work with calibrated images that are not necessarily coplanar.

1. (60 points) At the INRIA web site there are a lot of calibrated stereo pairs. You will use the two pairs that are located at:

<http://www-syntim.inria.fr/syntim/analyse/scenes/Color.html> and at

<http://www-syntim.inria.fr/syntim/analyse/scenes/BatInria.html>

Camera calibration information for each image is also provided at the above sites. The images are in color GIFs. Since the routines you already have work for grey-level RASter images, for every color image, at the course web site you can download three grey images, one for each color band.

All the above images are courtesy of INRIA-Syntim

<http://www-syntim.inria.fr/syntim/analyse/paires-eng.html>

The description of the calibration data is located at:

<http://www-syntim.inria.fr/syntim/analyse/calib-eng.html>

Using the above camera calibration description, rectify your images, so that the epipolar lines are horizontal. Make sure that you modify the intrinsic parameters of the cameras accordingly for the rectified images.

Then, perform stereo matching as in Project 3. You will need to modify your programs to read all 3 color band images and to output color points in the 3D point file. Does the use of color give you better results than what you would get if you used the grey level versions? What values of W work best?

2. (40 points) At the CMU-CIL web site you can find stereo images with ground truth. This will allow you to evaluate the accuracy of your reconstruction algorithm.

<http://www.cs.cmu.edu/cil/cil-ster.html>

Specifically go to <http://www.cs.cmu.edu/afs/cs.cmu.edu/project/cil/ftp/cil-0001/> read the information and download the appropriate files. You will work only with the first 5 images of the dataset, with numbers 101 to 105. Also an image with 30 points for which ground truth is known. RASter versions of the images are provided in the course web site. You will perform stereo reconstruction on the following pairs: 101-105, 102-104, and 103-104. For each of the 3 reconstructions calculate the error for the 30 points. Which reconstruction has the least error? As you can see from the camera calibration parameters the rotation angles are very close to 0 so you can consider the images coplanar (you might need to adjust the scaling to bring them on the same plane).

You can work in groups of up to three people. You will need to briefly present your project at the end.