Photogrammetric Computer Vision
Exercise 01

Group 18(G_18):

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Part 1: Theory

1. Which conditions on the image acquisition have to be fulfilled in order to model the image transformation successfully as a 2D homography?

Answer:

1. Adjacent images should overlap horizontal or vertical at least 30 percent
2. should find at least 4 image point pairs in Adjacent two image

2. How many degrees of freedom does a 2D homography have?

Answer:

The DOF is 8.

For a 2 dimensional projective transformation (2 observation per point in the plane, x and y coordinates), it can be decomposed into several steps(motion,scale,shear,distortion) and the homograph matrix is $\begin{bmatrix} \boldsymbol{a} & \boldsymbol{b} & \boldsymbol{c} \\ \boldsymbol{d} & \boldsymbol{e} & \boldsymbol{f} \\ \boldsymbol{g} & \boldsymbol{h} & \mathbf{1} \end{bmatrix}$, because we have 8 unknown parameters , so the degrees of freedom is 8.

3. Why should the homogeneous points be normalized before creating the design matrix?

Answer:

The wanted solution vector x ,where |Ax| under the constraint |x| = 1 is minimal ,is the right singular vector that corresponds to the smallest singular value of A, and for Ax = 0 the constraint ||x|| = 1 requires the magnitudes of rows and columns vectors of A to be approx.1 .

And ,Normalize the homogeneous coordinates make the coordinates of points in the same scale ,and make it more precisely to find the minimal singular value in Diagonal matrix $D_{n,n}$.