CS 6476 Project 3

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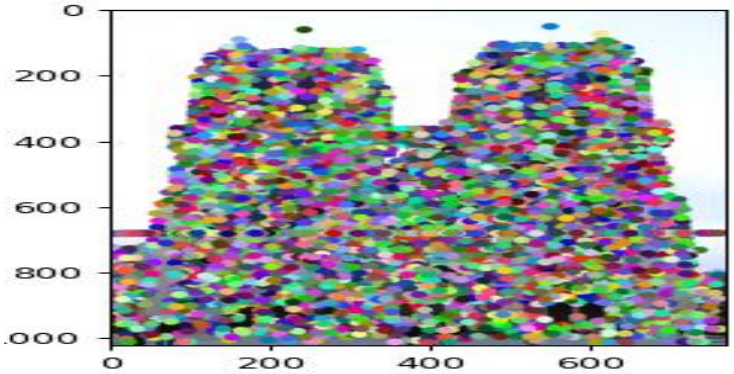
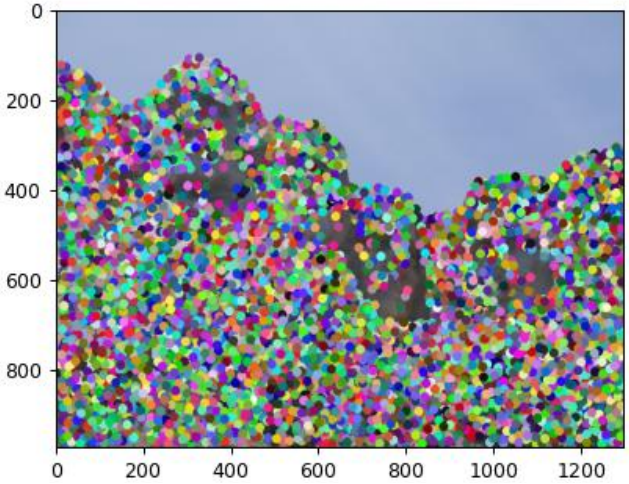
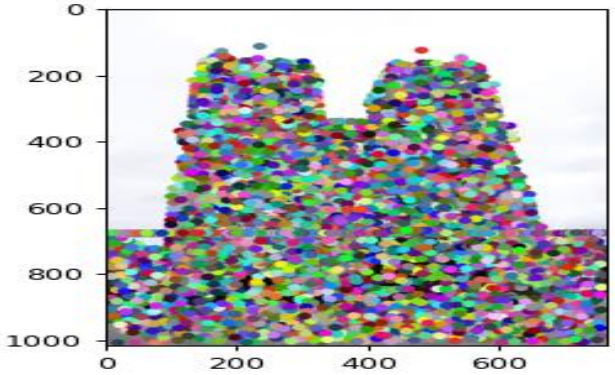
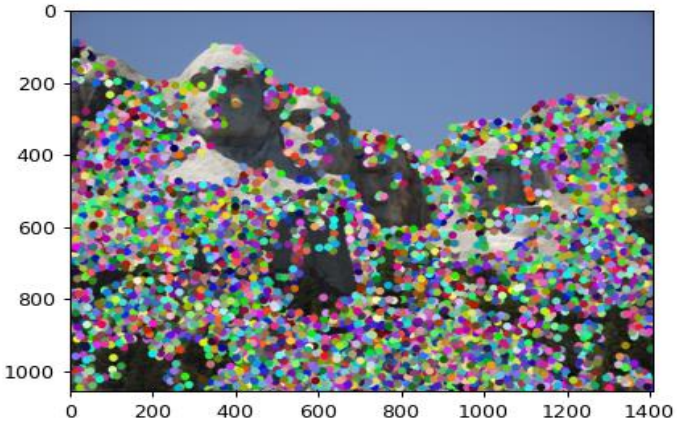
Gradescope Group Quiz Collaboration Photo

Part 1: HarrisNet

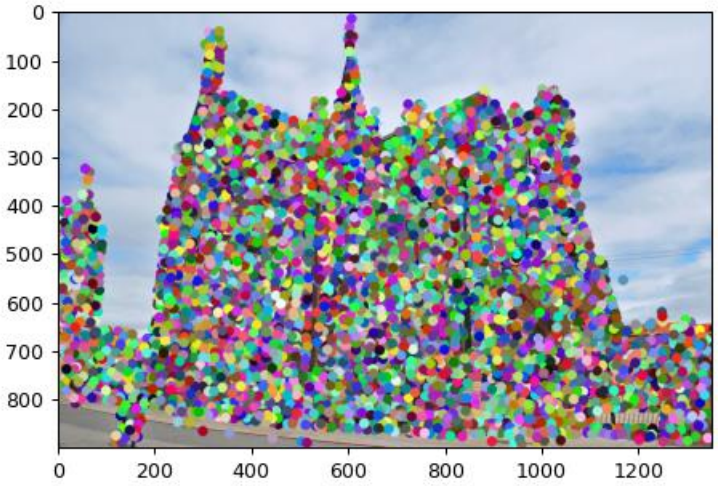


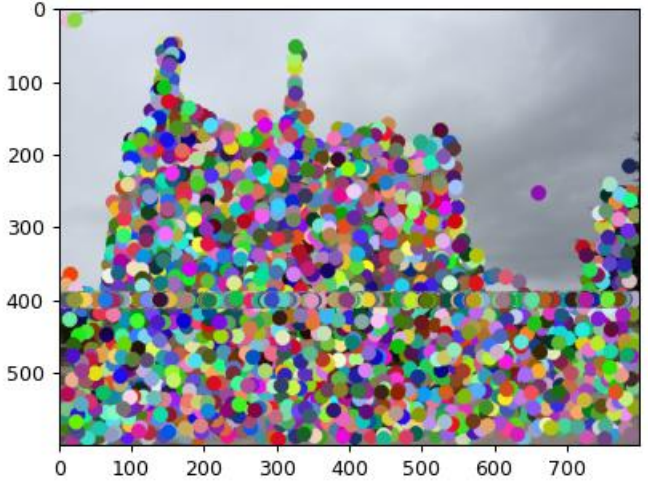






Part 1: HarrisNet





Part 1: HarrisNet

<Describe how the HarrisNet you implemented mirrors the original harris corner detector process. (First describe Harris) What does each layer do? How are the operations we perform equivalent?)>

For ImageGradientLayer we apply sobel filter across the image to get image gradient, this will detect edges. ChannelProductLayer computes lxx,lxy and ,lyy which the result is then used in SecondMomentMatrixLayer and calculates the second moment which is Gaussian kernel applied to smooth the image. Afterwards, CornerResponseLayer takes the second moment matrix and computes R = Det(M) - alpha(trace(M))^2 which assins score to each pixel on the image. Finally, NMS layer will set points with value < threshold(median) to 0 and performs non-max suppression so that only the to select the best point.

Part 2: SiftNet

<Describe how the SiftNet you implemented mirrors the Sift Process. (First describe Sift) What does each layer do? How are the operations we perform equivalent?)>

Sift starts by computing gradients around detected keybpoints, this is done in the ImageGradient layer . For the SiftOrientation Layer and Histogram layer, we get a histogram where each 4 by 4 quadrant , a gradient orientation histogram is created by adding the weighted gradient value to one of eight orientation histogram bin. Then in the SubGridAccumulation layer we take a region and accumulate the histogram for each pixel for that the entire region and create a unique description for that particular pixel.

Part 2: SiftNet

- <Explain what we would have to do make our version of Sift rotationally invariant (conceptually)>
- Find the main orientation of the descriptor and assign that angle to the keypoint.

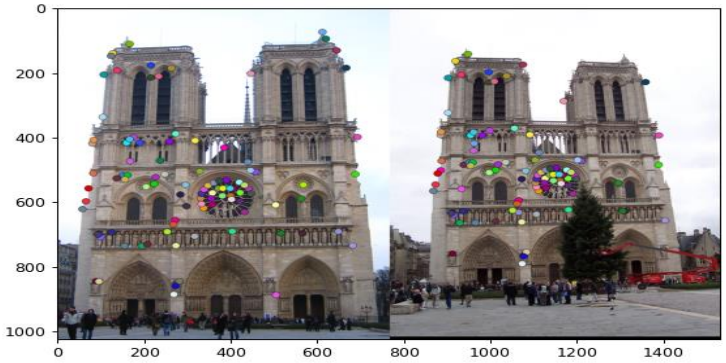
- <Explain what we would have to do to make our version of SIFT scale invariant (conceptually)>

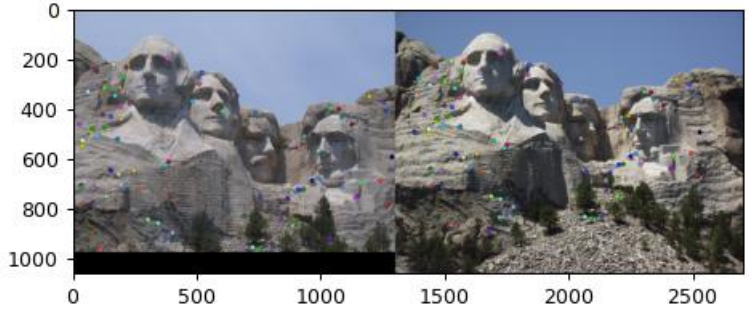
Part 2: SiftNet

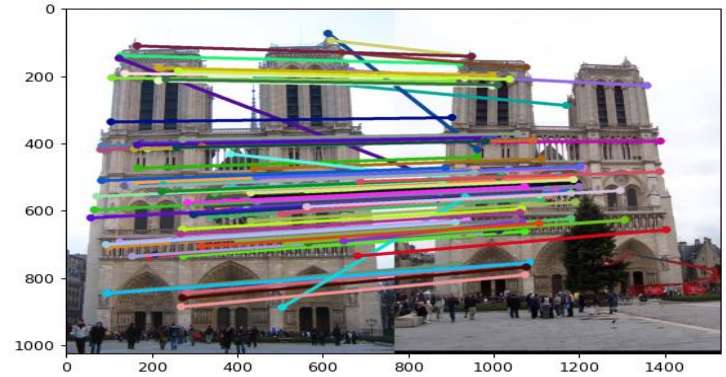
- <What would happen if instead of using 16 subgrids, we only used 4 (dividing the window into 4 grids total for our descriptor)>
- We would have had a less accurate descriptor would be my assumption.

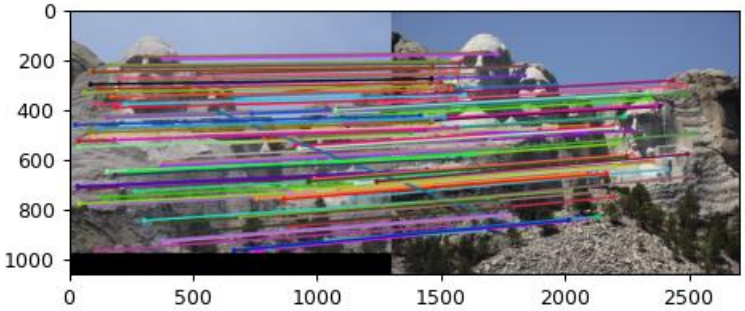
- <What could we do to make our histograms in this project more descriptive?>

Part 3: Feature Matching









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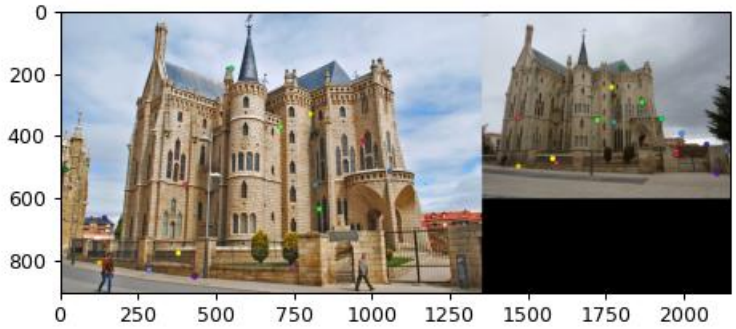
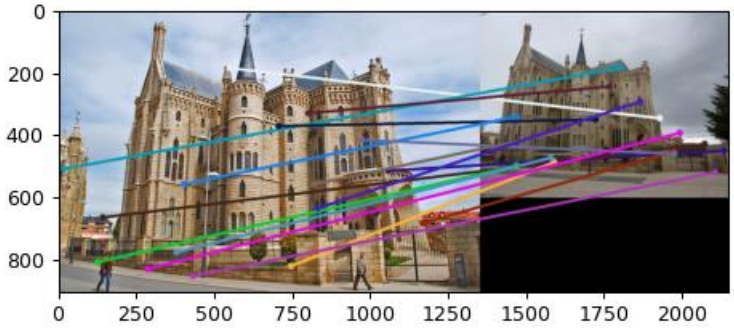
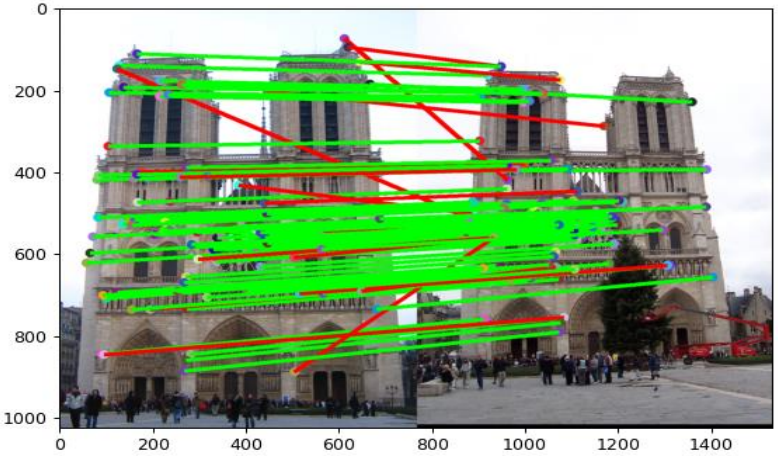


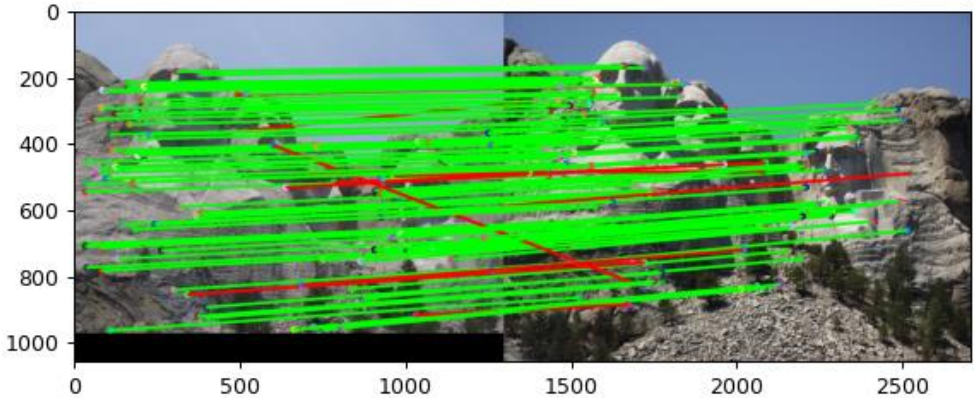


<Describe your implementation of feature matching.>

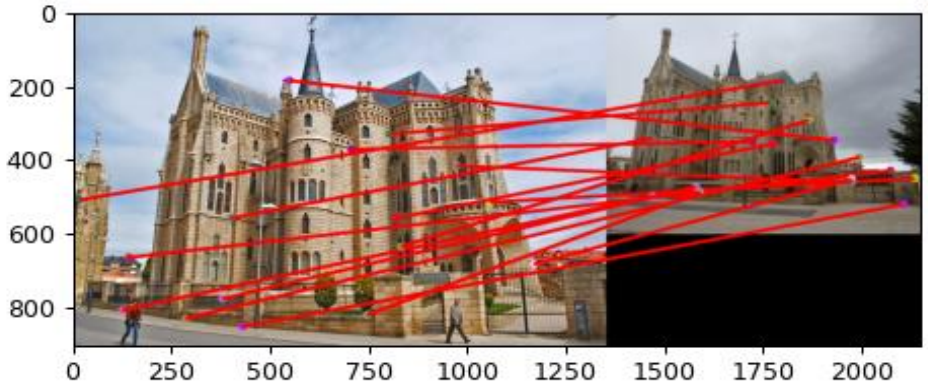
Before we start matching features, we need interest points from the two images, feature 1 and feature 2. We then compute the distance between them. Then we calculate nearest neighbor distance ratio or NNDR for feature1 and feature2 . Then we set a threshold for me it was 0.79. So we filter out features if has NNDR of <= 0.79 .

Results: Ground Truth Comparison





Results: Ground Truth Comparison



<Insert numerical performances on each image pair here.>
You found 100/100 required matches Accuracy = 0.890000 Mount Rushmore

You found 100/100 required matches Accuracy = 0.820000 for Notre Dome

You found 16/100 required matches Accuracy = 0.000000
For Episcopal Gaudi

Results: Discussion

- <Discuss the results. Why is the performance on some of the image pairs much better than the others?>
- Increasing the size of the grid would give a a more accurate description of features but may take up more memory. Which would hurt the performance since it’s costly when it comes to computation.

- <What sort of things could be done to improve performance on the Gaudi image pair?>
- I believe if we change the scale of the image, we may see an improvement in accuracy. And the fact that the lighting in the images are different isn’t helping in terms of accuracy.

Conclusions

<Describe what you have learned in this project. Feel free to include any challenges you ran into.>

For the group quiz portion of this project, we took a long time to get together and finally meet on Microsoft Teams. For the actual project, I think that this was conceptually a difficult project compared to the other ones. And I started out not knowing much about SiftNet and HarrisNet. But with the help from the TA and reading Piazza post this made the process a lot smoother.

Extra Credit: Sift Parameter variations

Extra Credit: Custom Image Pairs