DATA.ML.300 Computer Vision Exercise 6
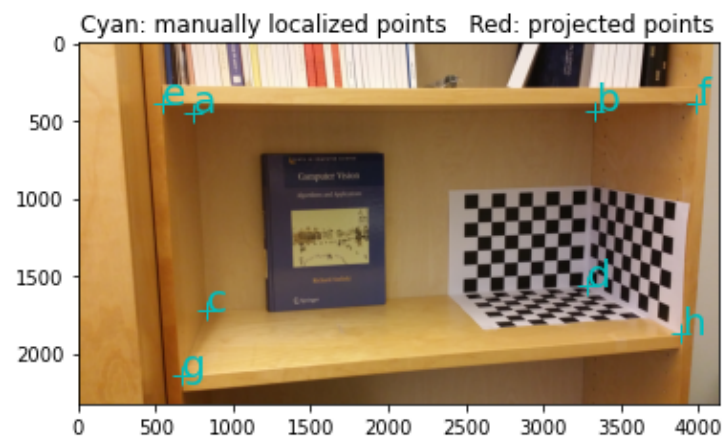
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(a) Fundamental matrix is used in stereo vision to encapsulate epipolar geometry between two images taken from different viewpoints by relating corresponding points between two images. Essential matrix encapsulates the same information and has the same purpose as essential matrix, but unlike fundamental matrix which also stores the intrinsic parameters of the cameras, essential matrix only stores the rotation and translation related to the orientation of the cameras. Therefore, essential matrix is only suitable for calibrated images.

(b) Essential matrix (E) can be derived from fundamental matrix (F) given that the camera calibration matrices are known. To derive the essential matrix, we can use E = K' * F * K where K is the camera calibration matrices.

(c) Fundamental matrix has 7 degrees of freedom. This is because it is a 3x3 matrix with 9 elements, but due to the essential constraint that it must have rank 2, only 7 elements are independent. This constraint arises from the fact that the epipolar lines should intersect at a unique point.

(d) Essential matrix has only 5 degrees of freedom and it is also a 3x3 matrix with 9 element. However, since 4 elements are determined by the intrinsic parameters of camera, only 5 elements are independent.

Cyan: manually localized points   Red: projected points

Cyan: manually localized points   Red: projected points

Cyan: manually localized points   Red: projected points

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Picture width: 0.61 mm
Picture height: 0.38 mm