

EEE-598 Image Stitching using Harris Corners and SIFT Descriptors

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1 Assignment Problems

1.1 Question 1 -Proof

To Prove; Images captured by cameras with the same center are related by the Homography equation -;

$$H = K_1^{-1} R K_2^{-1} \quad (1)$$

where K_1 and K_2 are Camera 1 and Camera 2 Intrinsic Parameters R is the relative Rotational Matrix

Proof:

Given X and x are homogeneous 3D and 2D points,

For Image 1,

$$x_1 = z^{-1} K_1 [R_1 t_1] X \quad (2)$$

For Image 2,

$$x_2 = z^{-1} K_2 [R_2 t_2] X \quad (3)$$

where R, t are camera extrinsics.

$$x = [K_2][R_2] X \quad (4)$$

As homogeneous, $z = 1$, and an Camera's origin coincide, $t = 0$ Hence, taking inverse of the above equation, and substituting x ,

$$\begin{aligned} x_1 &= [K_1 R_1] X \\ x_2 &= [K_2 R_2] X \\ \Rightarrow x_2 &= [K_2 R_2] [K_1^{-1} R_1^{-1}] x_1 \\ \Rightarrow x_2 &= [K_2 (R_2 / R_1) K_1^{-1}] x_1 \\ \Rightarrow x_2 &= [K_2 R K_1^{-1}] x_1 \end{aligned}$$

where R is the relative rotational matrix between the two images

Thus, $x_i = HX$ where, $H = [K_2RK_1-1]$. and H is called the Homography Matrix.

1.2 Question2- Based on the above derivation, does the derived homography depend on the scene? (i.e. position of points in the scene X)?

No, it does not depend upon the Scene Points.

1.3 Question3- Show the nal mosaic of the provided test images



Figure 1: The Left Image after Homography



Figure 2: The Original Center Image

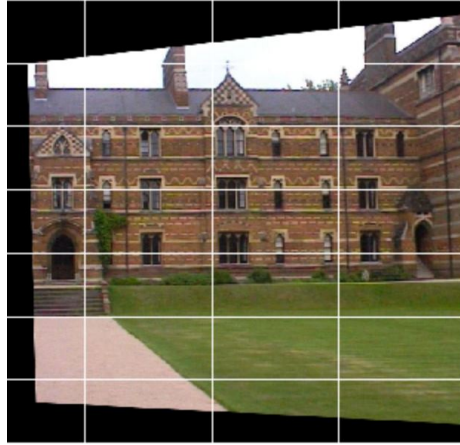


Figure 3: The Right Image after Homography

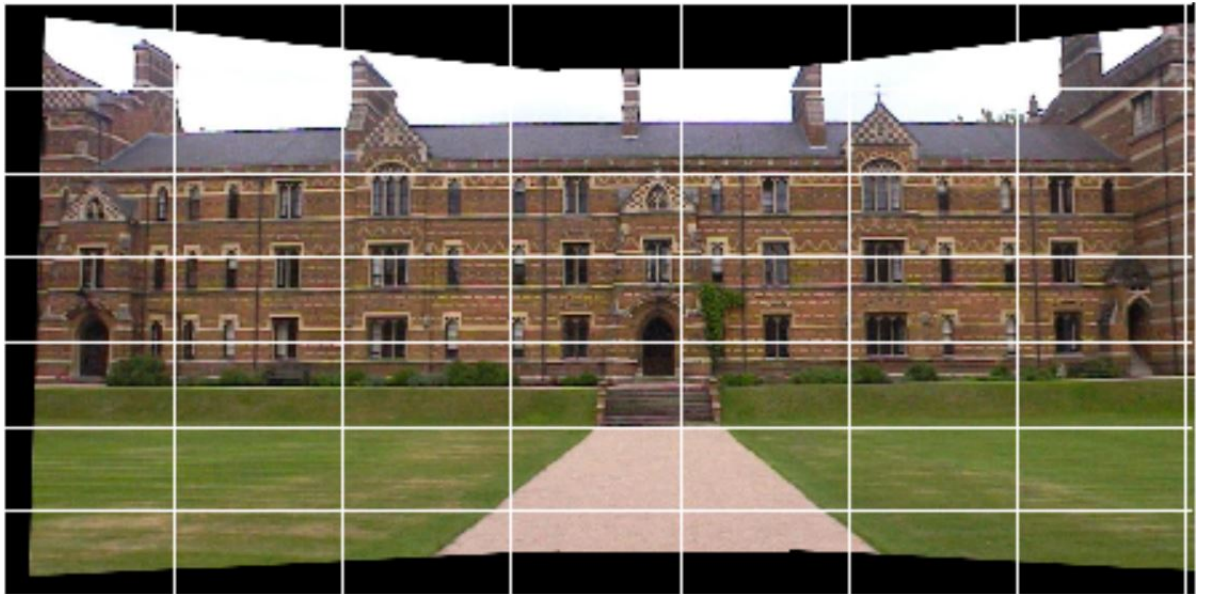


Figure 4: The Mosaic Image

1.4 Question4- Show the visualization of the set of tentative matches and the set of inliers for one image pair

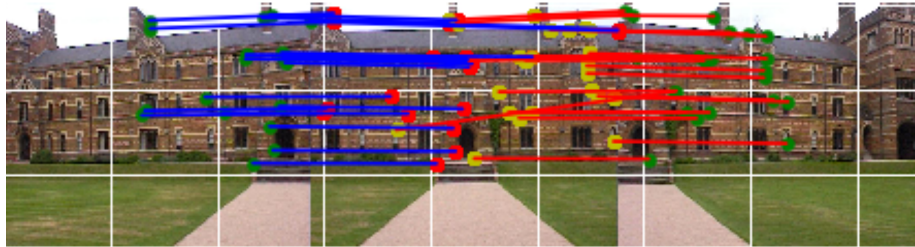


Figure 5: Tentative Good Matches after Lowe's Test

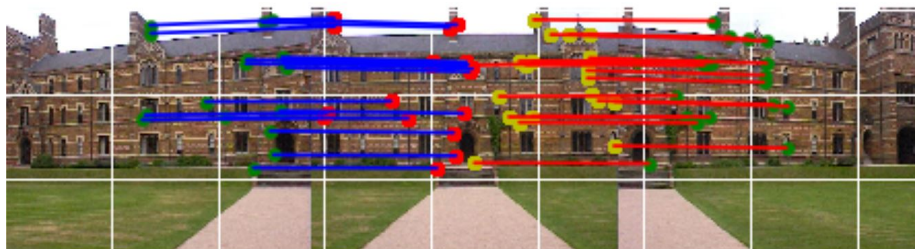


Figure 6: Inliers after RANSAC Algorithm

1.5 Extra Credit : Harris Corners

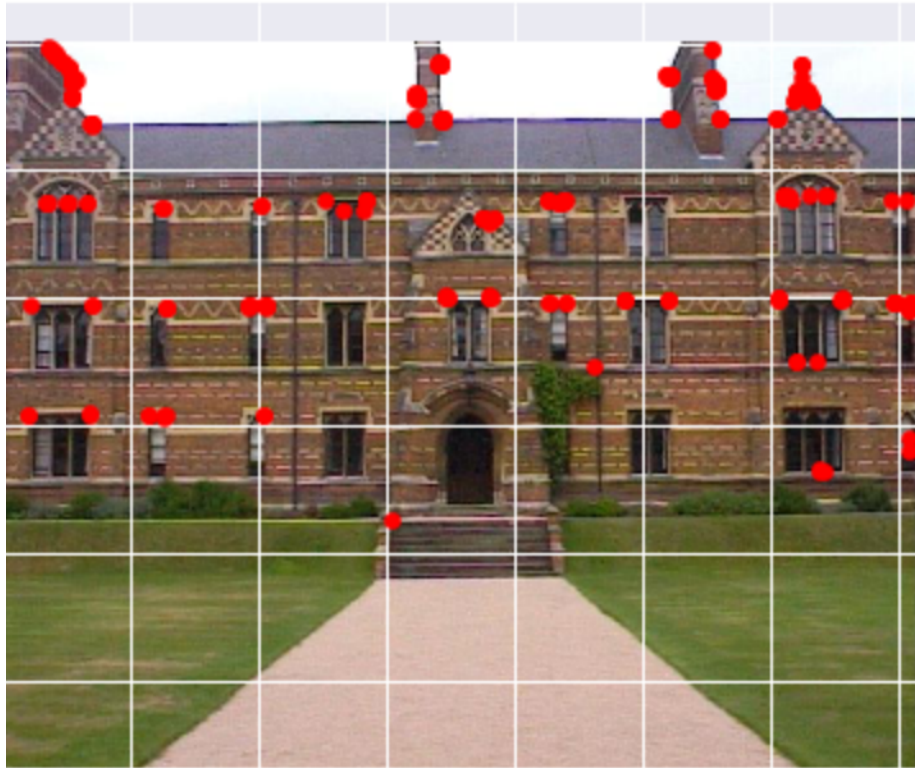


Figure 7: Harris Corners on Center Image

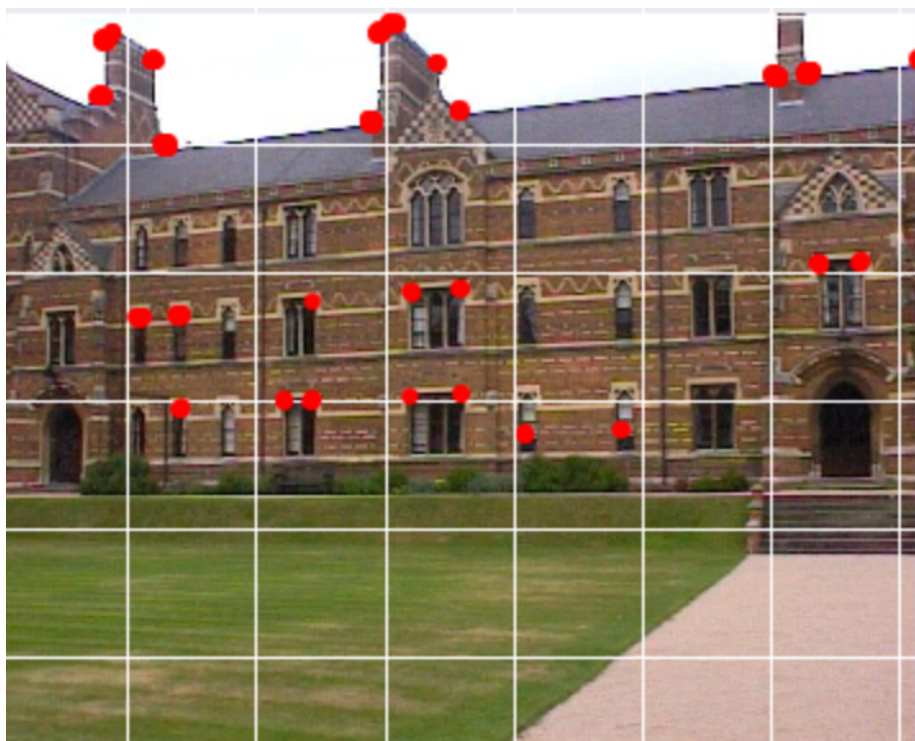


Figure 8: Harris Corners on Left Image