

Image Registration Project Report

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Functions Descriptions

- a. `featureMatching(image1,image2)`
 - i. This function takes in two gray scale images and returns corresponding points for image2 in image1. For each sift feature in image1 it will find the two closest sift features in image2 based on euclidean distance. It is a good match only if the second closest point is less than some threshold of the first point (Lowe's Method). It will then return a set of matching points between image1 and image2. This takes care of Part 1 and Part 2.
- b. `DLT_Standard(p1,p2)`
 - i. This function takes in the returned matchings points between image1 and image2 and compute the Homography transformation matrix using DLT algorithm.
- c. `DLT_Normalized(p1,p2)`
 - i. Similar to `DLT_Standard`, this functions takes an extra step which normalized the Homography matrix by turning the last element into 1. This also takes care of Part 3.
- d. `cv.findHomography`
 - i. RANSAC is used while calling this pre built function in opencv. This takes care of Part 4.
- e. `registerImage()`
 - i. This function outputs the transformed images together and represent as one combined image. This takes care of Part 5.

Algorithm Brief Description:

The input of our program takes in two images and gets fed into SIFT for feature extraction and correspondence. After sorting out the good corresponding points, those points are sent into DLT to compute the Homography matrix. RANSAC is also applied as an alternative to "clean up" the feature points and help enhance DLT performance. Homography matrices are then applied onto one of the input images to compare with the other for evaluation. Images are rescaled to be stitched together for visualization.

Results:

For overhead images. Homography matrices and results are shown below. H1 is standard DLT. H2 is Normalized DLT and H3 is RANSAC + DLT.

1	H1, H2, H3
	(array([[1.55502557e-01, -4.53632897e-01, 1.48220682e+02], [-3.80626838e-01, -2.71563274e-01, 2.85453114e+02], [-9.68792252e-04, -1.79362973e-03, 1.00000000e+00]]), array([[1.12435755e+00, 2.55902751e-01, 2.78272362e+00], [-9.83305430e-03, 1.30124123e+00, 1.73206572e+02], [1.19207328e-04, 7.77239904e-04, 1.00000000e+00]]), array([[9.82306116e-01, 6.10194797e-02, 2.74104052e+01], [-4.32831763e-02, 1.00188726e+00, 1.77121136e+02], [-3.65788575e-05, -2.55895182e-06, 1.00000000e+00]]))

Original Image 1



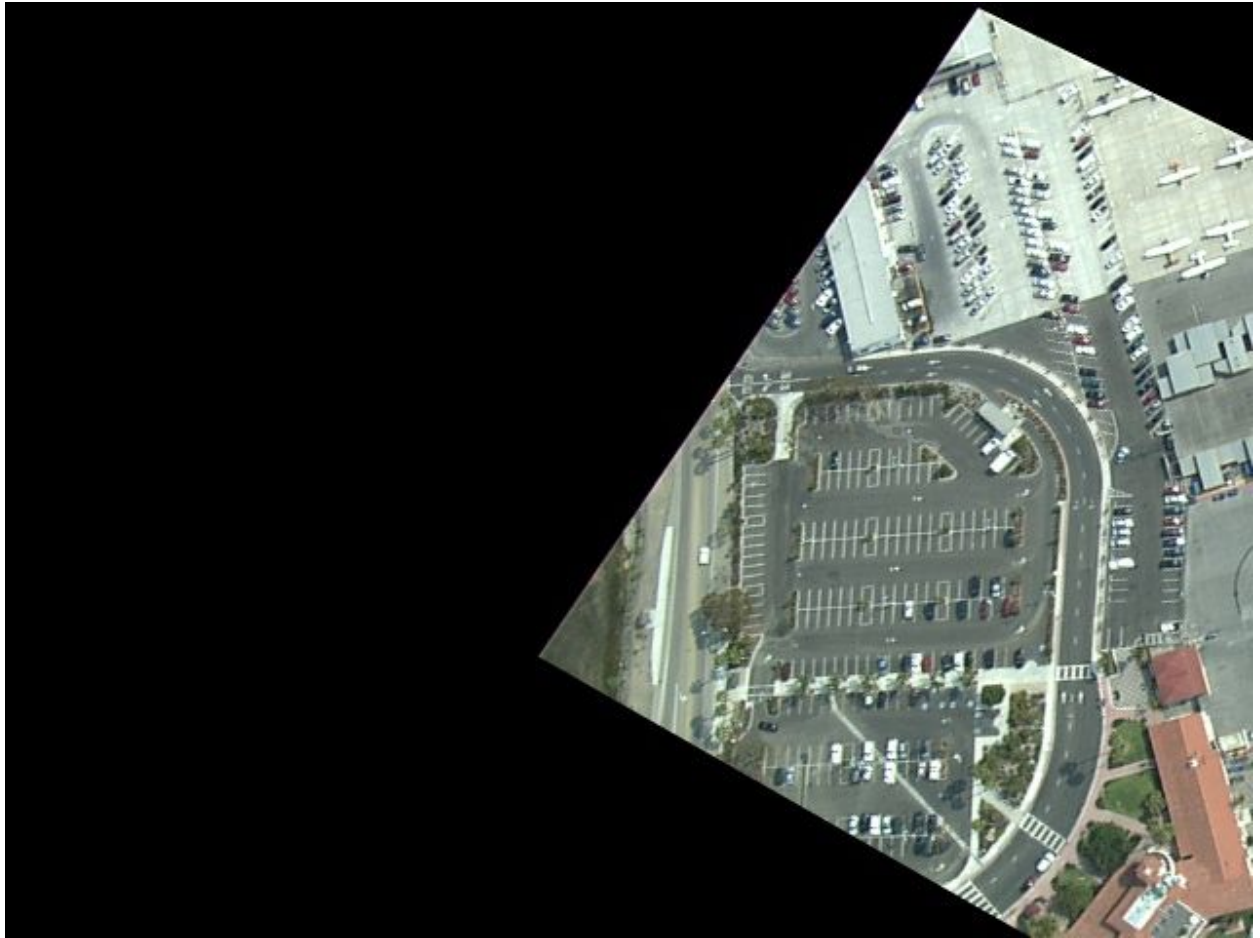
Original Image 2



Standard DLT



DLT Normalized



RANSAC DLT



For kitp images. Homography matrices and results are shown below. H1 is standard DLT. H2 is Normalized DLT and H3 is RANSAC + DLT.

1	H1, H2, H3
:	(array([[-4.95400925e-01, -8.00848580e-01, 2.40792890e+03], [-3.46444905e-01, -5.02494358e-01, 1.55624836e+03], [-2.02046299e-04, -3.26890554e-04, 1.00000000e+00]]), array([[-2.30333219e-03, -9.50646339e-01, 1.15500005e+03], [-6.91011051e-03, 1.75257886e-01, -1.96554698e+02], [9.84793609e-06, -8.44051051e-04, 1.00000000e+00]]), array([[-2.61494857e-01, 3.73870715e-01, 7.25142214e+02], [-1.13282866e-01, 4.23277628e-01, 1.30750012e+02], [-2.66513093e-04, 1.13264085e-04, 1.00000000e+00]]))

RANASC DLT Snitched Result



For self supplied testing images. Homography matrices and results are shown below. H1 is standard DLT. H2 is Normalized DLT and H3 is RANSAC + DLT.

1	H1, H2, H3
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]:(array([[ 5.07554420e-01, -5.01614167e-01,  5.39028609e+02],
          [ 2.62716152e-01,  5.28754940e-01,  5.84255274e+01],
          [-1.81533069e-04, -1.36400709e-04,  1.00000000e+00]]),
      array([[ 6.43342910e-01, -4.80668008e-01,  4.97896155e+02],
          [ 3.43830996e-01,  6.80144800e-01,  2.59172319e+00],
          [-1.28395923e-04, -3.75729698e-05,  1.00000000e+00]]),
      array([[ 6.50790721e-01, -4.86526037e-01,  4.96974786e+02],
          [ 3.46749854e-01,  6.78807865e-01, -4.01882603e-01],
          [-1.26242986e-04, -4.26521770e-05,  1.00000000e+00]]))
```

Original Image 1



Original Image 2



Standard DLT



DLT Normalized



RANSAC DLT



