

Assignment 4: Orientation of an Image Pair

Assignment 4:
Orientation of an Image Pair

Group 30

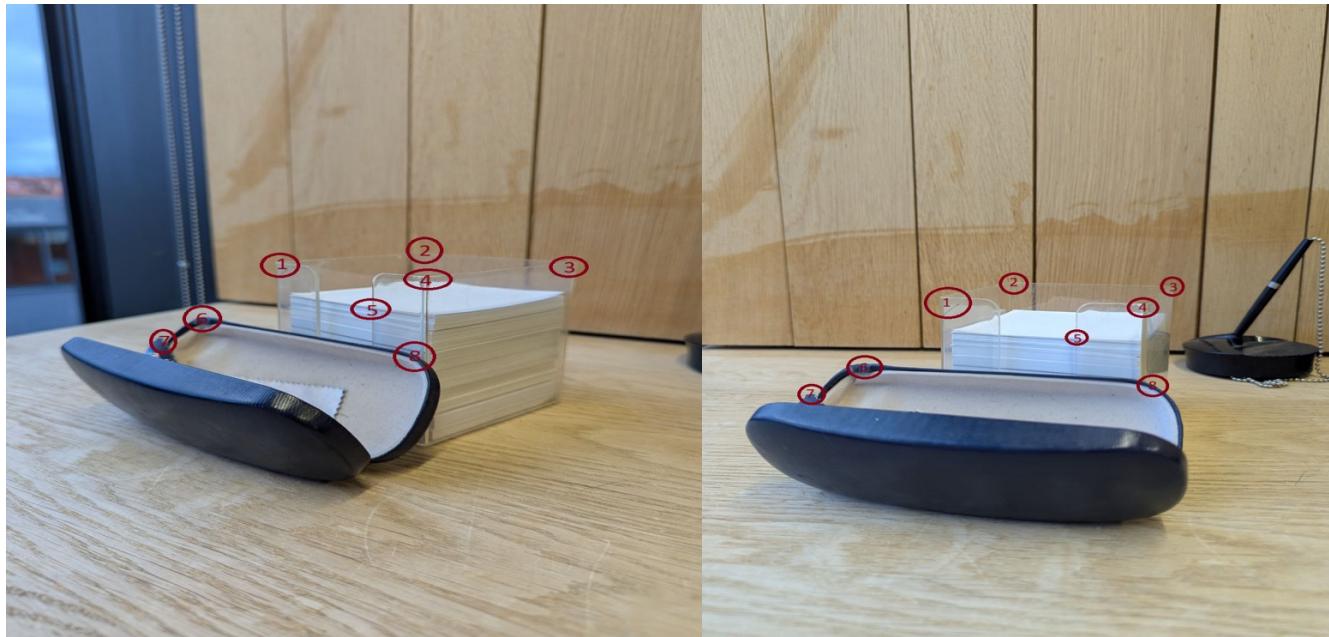


Image 1

Image 2

1. Midpoints and Scaling Factors

Midpoints:

Image 1 midpoint: (486.2500 , 595.2500)

Image 2 midpoint: (493.9970 664.0415)

Scaling Factors:

- Image 1 scaling: (147.1875 , 65.7500)

- Image 1 scaling: (173.5500 , 74.4568)

These values were used to normalize the point coordinates for robust computation.

Assignment 4: Orientation of an Image Pair

2.coordinate transformation:

The coordinate transformation for Image 1 is:

$$\begin{matrix} 0.0068 & 0 & -3.3036 \\ 0 & 0.0152 & -9.0532 \\ 0 & 0 & 1.0000 \end{matrix}$$

The coordinate transformation for Image 2 is:

$$\begin{matrix} 0.0058 & 0 & -2.8464 \\ 0 & 0.0134 & -8.9185 \\ 0 & 0 & 1.0000 \end{matrix}$$

3.conditioned coordinates:

The conditioned coordinates of Image 1 are:

$$\begin{matrix} -0.7083 & -1.0228 \\ 0.6641 & -1.4487 \\ 1.9822 & -0.9620 \\ 0.6505 & -0.5665 \\ 0.1614 & 0.3764 \\ -1.4556 & 0.5589 \\ -1.8361 & 1.3194 \\ 0.5418 & 1.7452 \end{matrix}$$

The conditioned coordinates of Image 2 are:

$$\begin{matrix} -0.6751 & -0.8162 \\ -0.0568 & -1.3162 \\ 1.3060 & -1.2279 \\ 1.0662 & -0.6397 \\ 0.4984 & 0.0662 \\ -1.3691 & 0.8015 \\ -1.8991 & 1.7132 \\ 1.1293 & 1.4191 \end{matrix}$$

Assignment 4: Orientation of an Image Pair

4. Design Matrix and Singular Values:

The Design Matrix (A) was formed using the conditioned coordinates, and singular value decomposition (SVD) was performed. The singular values are:

Singular Values: [7.9891, 5.2013, 4.3672, 2.9226, 1.6269, 0.9788, 0.5723, 0.0940]

5. Evaluation

Epipolar Line Characteristics:

- The epipolar lines are overlaid on both images and align closely with their corresponding points in the opposite image.
- Observations show that the epipolar lines pass through or very close to the corresponding points, ensuring accurate alignment.
- All epipolar lines intersect at the epipole (common point), fulfilling the geometric constraints of epipolar geometry.

Geometric Error:

- The symmetric epipolar distances for the 8 homologous points are as follows:
[1.6301e-09, 1.9404e-09, 2.6171e-09, 2.4712e-09, 2.5122e-09, 1.5959e-09, 1.4724e-09, 3.3015e-09]
- The average geometric error is 5.8281e-08, indicating high precision in the computation of the fundamental matrix.

Assignment 4: Orientation of an Image Pair

6. Visual Results

The following images show the marked points and epipolar lines:

- Marked points in both images.
- Epipolar lines overlaid on the images.

