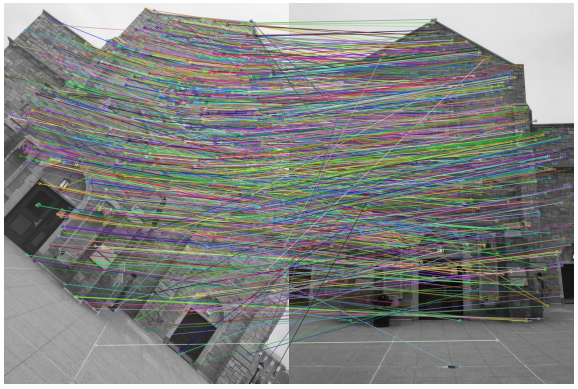
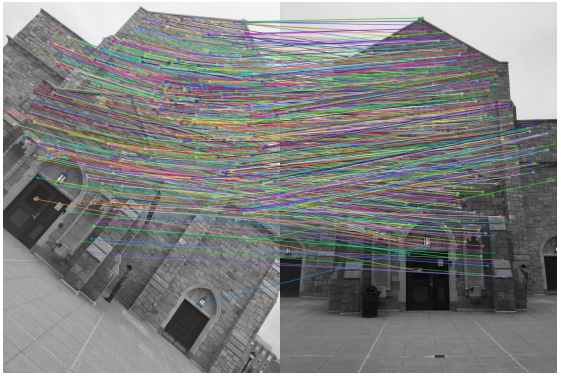
vcc-entrance

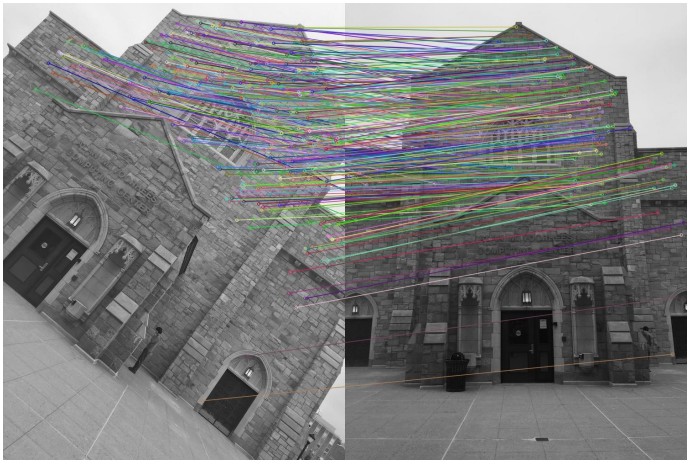
mosaic of image 1 and image 2



Keypoint matching from SIFT



Keypoint matching after F estimation

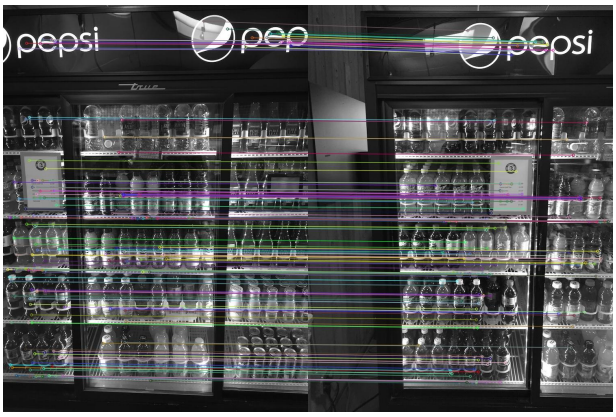


Keypoint matching after H estimation

drink-machine

No mosaic because images didn’t pass the threshold (in terms of how similar they are)

Keypoint matching from SIFT

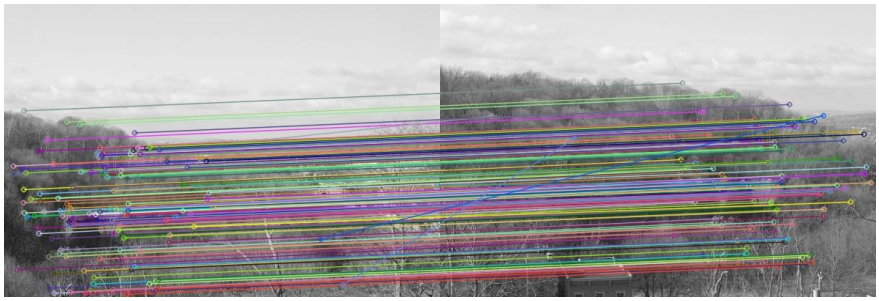


Keypoint matching after F estimation

Keypoint matching after H estimation

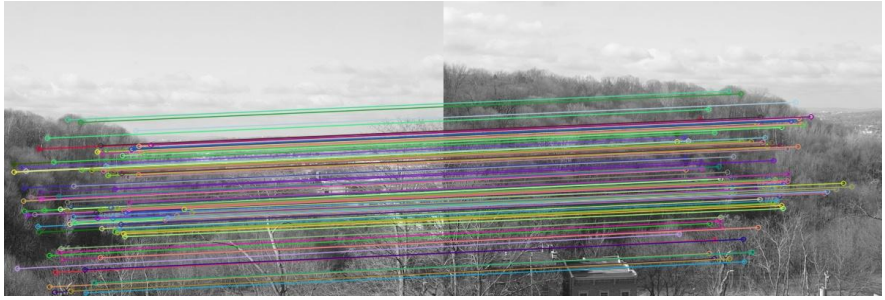
frear-park

mosaic of image 1 and image 2



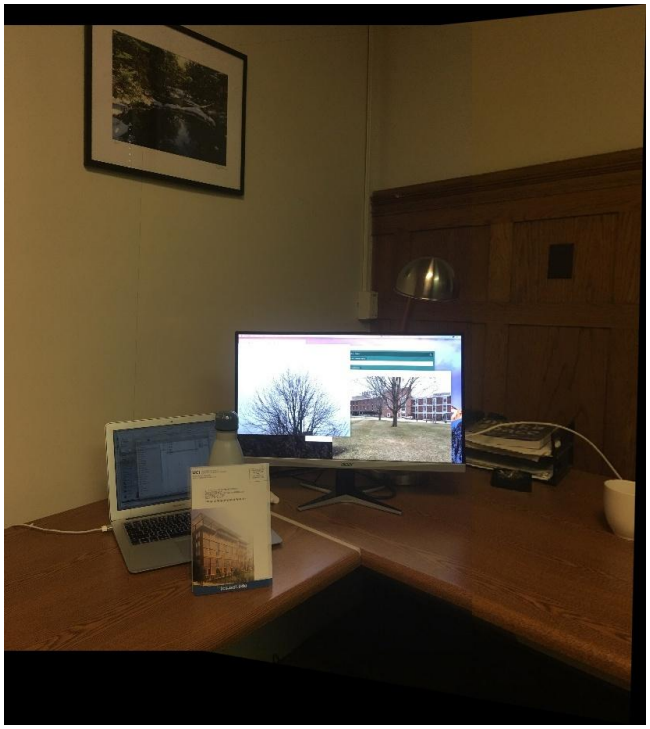
Keypoint matching from SIFT

Keypoint matching after F estimation

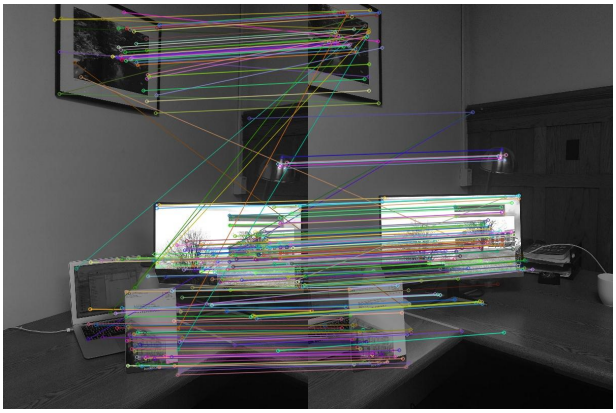


Keypoint matching after H estimation

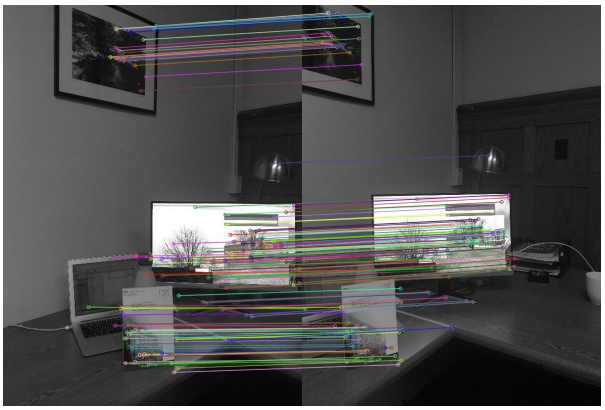
office



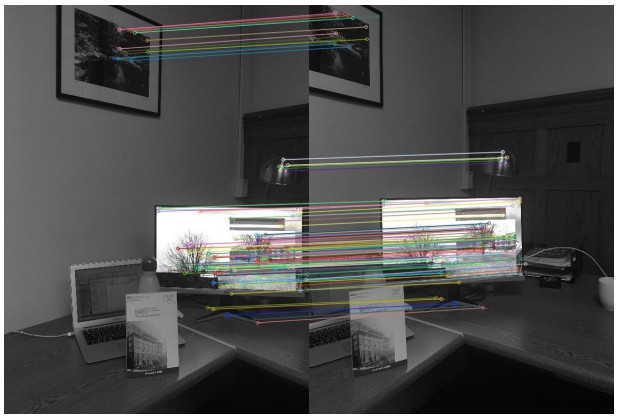
mosaic of image 1 and image 2



Keypoint matching from SIFT



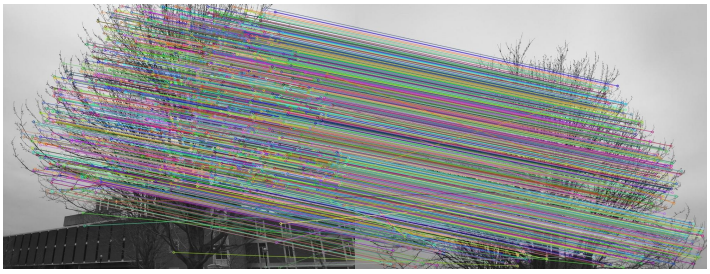
Keypoint matching after F estimation



Keypoint matching after H estimation

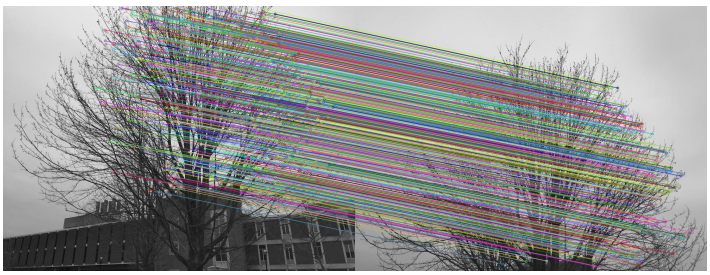
tree_mrc

mosaic of image 1 and image 2



Keypoint matching from SIFT

Keypoint matching after F estimation



Keypoint matching after H estimation

1. **Algorithm**
   Between two image pair:
   Run SIFT to get keypoints → Using the matches produced by keypoint description matching, use RANSAC to estimate the fundamental matrix F →If the percentage of matches that are inliers are above threshold, move on; else quit → use RANSAC to estimate H → if above threshold, choose the anchor image by evaluating the distortion in H and inverse(H) → form a mosaic between two images (multiple-image mosaic could not be done)
2. **Decision criteria**
   Most of the threshold values and parameters are empirically decided after testing on different images. For SIFT ratio test, the ratio of the distance between two descriptors is decided to be 0.8. I remember reading from some website that a value around 0.7 was recommended, so I was testing with different values.
   For the inliers that are consistent with the Fundamental matrix, the ratio has to be greater than 0.2 That is, (matches from F estimation) / (number of initial matches) > 0.2. This is determined after testing on two images that are of different scenes, and their values were around 0.1±0.05.
   Similarly, the threshold ratio for H has been determined to be 0.3 using similar methodology.
3. **Blending algorithms**
   This is for forming a mosaic image with two images; not a multi-image mosaic

   Given two images and matrix H,
   first, calculate new coordinates for img1 and img2. Img2 is the anchor image.
   then, calculate the mosaic size

   [0.8] and [0.2] represent matrices of mask of weights
   new_image[i, j] = [0.2] * img1[i,j] + [0.8] * img2[i,j] for the region where they overlap

   For non-overlapping region, copy from the rest of img1 and img2

4. **Overall results (strengths and weaknesses)**

The mosaic accounts for rotation and translation well. The resulting image looks good for the frear park and office case. For the tree-mrc, the tree looks intact, but some exposure difference makes the image look modified. VCC-entrance also looks okay in terms of the shape of the building, but the background is a little off. This brings up a weakness on this algorithm and that is blending is simply warping the image and stitching them up together. It doesn't do any color smoothing or exposure correction. For the drink-machine case, image 1 and image 2 didn't form a mosaic because they didn't pass the thresholds. This is one other weakness that, although two images are showing the same scene, if they don't pass each decision criterion, the algorithm doesn't form a mosaic. From our eyes it is evident that all the images in the drink-machine directory are showing the same scene, but that's not always true for the computers. I suspect it is because the images have too much detail and similar shapes within that keypoint detection and matching couldn't work so great. Also, if you look at the paired-up keypoints in drink-machine images, they don't always point to the same details(spots) on the images. Further analysis can be done on different decision criteria, what to look into in deciding if two images are of the same scene, reprojection threshold and confidence level for RANSAC, etc.

drink-machine	SIFT keypoint	inliers - F	inliers - H
Image 1 & 2	414	158 (38%)	28 (6.76%)
Image 2 & 3	364	134 (37%)	39 (0.11%)
Image 3 & 1	130	18 (14%)	x

frear-park	SIFT keypoint	F	H
Image 1 & 2	152	143 (94%)	109 (71.71%)

office	SIFT keypoint	F	H
IMG 2536 & 2538	151	89 (59%)	37 (24.5%)
IMG 2536 & 2537	258	177 (69%)	117 (45.35%)
IMG 2538 & 2537	125	75 (60%)	33 (26.4%)

tree_mrc	SIFT keypoint	F	H
Image 4 & 2	259	105 (41%)	40 (15.44%)
Image 4 & 3	670	448 (67%)	191 (28.51%)
Image 4 & 1	127	28 (22%)	14 (11.02%)
Image 2 & 3	1295	907 (70%)	393 (30.35%)
Image 2 & 1	1638	1461 (89%)	702 (42.86%)
Image 3 & 1	524	320 (61%)	101 (19.27%)

vcc-entrance	SIFT keypoint	F	H
Image 2 & 3	202	65 (32%)	28 (13.86%)
Image 2 & 1	1057	806 (76%)	392 (37.09%)
Image 3 & 1	58	27 (47%)	15 (25.86%)