# 16-720 Computer Vision Spring 2016

# Azarakhsh Keipour (akeipour@andrew) Assignment 4

## Q 1.1 Intersection of principal axes in point P

Coordinate origins coincide with the same point P (principal point), therefore:



## Q 1.2

## Q 2.1 Estimation of F using 8-Point Algorithm

The calculated fundamental matrix F using 8-point algorithm is:

-0.0000 0.0003 -6.3885

0.0008 -0.0000 -0.0743

6.1527 -0.0402 24.5403

The result of the 8-point algorithm visualized using the provided displayEpipolarF tool is shown in Fig. 1.

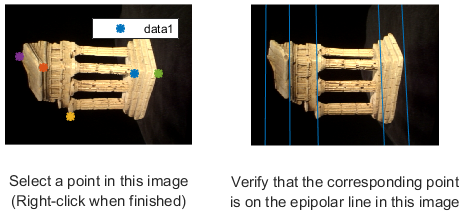


Figure 1. The result of using 8-point algorithm for estimating the fundamental matrix.

## Q 2.2 Estimation of F using 7-Point Algorithm

There are 3 calculated fundamental matrices for each set of points. For the correspondences selected by me using the cpselect tool (points are shown in ‘test\_q2.m’ file), the 3rd fundamental matrix (F{3}) gives the best results. This matrix is:

0.0000 0.0000 -0.0008

-0.0000 -0.0000 0.0001

0.0008 -0.0001 -0.0038

The result of the 7-point algorithm visualized using the provided displayEpipolarF tool on some points is shown in Fig. 2.

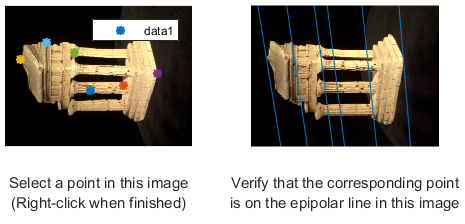


Figure 2. The result of using 7-point algorithm for estimating the fundamental matrix.

## Q 2.X Estimation of F using RANSAC

The number of iterations *k* is calculated using the following equation discussed in the class:



Where *n* is the number of points used to estimate the model (*n = 7* for 7-point algorithm and *n = 8* for 8-point algorithm), *p* is the probability of finding a good set of points to estimate the model (*0.999* in my code), and *w* is the fraction of inliers in the data (*0.75* for the given noisy set of point pairs). This choice of parameters results in 49 iterations for 7-point algorithm and 66 iterations for 8-point algorithm. Just to be safe, I used 2 times the resulted number of iterations in the code.

As the error metric, I used  and selected those with result less than a  threshold as inliers. The reason for this error measure is to minimize the distance of points on the second image from the estimated epipolar line of their corresponding point in the first image.

The estimated fundamental matrix F using RANSAC and 7-point algorithm is:

0.0000 0.0000 -0.0008

-0.0000 -0.0000 0.0001

0.0007 -0.0001 0.0021

The result of the 7-point algorithm with the RANSAC, visualized using the provided displayEpipolarF tool on some points is shown in Fig. 3.

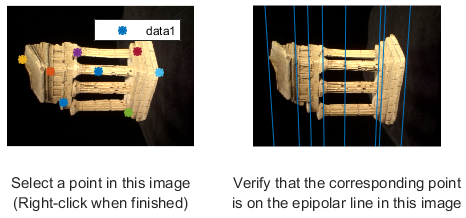


Figure 3. The result of using 7-point algorithm with RANSAC for estimating the fundamental matrix.

The estimated fundamental matrix F using RANSAC and 8-point algorithm is:

0.0000 -0.0000 -0.0011

0.0000 0.0000 -0.0008

0.0010 0.0009 0.0009

The result of the 8-point algorithm with the RANSAC, visualized using the provided displayEpipolarF tool on some points is shown in Fig. 4.

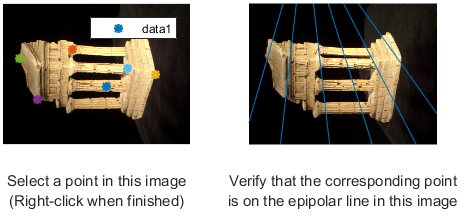


Figure 4. The result of using 8-point algorithm with RANSAC for estimating the fundamental matrix.

## Q 2.3 Computing the essential matrix

The essential matrix computed from the fundamental matrix obtained from the 8-point algorithm (Q2.1) is:

1.0e+03 \*

-0.0439 0.7193 -9.6055

1.7882 -0.0030 0.2417

9.6352 0.0811 0.0038

## Q 2.4