CS 378 Computer Vision Pset#3
CHI-MING YEH Unix Account: ychm

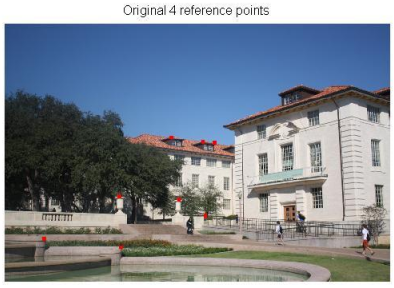
Part I :

1. When a camera's focal length gets smaller, we will get a blurred and bigger area on the image's field. By the equation 1/f = 1/u + 1/v, we will get a smaller u because f is smaller and the image field distance v does not change. That is, we will get a precise focus object without blurring in a nearer object distance than before.

2. When a building's surface is parallel to the image plane, this is just like the weak perspective transformation. Parallel lines are preserved in the perspective transformation. Therefore, we could check the boundaries of the building if they are 2 parallel pairs of lines. Actually, the angle should be 90 degrees as a rectangular object in the image plane.

Part II :

1. Verify the homography matrix by mapping the reference points in the original image to the transformed points in another image. Left image is the original image with 8 clicked points as red dots and right image is the transformed points.



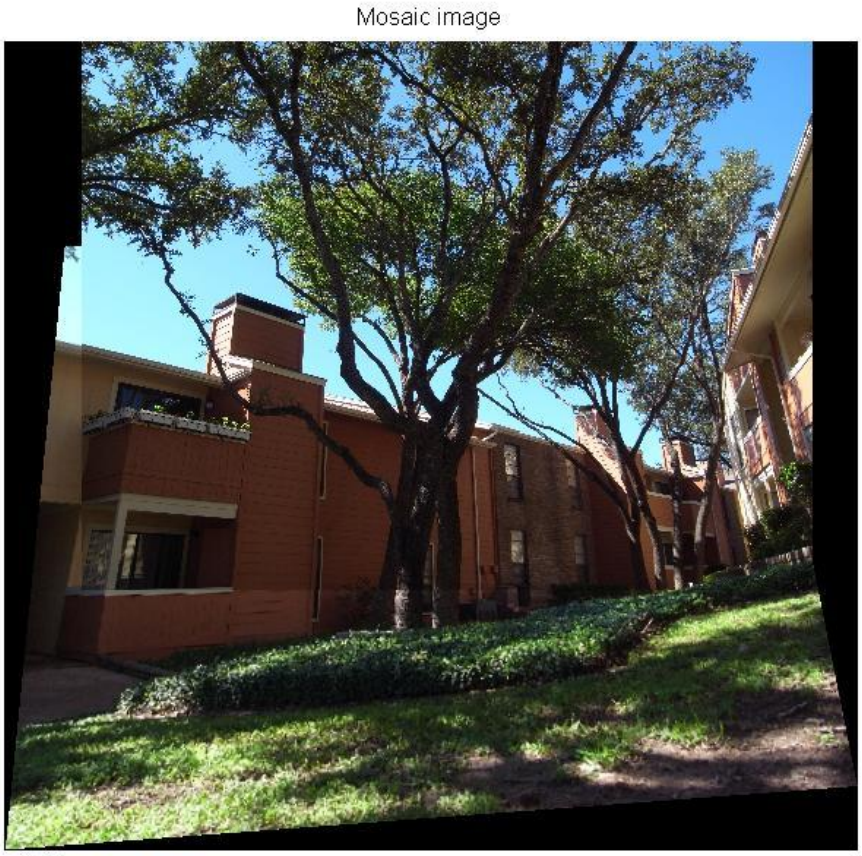
2. Warp the image1 to the image plane of image2 by means of inverse warping.

warped image

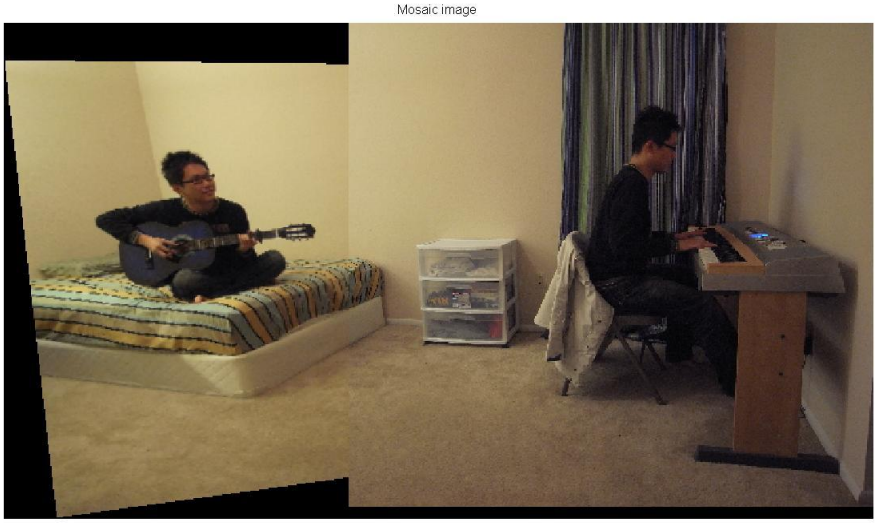
3. Create the output mosaic by overwrite the image2 to the warped image1.

Mosaic image

4. Additional example 1, making a mosaic from two images of a broad scene to a wide angle view of trees.



5. Additional example 2, using two images from the same room where the same person appears in both.



6. Warp one image into a “frame” region in the second image.

original image1

original image2

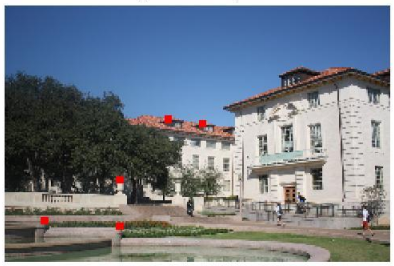
pasted image

paste the image1 as movie poster in image2

Part III :

1. Implement RANSAC for robustly estimating the homography matrix from noisy correspondeness. From the 5 clicked pairs of corresponding points, we pick every 4 pairs to calculate their H and then compute the SSD of the corresponding points and mapped points. Finally, we pick the H that has the smallest SSD as the best reference pairs to form the mosaic.

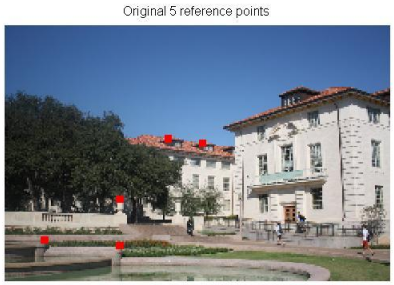
Original 5 reference points



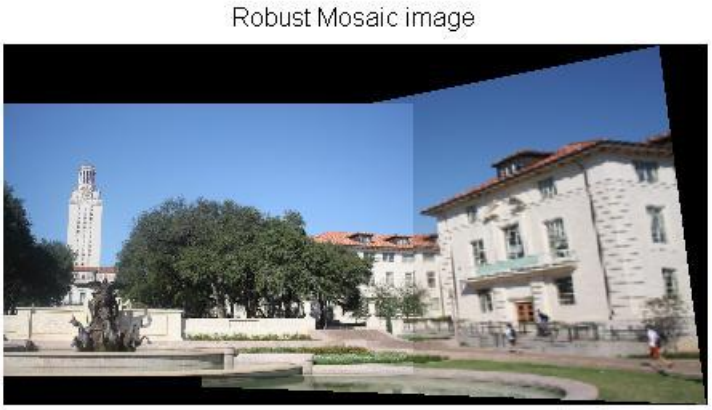
Averaging 5 transfered points

By calculating the 5 pairs to form H, we can get a bad homography because of the bad correspondences given as input. Then, we will get a bad mosaic image as below. Actually, there is only one outlier that is the one in the middle, others 4 pairs are correct correspondences. However, the outlier makes a big difference in matrix H so that the mapped points change a lot in the right image above.

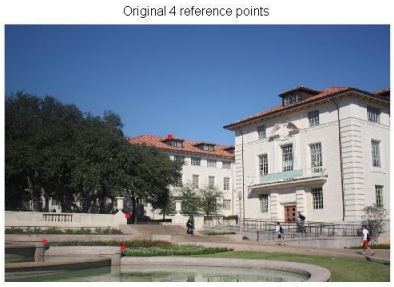
Average Mosaic image



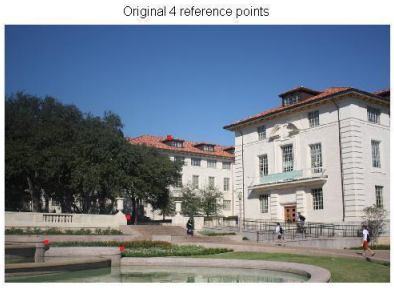
By using the RANSAC, we can dismiss one outlier from 5 pairs. We can generate a good homography as the mapped corresponding points above.



2. Refine the initial correspondences automatically by searching small pathes (21x21 window) near the clicked points for a good alignment. We use the correlation between two widows in the left image and the right image and find the largest correlation as the fined corresponding point.

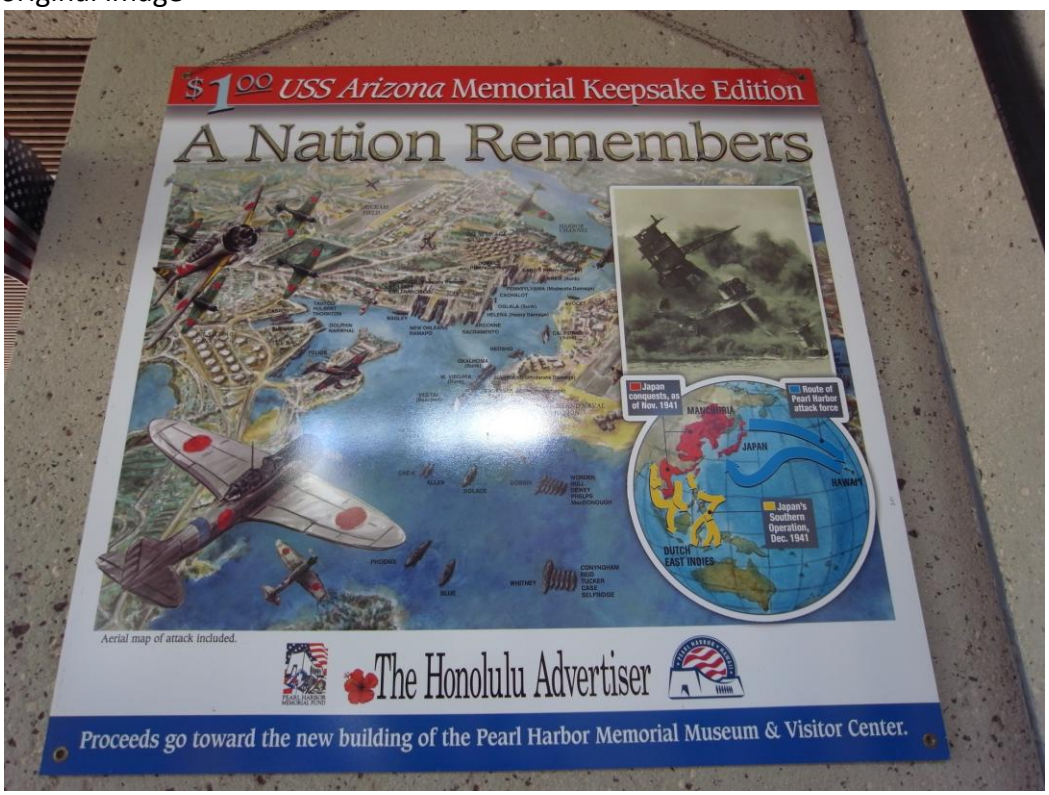


In the original corresponding points above, there are deviations while clicking. By using automatic patches matching, we can get a much better corresponding points as the right image below.



3. Rectify an image with some known planar surface and show the virtual fronto-parallel view.

original image



Rectified image