image_mosaicing

February 17, 2019

0.0.1 Assignment 2 image Mosaicing

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```
In [20]: import cv2
         import numpy as np
         import matplotlib.pyplot as plt
         from random import randrange
         import random
```

0.0.3 find the homography matrix

0.0.4 DLT way to calculate homography

```
In [21]: ## helper function to create n x 9 matrix of points
```

```
In [22]: def point1_point2_matrix(img_point1, img_point2):
             pointX = [img_point1[0,0],img_point1[0,1],1,0,0,0,
                       -img_point2[0,0]*img_point1[0,0],
                       -img_point2[0,0]*img_point1[0,1],-img_point2[0,0]]
             pointY = [0,0,0,img_point1[0,0],img_point1[0,1],1,
                       -img_point2[0,1]*img_point1[0,0],
                       -img_point2[0,1]*img_point1[0,1],-img_point2[0,1]]
             return pointX,pointY
```

```
In [23]: def DLT_homography(img1_points,img2_points):
             #M = np.empty((2*img_points.shape[0], 12),dtype='int64')
             A = []
             count = 0
             for img1_point,img2_point in zip(img1_points,img2_points):
                 pointX,pointY = point1_point2_matrix(img1_point,img2_point)
                 #print(pointX,pointY)
                 ## 2x9 matr
                 #np.append(M,np.array(A_point),axis=0)
                 A.append(pointX)
                 A.append(pointY)
             A = np.array(A)
             ### perfomr SVD
             u, s, vh = np.linalg.svd(A, full_matrices=True)
```

```
            ## use the last value
            M = np.transpose(vh)
            M_1d = M[:,-1]
            M_1d = M_1d/M_1d[-1]
            M_2d = np.reshape(M_1d,[3,3])
            return M_2d
```

In [ ]:

0.0.5 Ransac variation to calculate optimal Homography matrix

Helper function to calcuate Homograpgy projection error

```
In [24]: def reprojection_error(img1_points,img2_points,P):
            error = 0
            for img1_point, img2_point in zip(img1_points,img2_points):
                h_img1_point = np.array([img1_point[0,0],img1_point[0,1],1])
                predicted_img_point = np.dot(P,h_img1_point)
                X = int(round(predicted_img_point[0]/predicted_img_point[2]))
                Y = int(round(predicted_img_point[1]/predicted_img_point[2]))
                temp_error = np.linalg.norm(img2_point-np.array([X,Y]))
                #print(temp_error)
                error = temp_error + error
            return error
            #return temp_error
```

```
In [25]: #reprojection_error(src,dst,H)
```

```
In [26]: def ransac_variation_homography(img1_points,img2_points):
         ## select random points
            count =0
            temp = 1000000

            while(count<100):
                index = random.sample(range(len(img1_points)), 4)
                random_img1_points = img1_points[index,:]
                random_img2_points = img2_points[index,:]
                M1 = DLT_homography(random_img1_points,random_img2_points)
                r_error = reprojection_error(img1_points,img2_points,M1)
                #print(index, r_error)
                count=count+1
                if(r_error < temp):
                    temp = r_error
                    M = M1

            return M
```

```
In [28]: def crop_function(img):
```

```
    [height,width,channel] = img.shape

    w = width

    h = height
    temp1 = np.zeros((height,4,3))
    temp2 = np.zeros((4,width,3))
    for col in range(width-5):
        if(np.array_equal(img[:,col:col+4,:],temp1)):

            w = col
            break
    for row in range(height-5):

        if(np.array_equal(img[row:row+4,:,:],temp2)):
            h = row
            break
    #print(h)
    img1 = img[0:h,0:w]
    #print (w)
    return img1
```

0.0.6 stitching the image together

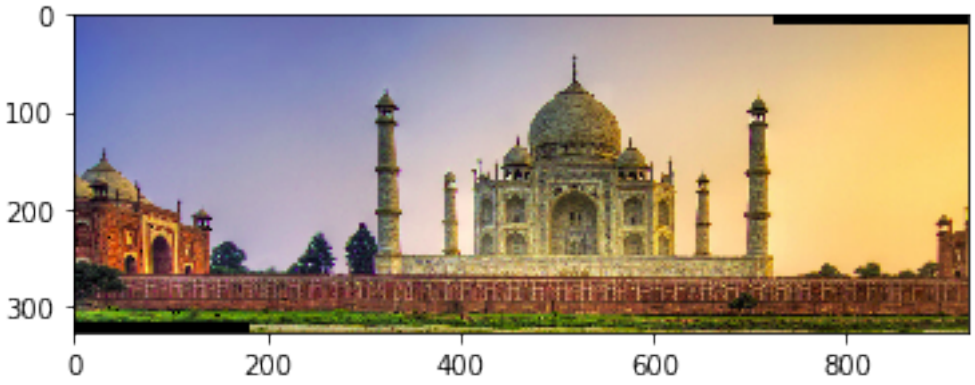
image_mosaicing function takes two images and perfrom the image mosaicing and return panoroma image

```
In [29]: def image_mosaicing(img_1,img_2):

    img2 = cv2.cvtColor(img_2,cv2.COLOR_BGR2GRAY)

    img1 = cv2.cvtColor(img_1,cv2.COLOR_BGR2GRAY)

    #find the shift point

    sift = cv2.xfeatures2d.SIFT_create()
    # find the keypoints and descriptors with SIFT
    kp1, des1 = sift.detectAndCompute(img1,None)
    kp2, des2 = sift.detectAndCompute(img2,None)


    ## match the points
    bf = cv2.BFMatcher()
    matches = bf.knnMatch(des1,des2, k=2)
```

```
            # select the good points
            selected_match = []
            number_of_good_point=0
            for match in matches:
                if match[0].distance < 0.5*match[1].distance:
                    selected_match.append(match)
                    number_of_good_point = number_of_good_point+1
            matches = np.asarray(selected_match)
                #if len(matches[:,0]) >= 4:
            ## check if number of good matched points are greater or equal to 4
            if number_of_good_point >= 4:
                src = np.float32([ kp1[m.queryIdx].pt for m in matches[:,0] ]).reshape(-1,1,2)
                dst = np.float32([ kp2[m.trainIdx].pt for m in matches[:,0] ]).reshape(-1,1,2)
                ## calculate the homography
                H = ransac_variation_homography(src,dst)
                #H = DLT_homography(src,dst)

                ## perform the image warping
                # warp the image1 in with homograply
                dst_img = cv2.warpPerspective(img_1,H,(img_2.shape[1] + img_1.shape[1], img_2.s

                #assign img2 to warp image for only valid pixels
                for i in range(img_2.shape[0]):
                    for j in range(img_2.shape[1]):

                        if((img_2[i,j,0]!= 0) & (img_2[i,j,1]!= 0) & (img_2[i,j,2]!= 0)):

                            dst_img[i,j] = img_2[i,j]


                ## crop the image for valid pixels
                dst1_img = crop_function(dst_img)

                #cv2.imwrite('test_images/output.jpg',dst1_img)
                plt.imshow(cv2.cvtColor(dst1_img,cv2.COLOR_BGR2RGB))
                plt.show()
                return dst1_img
            else:
                print ("no proper matches found")
                return None
```

In [ ]:
```
## check the image_mosaicing function
```

In [30]:
```
img_1 = cv2.imread('test_images/img2_2.png')
img_2 = cv2.imread('test_images/img2_1.png')

dst = image_mosaicing(img_1,img_2)
```



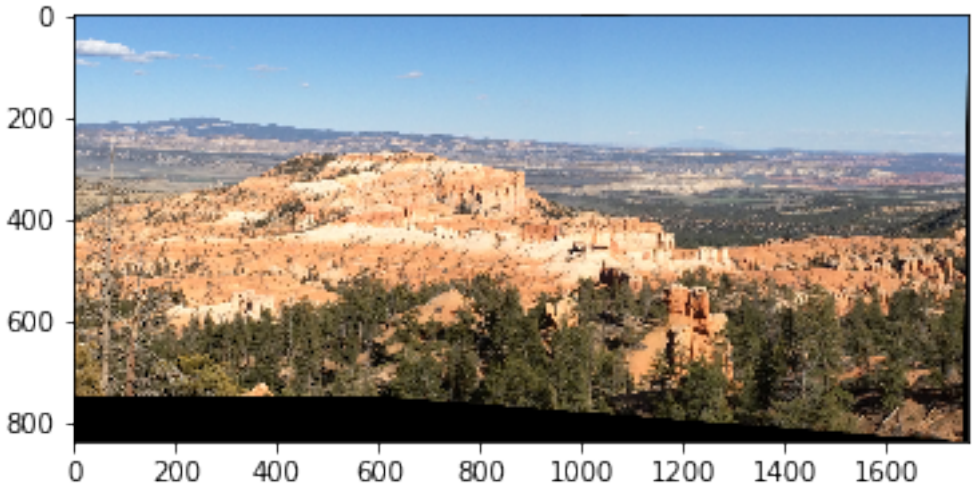
0.1 main function to stitch multiple images

The function accept the path folder where sequence of images are stored. It uses the avove image_mosaicing function which stiches two images to perform the stitch multiple images

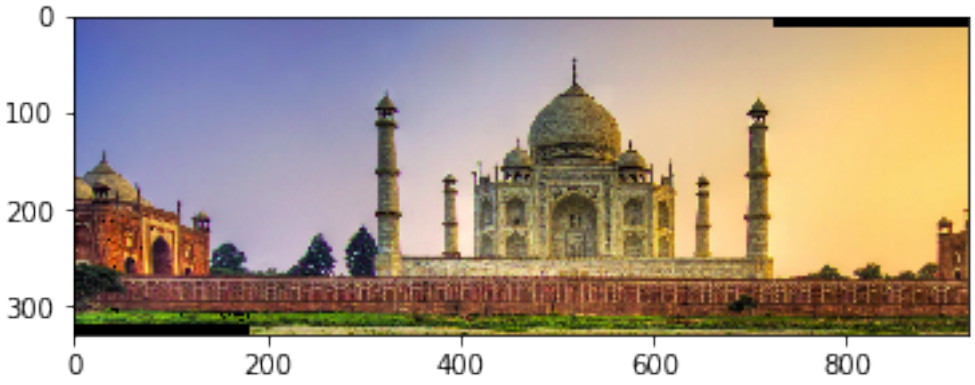
```
In [31]: def stich_multiple_images(path):

             images = glob.glob(path)

             count =0
             for fname in sorted(images):
                 img_1 = cv2.imread(fname)

                 if(count < 1):
                     img_2 = img_1.copy()
                 else:

                     img_2 = image_mosaicing(img_1,img_2)
                 count = count+1

             #plt.imshow(img_2)
             #plt.show()
```

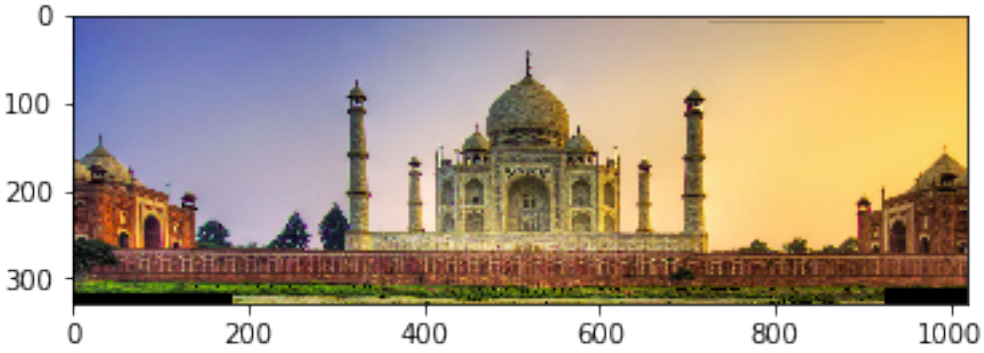
0.2 results on test images

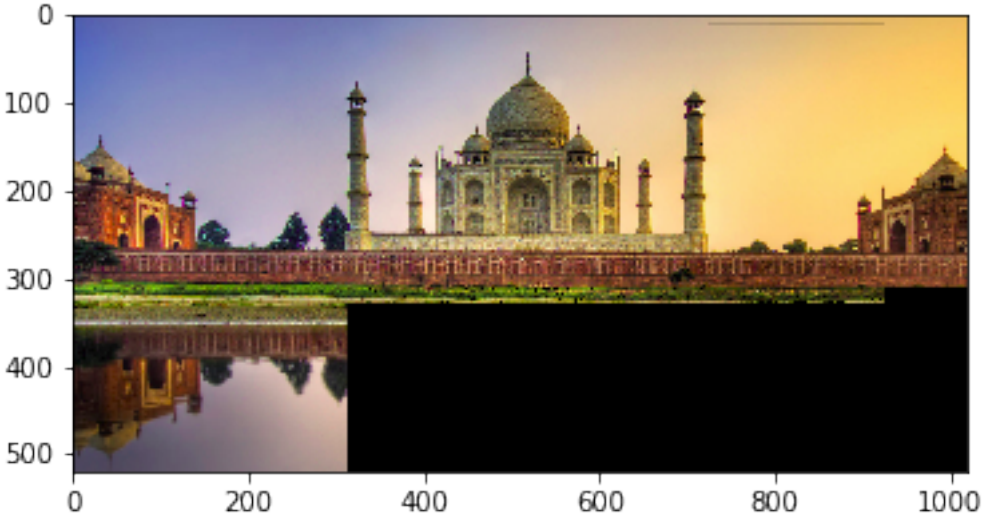
```
In [32]: import glob
         path = 'test_images1/*png'
         stich_multiple_images(path)
```

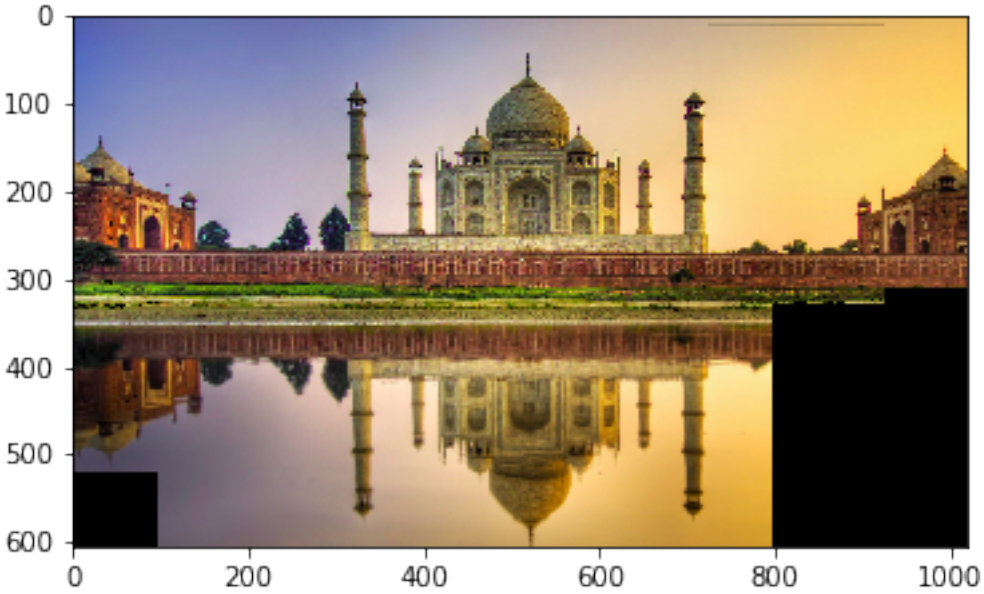


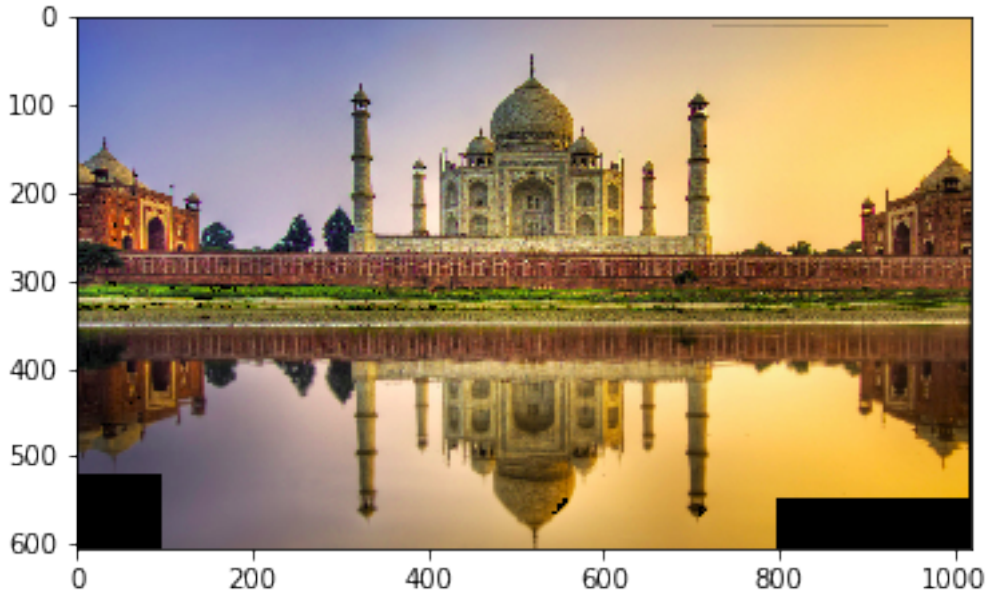
In [33]:
```
path = 'test_images2/*png'
stich_multiple_images(path)
```



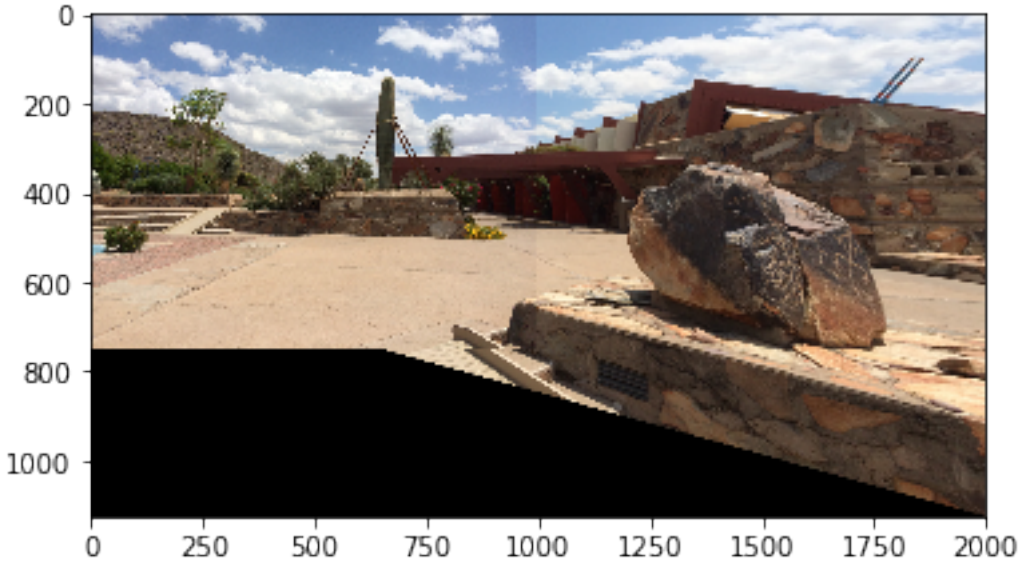



0
100
200
300
400
500
0
200
400
600
800
1000


0
100
200
300
400
500
600
0
200
400
600
800
1000



In [34]:
```
path = 'test_images3/*png'
stich_multiple_images(path)
```

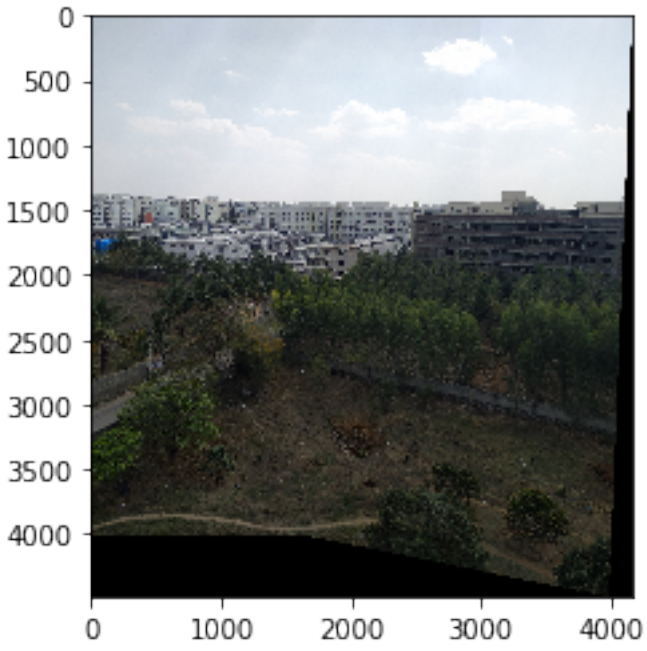


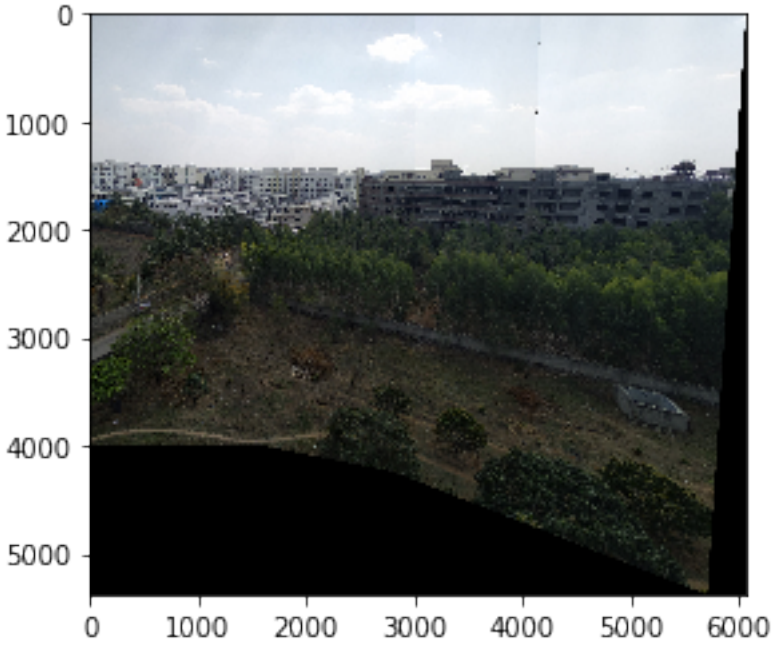
In [16]:
```
path = 'test_images4/*jpg'
stich_multiple_images(path)
```

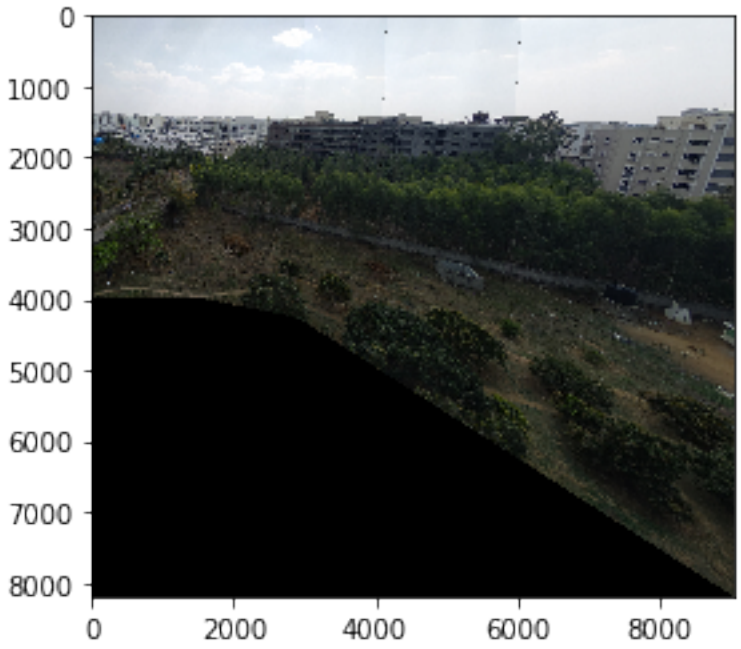
```
no proper matches found
```

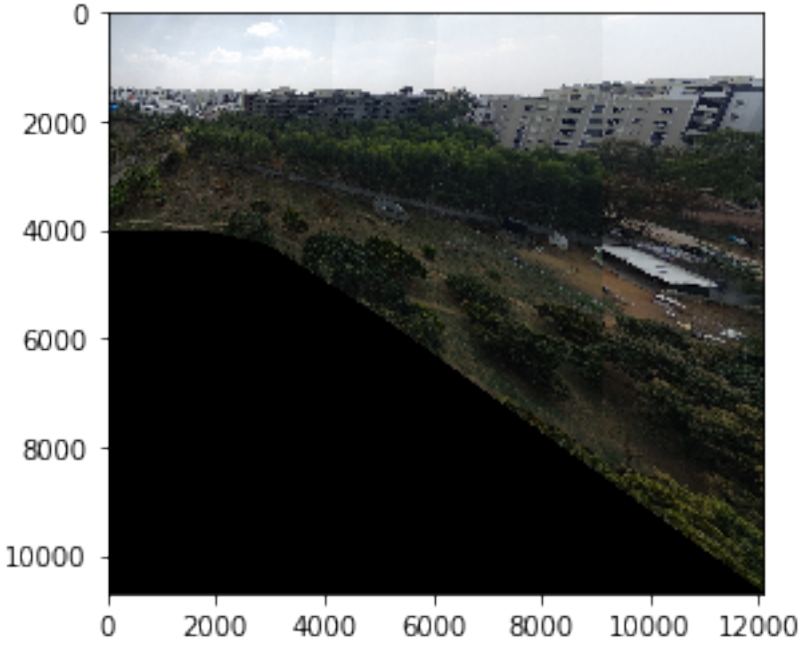
0.3 result on own image

```
In [35]: path = 'own_images/*jpg'
         stich_multiple_images(path)
```






0
1000
2000
3000
4000
5000
6000
7000
8000
0
2000
4000
6000
8000


0
2000
4000
6000
8000
10000
0
2000
4000
6000
8000
10000
12000