

# Assignment 5

HARRIS, SIFT, RANSAC

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## 1. Harris Corners

### a. Image gradients

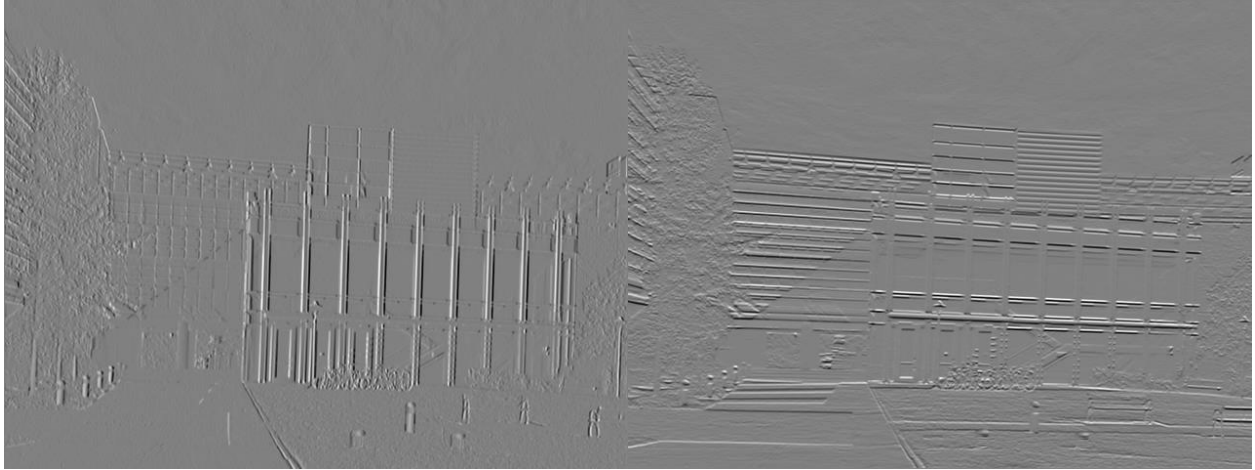


Figure 1: ps5-1-a.png

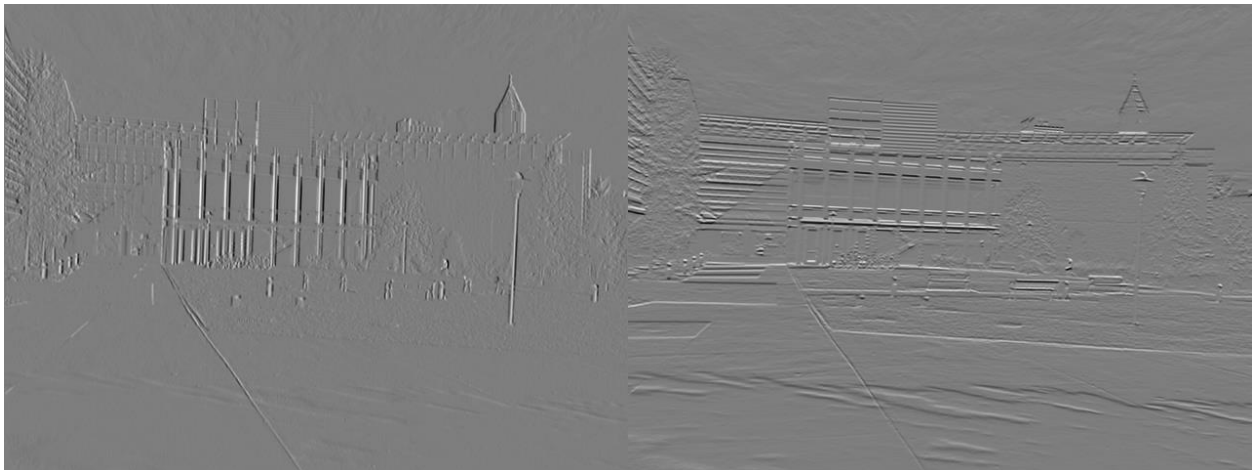


Figure 2:ps5-1-a-2.png

b. Harris response

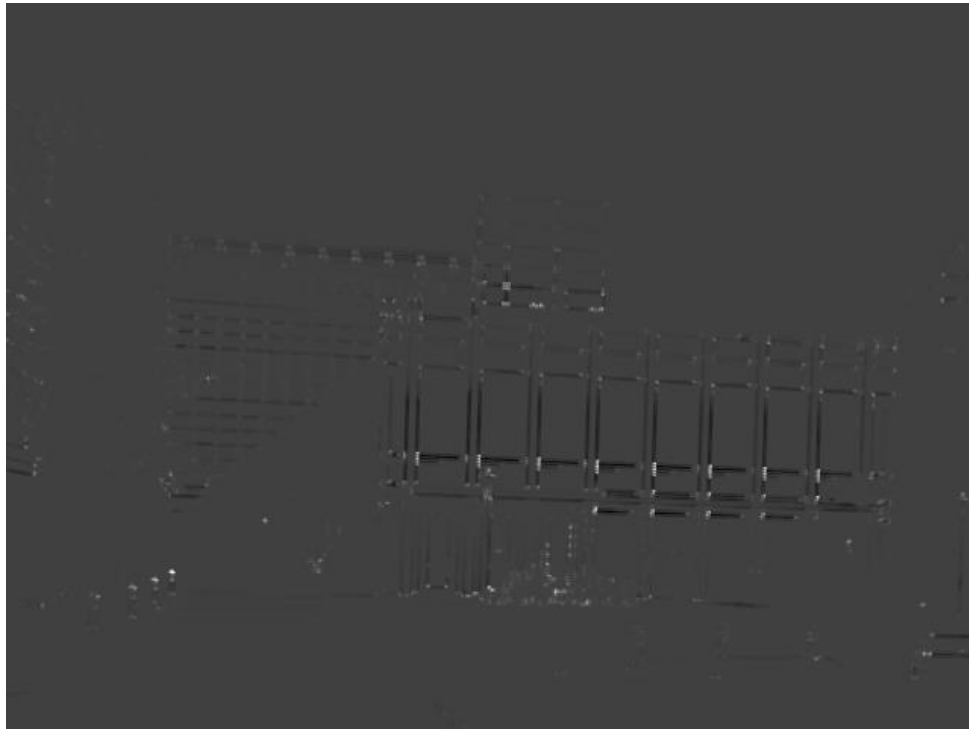


Figure 3: ps5-1-b-1.png

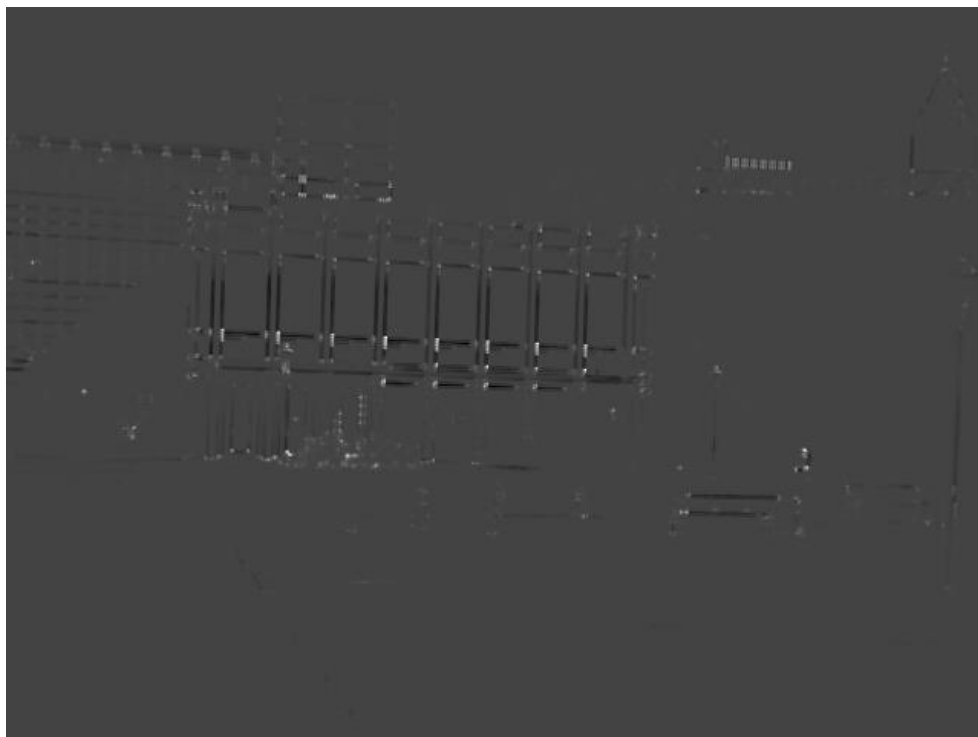
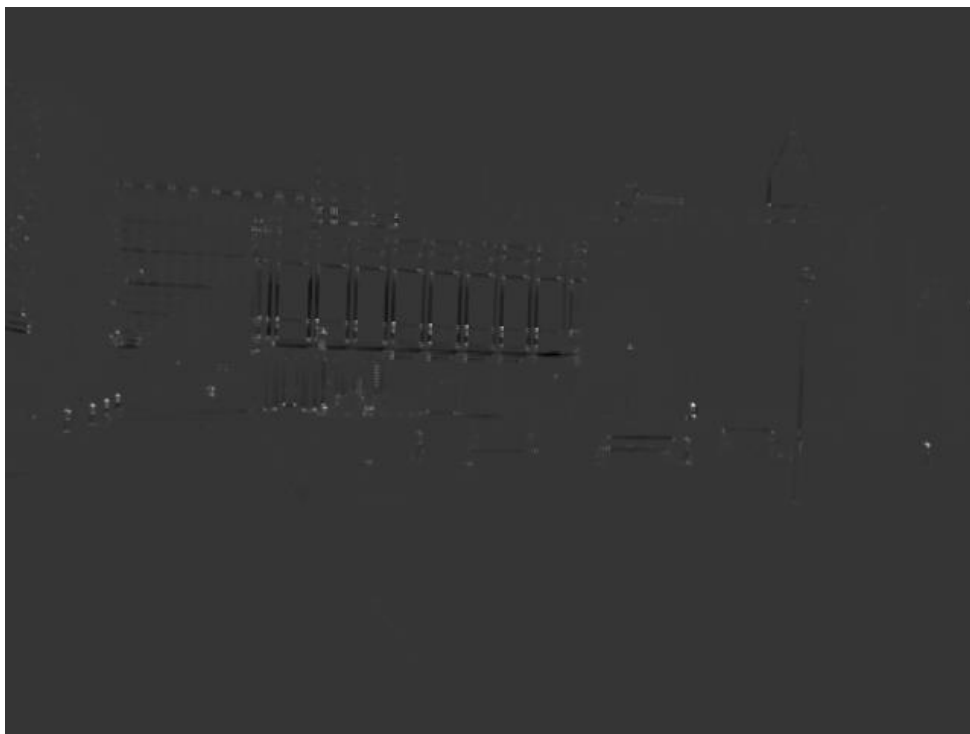
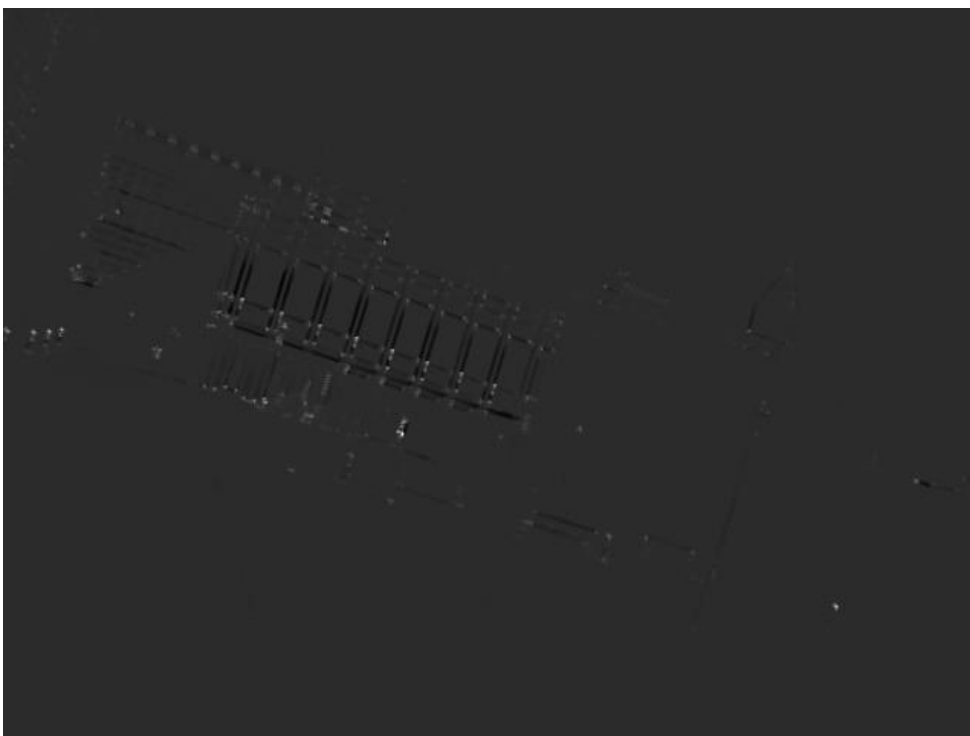


Figure 4: ps5-1-b-2.png



*Figure 5: ps5-1-b-3.png*



*Figure 6: ps5-1-b-4.png*

c. Corners



Figure 7: ps5-1-c-1.png



Figure 8: ps5-1-c-2.png



Figure 9: ps5-1-c-3.png





*Figure 10: ps5-1-c-4.png*

The corner detector found many but there are many corners that were not found, or rather that were not among the most prominent corners. I expected to have corners all over the grid of the building. Instead however, most of the corners are concentrated at the center of the image, where the white pillars contrast the most with the black shadows. Furthermore, there were many corners that were found that were not where I expected, like in middle of a tree or along a brick wall. These were likely due to small variations that were not noticeable at the human eye level. An adjustment of the filter window kernel would most likely remove these. Nevertheless, they do no harm remaining in the set of corners.



## 2. SIFT features

### a. Keypoints



Figure 11: ps5-2-a-1.png

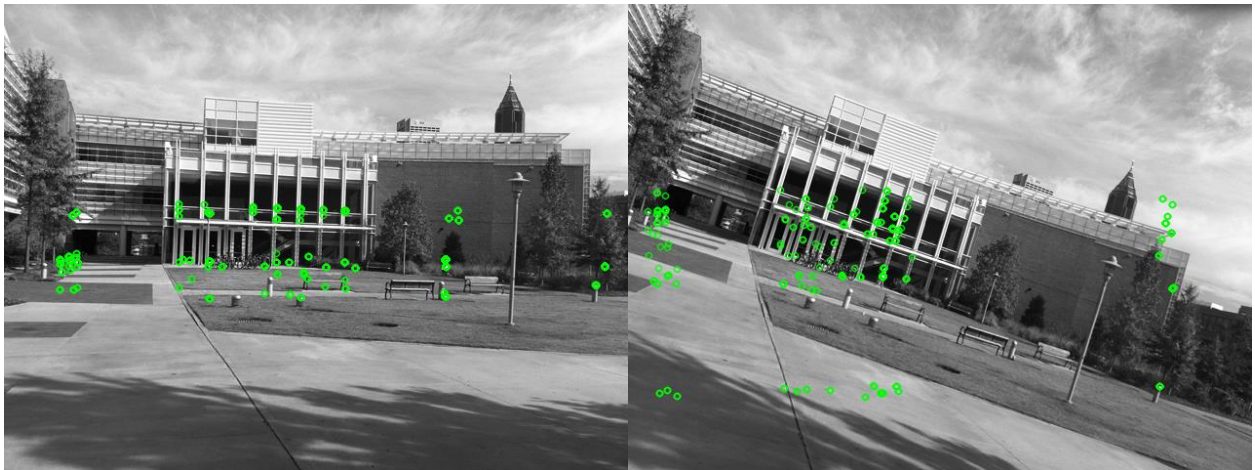


Figure 12: ps5-2-a-2.png

b. Drawing matches

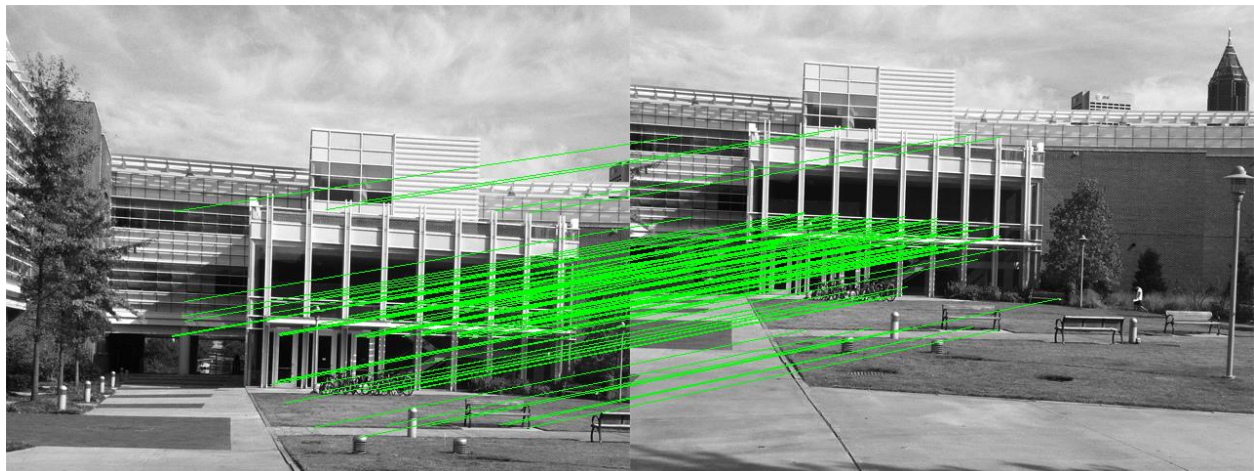


Figure 13: ps5-2-b-1.png

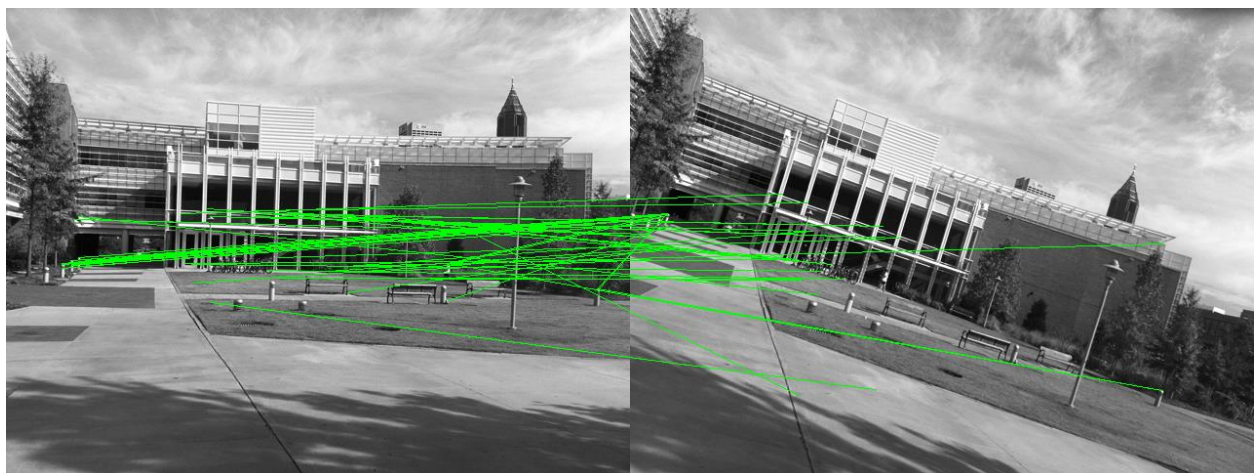


Figure 14: ps5-2-b-2.png

Please note that there are many true matches here, but there are also some spurious matches that are very obvious. I attempted to remove these, but without success.



### 3. RANSAC

#### a. Translation

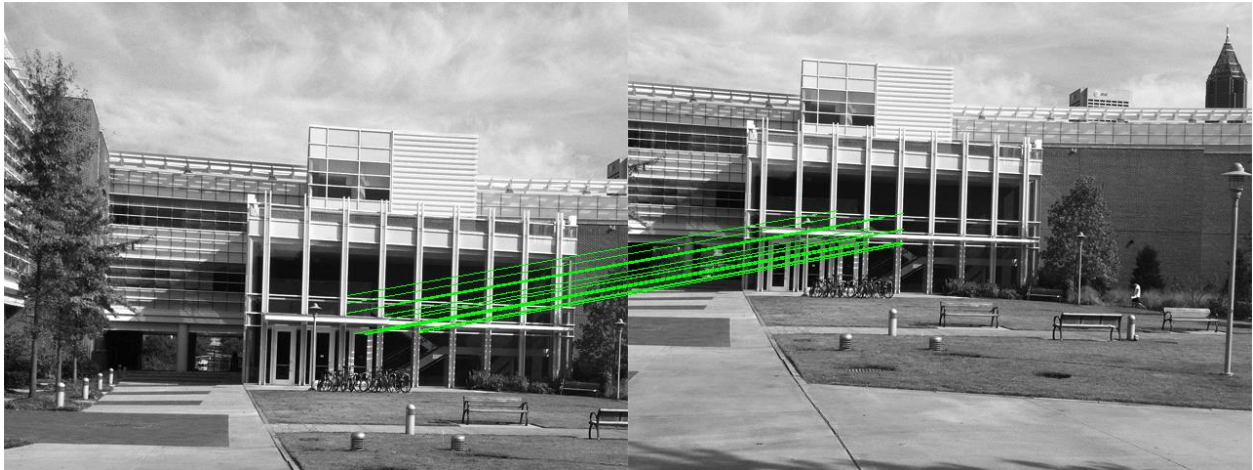


Figure 15: ps5-3-a-1.png

The resulting translation was

$$\begin{bmatrix} 147 \\ 90 \end{bmatrix}$$

The consensus set contained 23.2% of the total matches. As discussed in lecture, this shows that RANSAC is able to handle large numbers of outliers.

#### b. Similarity

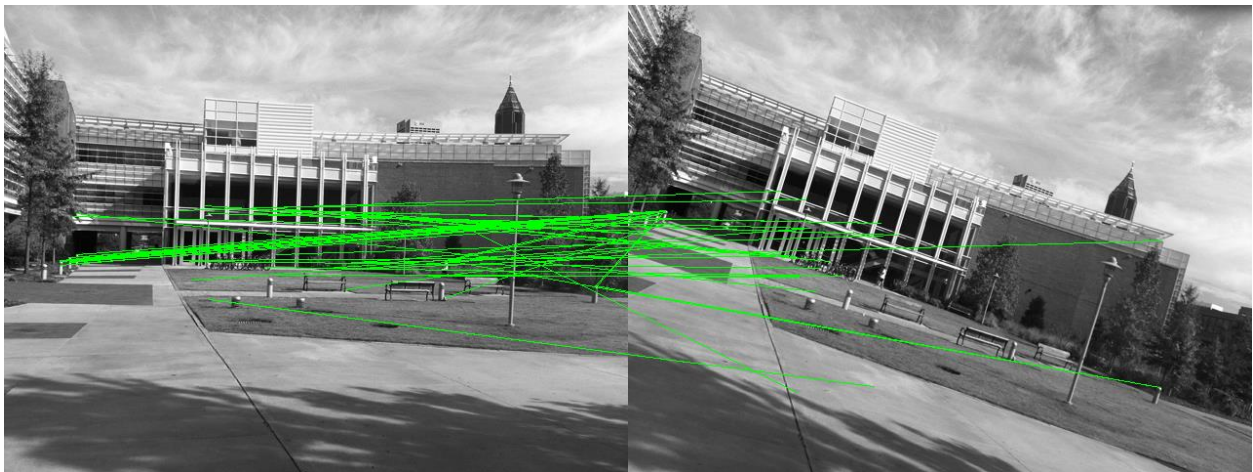


Figure 16: ps5-3-b-1.png

The similarity transform matrix that resulted was

$$\begin{bmatrix} 0.0147 & 0.0043 & 30.29 \\ -0.0043 & 0.0147 & 208.4 \end{bmatrix}$$

The consensus set contained 12% of the total matches.