EE4266 Assignment 2

Part 1: Determining the fundamental matrix

1. Picking points

Initially corner detection method was applied to find the points of interest. However, the effect did not meet the expectation:



It can be seen that the points picked hardly represent some form of corners and there is no one-to-one correspondence. Therefore, the corner detection approach was abandoned due to its low robustness. Instead, 8 pairs of corresponding points were manually selected from two images respectively:



The coordinates of the corresponding points from the left image L are: (3185, 1638), (3299, 2055), (3850, 2240), (289, 996), (3102, 2471), (1065, 494), (653, 1401), (1123, 1117).



The coordinates of the points from the right image R are: (1557, 1451), (1452, 1851), (1260, 2114), (1847, 636), (669, 1862), (2549, 230), (1979, 974), (2500, 818).

We use the technique provided in the notes to compute the fundamental matrix:

1. Arrange the points’ coordinates and the elements of fundamental matrix into a linear system of equations:

Where and denote the coordinates of the points from the left and right image L and R respectively.

Substitute in the values found from image L and R:

Use the augmented matrix representation:

Use Gaussian elimination to obtain its reduced row echelon form by using the MATLAB command ‘rref()’:

Therefore we have:

, , ,,, ,, .

Therefore, the fundamental matrix

We check that is rank-2 which satisfies the rank deficiency constraint.

Proof check:

Let , to be the homogeneous coordinates of image A and B respectively.

for integer ranges from 1 to 8

This result has observable discrepancy since we expect . This might arise of the floating point error during the matrix manipulation and computation. Therefore, it is necessary to use an alternative technique.

MATLAB System of Linear Equations solver:

X = linsolve(A,B)

Produced the following results:

, , ,, , , ,.

The fundamental matrix is now

However, after checking is rank-3. Therefore, we need to manually impose the rank deficient constraint.

Apply singular value decomposition to by using MATLAB command [U,S,V] = svd(F):

Set the smallest singular value of to be 0 and obtain the new matrix :

Proof check:

for integer ranges from 1 to 8

It is obvious that the result has less discrepancies as compared to the first method.

Therefore, we adapt the second result .

Part 2: Determining the epipolar line