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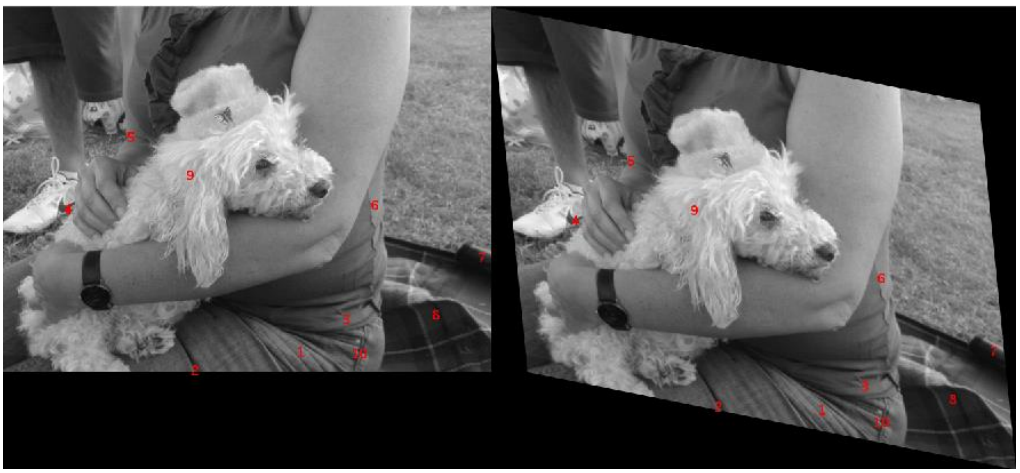
EX3 – Explanations

1. The following images presents an image and the same image after transformation:



The transformation matrix used is the following:

H = [1 .2 0; .1 1 0; 0.5 0.2 1]. This is a shear transformation.

2. The best 10 matches ordered by match ratio:

379.33, 437.83 -> 423.39, 513.94

241.54, 461.97 -> 287.57, 510.16

440.09, 394.79 -> 480.3, 482.8

75.39, 250.4 -> 100.41, 265.37

158.35, 156.01 -> 174.26, 187.07

476.96, 245.2 -> 501.38, 340.81

616.78, 313.85 -> 647.94, 436.97

557.03, 388.95 -> 594.79, 500.29

235.3, 205.58 -> 255.94, 252.44

450.63, 440.35 -> 494.52, 530.4

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3. In the next image, you can see the image transformed by the given transformation (left), and the image transformed by the calculated transformation in the DLT (right):

The calculated image looks almost the same like the computed one, but clearly that there is a difference. If the DLT had more accurate matches, it could have produces a more accurate result.

5. In this exercise, we used the RANSAC function in order to get better results from the DLT algorithm. We gave the RANSAC all our matches, and asked him to find for us the model (in our case the estimation for the projective matrix) that have the biggest number of inliers, from all the matches.

In every iteration, the RANSAC 'tossed' some matches, run the DLT on them in order to get estimation model, and count the number of inliers according to this model, using distance function we implemented and a threshold parameter in order to decide which match is an inlier or outlier. At the end the RANSAC returned the best model and all the inliers.

In this way, we calculated the model based only on inliers matches, and ignored the bad matches, and the result was more accurate.

In addition, we gave the RANSAC a function that validate that no 3 points from the 'tossed' matches are collinear, because the DLT function perform better this way. We also gave him loop boundaries to prevent from the inner loop to run forever.

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An example of RANSAC not improving the DLT algorithm, is presented in Example1.m. Basically, we executed the script and saw that transforming the original image using the transformation calculated using DLT and transforming the original image using the RANSAC produces 2 images that look the same. We also used the ComputeError function from question 4 and noticed that both errors are practically the same. We used the same image and the same transformation from question 1. The reason RANSAC didn't improve the result is due to the high value of the parameter that is used in the distance calculation as threshold. The given parameter causes the RANSAC function to consider all matches as inliers, so it's doing the same thing the DLT algorithm does, and doesn't ignore the bad matches as well. All other specific information can be found in Exanple2.m. (Including code explanations and figures)

An example of RANSAC improving the DLT algorithm, is presented in Example2.m. Basically, we executed the script and saw that transforming the original image using the transformation calculated using DLT and transforming the original image using the RANSAC produces 2 images that look almost the same, being that the one produces by the RANSAC looks somewhat more like the one produced on question 1 more than the other. We also used the ComputeError function from question 4 and noticed that the error of the RANSAC function is smaller as absolute, and that the division of the RANSAC error by the DLT error is smaller than 1. We used the same image and the same transformation from question 1. The reason RANSAC improve the result is due to the sweet spot of the value of the threshold parameter that used in the distance calculation. The accurate threshold causes the RANSAC function to consider the good matches as inliers, and the actually bad matches as outliers, so that the DLT using the Inliers can produce a much more accurate result and ignore the bad matches. It is important to notice that the RANSAC is a probability algorithm, so it improves the result most of the time, but might not prove the result sometimes. This is due the parameter deciding the maximum iterations the algorithm does: The higher the value is, the more chance that we will get an improvement, but the longer the algorithm might take on order to finish. All other specific information can be found in Exanple2.m. (Including code explanations and figures)