CS 4/791E Computer Vision

Spring 2004 - Dr. George Bebis

Programming Assignment 4

Due date: 5/13/04

In this programming assignment, you will implement and compare two versions of 8-point algorithm discussed in class (see page 156) for estimating the fundamental matrix. Although very simple, the original 8-point algorithm (herein called "vanilla 8-point algorithm") can become very unstable if we do not normalize the coordinates of the corresponding points. R. Hartley has proposed a simple normalization procedure for making the 8-point algorithm much more stable (herein called "normalized 8-point algorithm").

Read and understand very well Hartley's paper "In Defense of the Eight-Point Algorithm", *IEEE Transactions on Pattern Analysis and Machine Intelligence* 19(6): 580-593 (1997). You can download a copy of the paper from the course's webpage.

Data

The data that you will be using in this assignment have been posted on the webpage of the course. In particular, I have posted the following files:

(a) house stereo pair and corresponding points (Fig 1 in paper)
(b) corridor stereo pair and corresponding points (Fig 4 in paper)
(c) calibration jig and corresponding points (Fig 5 in paper)

Vanilla eight-point algorithm

Implement the vanilla eight-point algorithm as described in our book.

Normalized eight-point algorithm

Implement the normalized eight-point algorithm as described in Hartley's paper. Consider the case of isotropic scaling only.

Experimentation and Comparisons

We will follow the experimental and evaluation procedures described in Section 7 of the paper. Our goal is to verify some of the results shown in the paper. First, you need to reproduce the graph shown in Fig 6 (left) for the house pair. Second, reproduce the results shown in Figure 8 for the house, calibration jig, and corridor pairs. The vertical axis corresponds to the reprojection error which is defined in Section 7.1. This is similar to the reprojection error we computed in assignment 3 to test the camera calibration method. Third, compute the epipoles for stereo pair. Last, compute the epipolar lines and overlay them with the images as shown in Figures 1, 4, and 5.