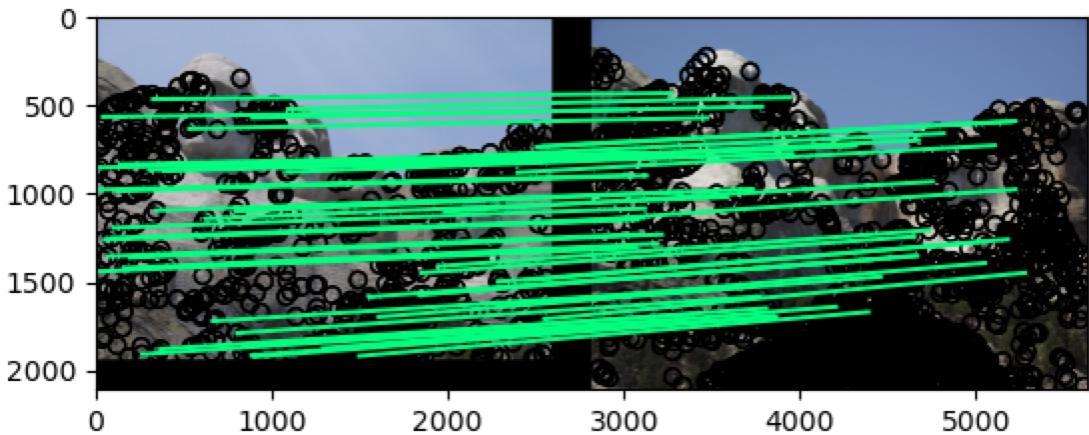
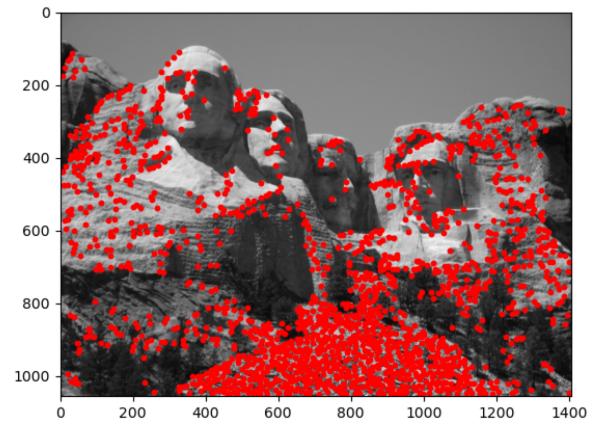
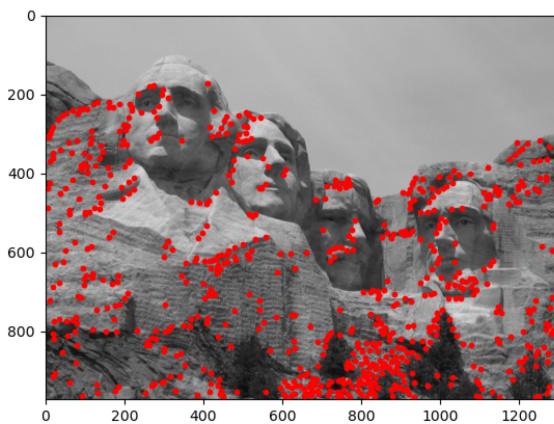


# Computer Vision Homework 2, Code Writeup

Siddharth Iyer

## 1 Resulting Images, Accuracy

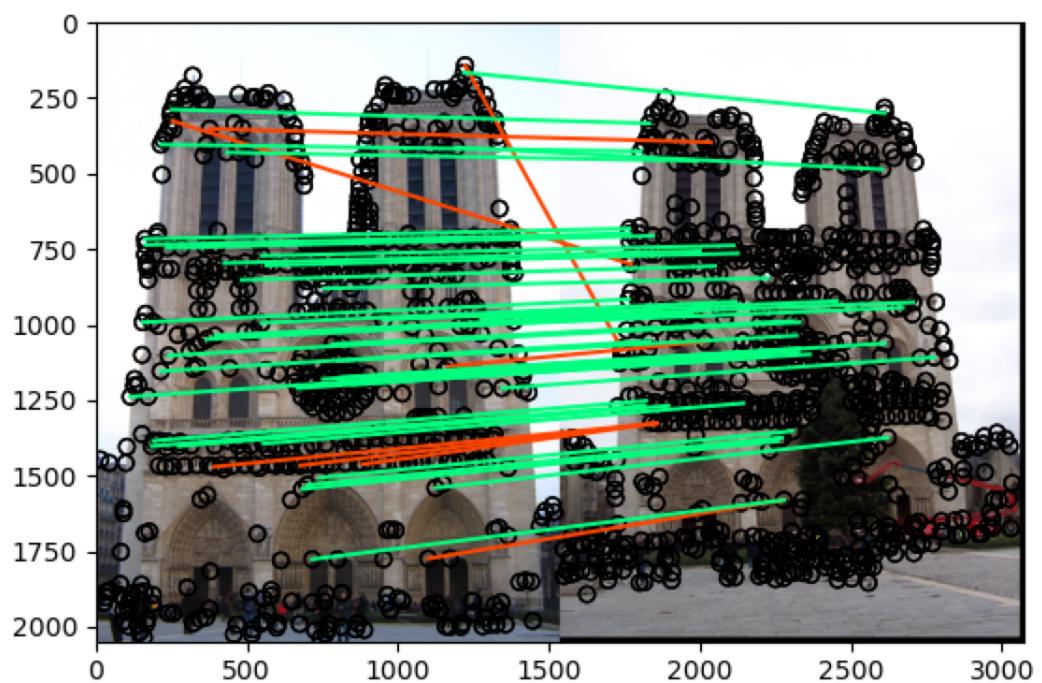
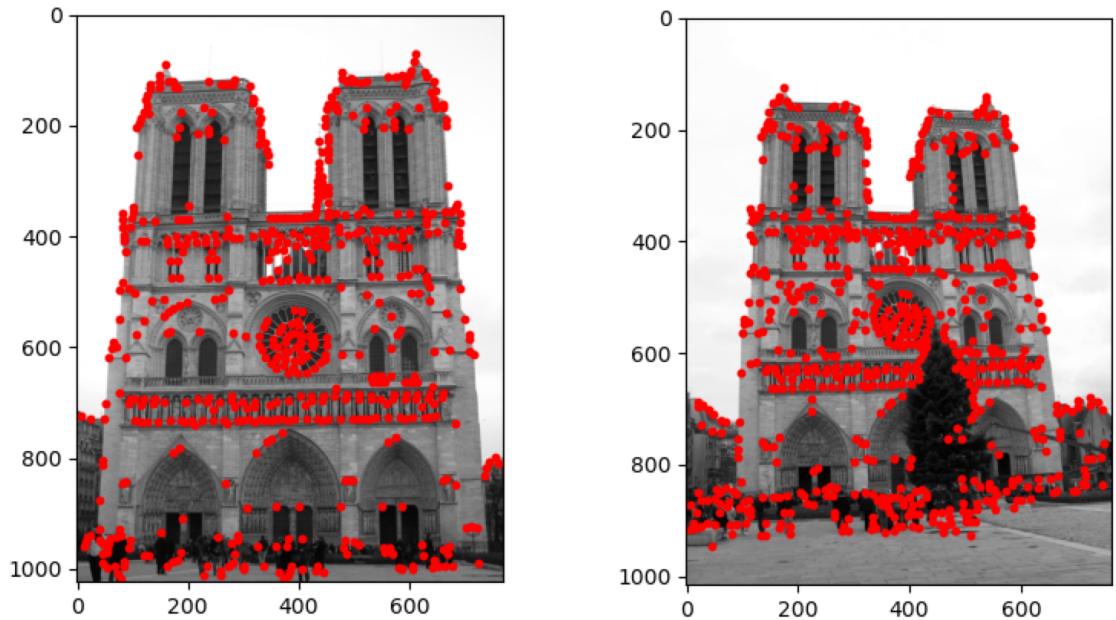
**Mount Rushmore Feature Matching:**



Accuracy on 50 Most Confident Matches: 100%

Accuracy on All Matches: 100%

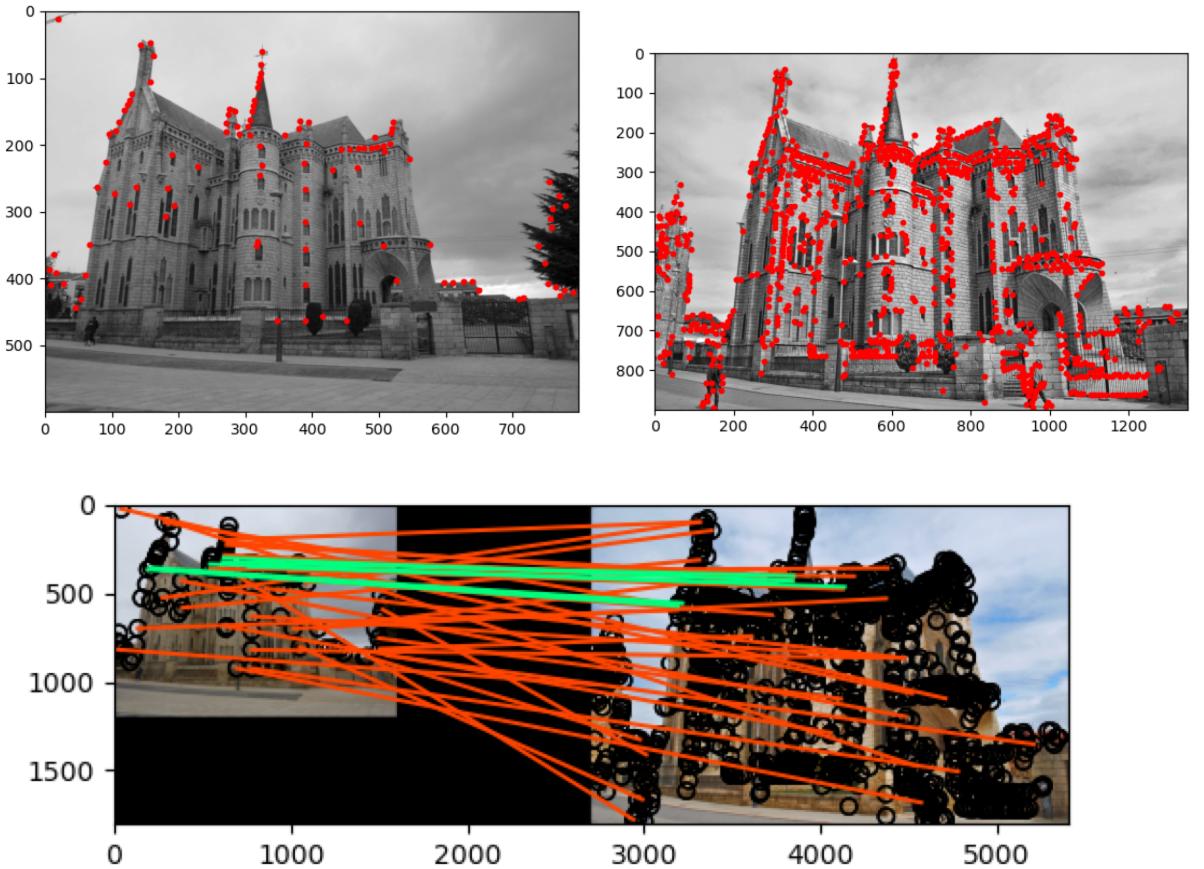
### Notre Dame Feature Matching:



Accuracy on 50 Most Confident Matches: 84%

Accuracy on All Matches: 84%

### Episcopal Gaudi Feature Matching:



Accuracy on All Matches: 15%

Since the Matching Algorithm wasn't tuned for scaling, naturally, this accuracy is quite low.

## 2 Design Considerations, Parameter Tuning

When finding interest points, and then generating features, I noticed in my findings that tuning parameters was necessary to not only find interest points and features, and also to ensure accurate matching.

One primary example of this can be seen in the obvious differences between Mt. Rushmore and Notre Dame. Underneath the presidents' heads, especially in Mt. Rushmore 2, the noise of the shadows causes a very high Harris Corner Response, so naturally, detecting an interest point for those images should use a higher threshold than that of Notre Dame to block out noise. Using the Mt. Rushmore Harris Corner Response threshold on Notre Dame resulted in less than 30 interest points in each Notre Dame image.

Thus, to allow greater tuning for accuracy, I separated all parameters of interest. These being:

- Kernel Size for the Gaussian Blur filter generated

- Sigma for the Gaussian Blur Kernel
- Harris Response Threshold to Determine if Interest Point has a Relevant Corner response
- Alpha for Computing Harris Response
- Match Ratio Threshold for Computing NNDR Test
- Radius and Top Percentile for Removing Points in Adaptive Non-Max Suppression

For the Matches Computed in the earlier section, we can also see these parameters visualized in code here, Notre Dame on the left, and Mt. Rushmore on the right:

<pre>##### GLOBAL PARAMS FOR TUNING ##### GLOBAL_KERNEL_SIZE = 5 GLOBAL_SIGMA = 1  GLOBAL_HARRIS_RESPONSE_THRESHOLD = 0.08  GLOBAL_ALPHA = 0.04    You, 9 hours ago •  GLOBAL_MATCH_RATIO_THRESHOLD = 0.70  GLOBAL_RADIUS = 50 GLOBAL_TOP_PERCENTILE = 10 ##### ##### ##### ##### ##### ##### #####</pre>	<pre>##### GLOBAL PARAMS FOR TUNING ##### GLOBAL_KERNEL_SIZE = 5 GLOBAL_SIGMA = 1  GLOBAL_HARRIS_RESPONSE_THRESHOLD = 0.15  GLOBAL_ALPHA = 0.04  GLOBAL_MATCH_RATIO_THRESHOLD = 0.72  GLOBAL_RADIUS = 50 GLOBAL_TOP_PERCENTILE = 10 ##### ##### ##### ##### ##### #####</pre>
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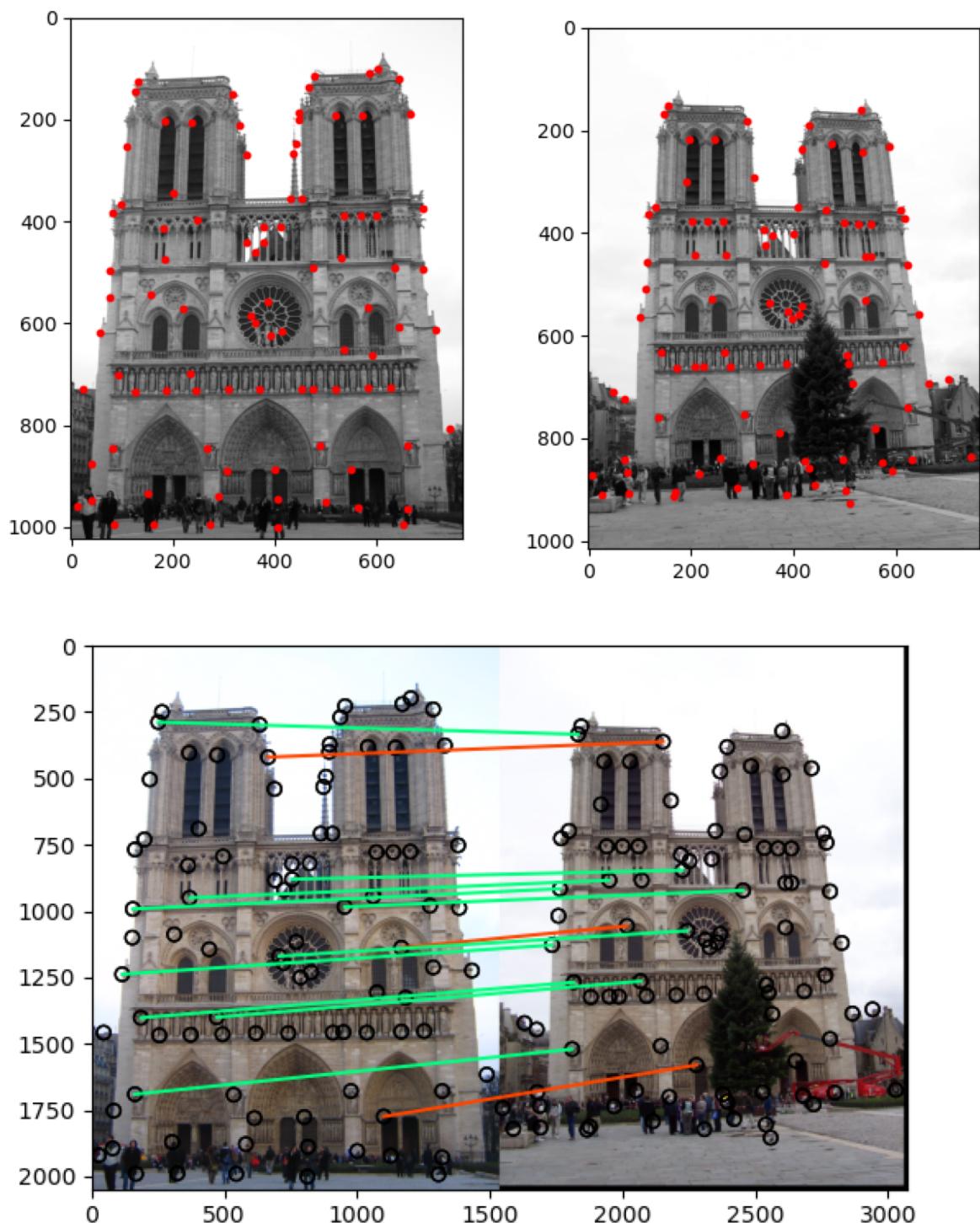
### 3 Extra Credit - Adaptive Non-Maxima Suppression

Utilizing an algorithm from the textbook, we were able to localize interest points and pick out only the ones that net the Highest Harris Corner Response Score, which can be seen in the parameters above this section.

This was accomplished by first sorting all interest points by Corner Response Score, and then generating a Distance Matrix for the distance between points. From there, for each point, we were able to find points in a localized radius around that point. Then only the points with the strongest Corner Response were included. This resulted in a cleaner image, more relevant points, and a similar match accuracy.

The code for this can be run by uncommenting lines 65-84 in Student.py

**Notre Dame Suppressed Feature Matching:**



Accuracy on 50 Most Confident Matches: 80%