Exercise 3 - Theory

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1 Theory

1.1 T1

Point x_0 constrains the position of x_1 to lie on the corresponding epipolar line l_1 on the second image. where $l_1 = Fx_0$.

1.2 T2

Using the equation $x_i = K_i[R_i|t_i].X$ we can get two linearly independent equations for each camera, for two cameras we will have 4 linearly independent equations to solve for 3 unkowns in X.

1.3 T3

Since epipole e is the image of the center of the other camera C' it can be computed as $e = PC'$. Since all epipolar planes rotate around the same baseline, then all epipolar lines intersect at the epipole point.

1.4 T4

For each corresponding points x , x' it satfies the following equation $x'^T Fx = 0$, where F is a 3*3 matrix (9 unkowns). We can set up a homogeneous linear system with 9 unkowns, and given enough corresponding points we can solve for the 9 unkowns of F.

1.5 T5

Given the camera calibration, the fundamental matrix can be computed using the following equation

$$F = K'^{-T}.[t].R.K^{-1} \tag{1}$$

2 Implementation

You may find the implementation code inside the main.py file. To run the code, call python main.py.