CIS 581: Computer Vision: Project 3A Image Stitching

Team 7: Weiyi Tang, Zhiyuan Li

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Image Stitching without Seam Carving

This part will show Panorama Image without seam carving. Only Linear interpolation will be applied for image mosaic.

The 1st set of images are from Penn campus provided by TA.

Original Image Set 1 – Penn:

Figure 1: Left Image

Figure 2: Middle Image

Figure 3: Right Image

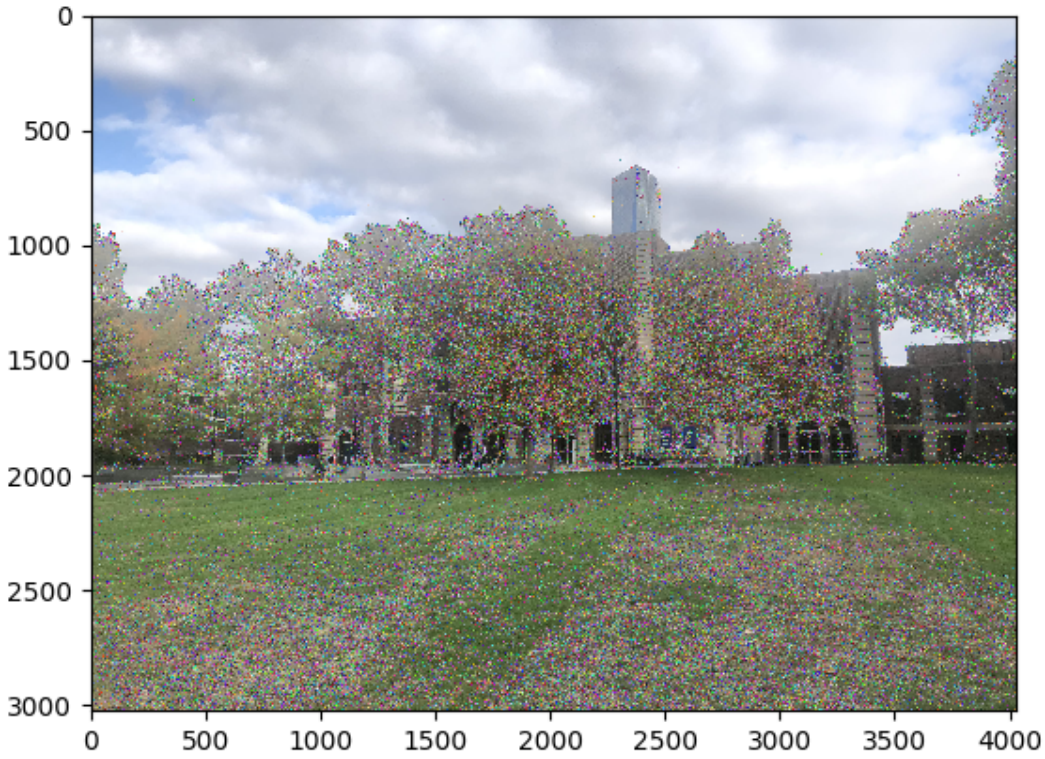

Figure 4: Feature Corner Detection of Left Image

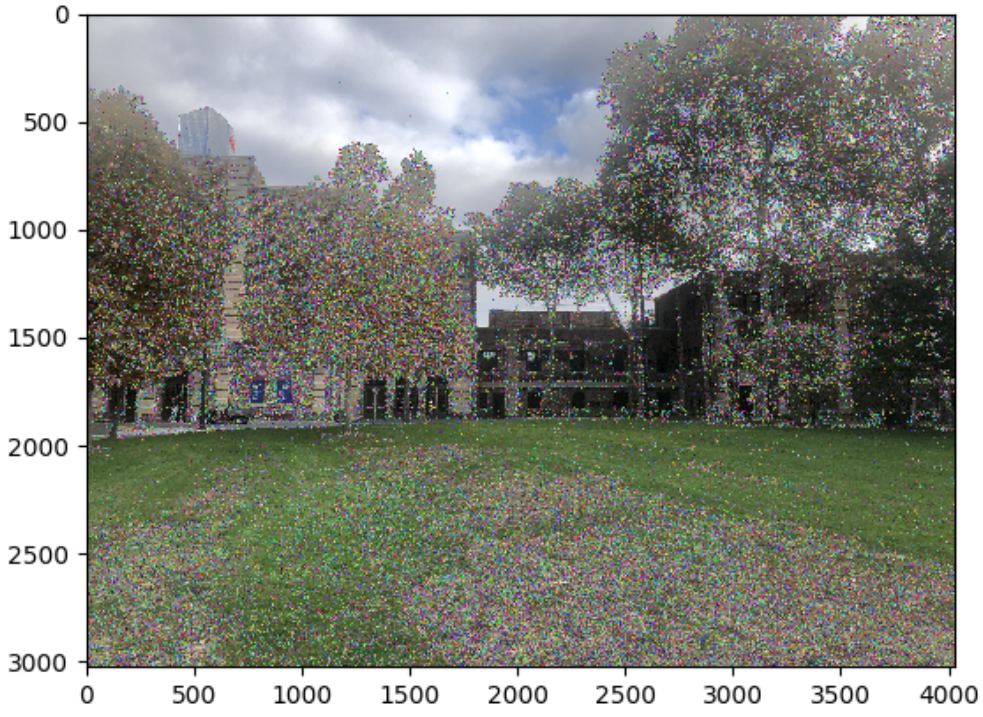

Figure 5: Feature Corner Detection of Middle Image

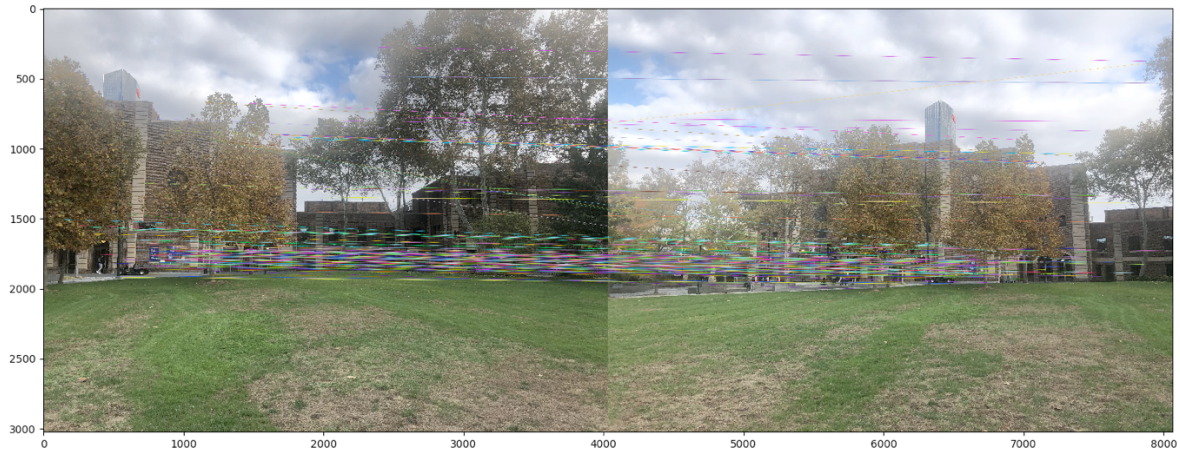

Figure 6: Feature Matching of Left and Middle Images BEFORE RANSAC

Figure 7: Feature Matching of Left and Middle Images AFTER RANSAC

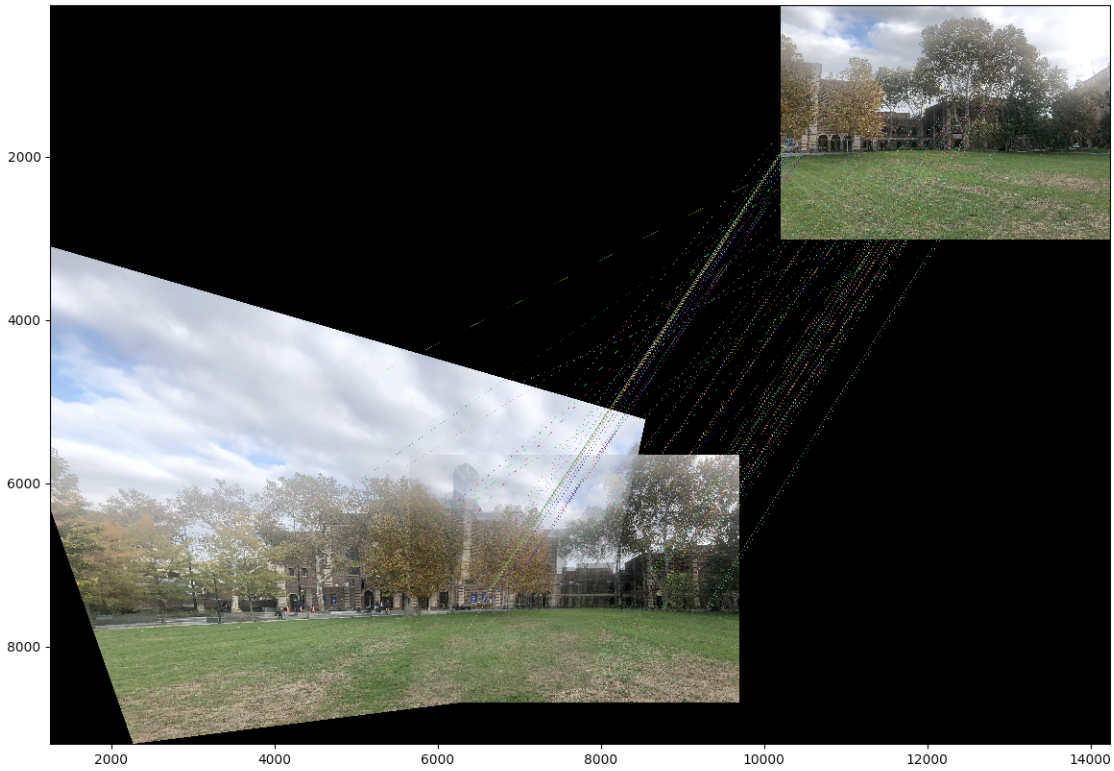

Figure 8: Feature Matching of Combined (Left, Middle) and Right Images BEFORE RANSAC

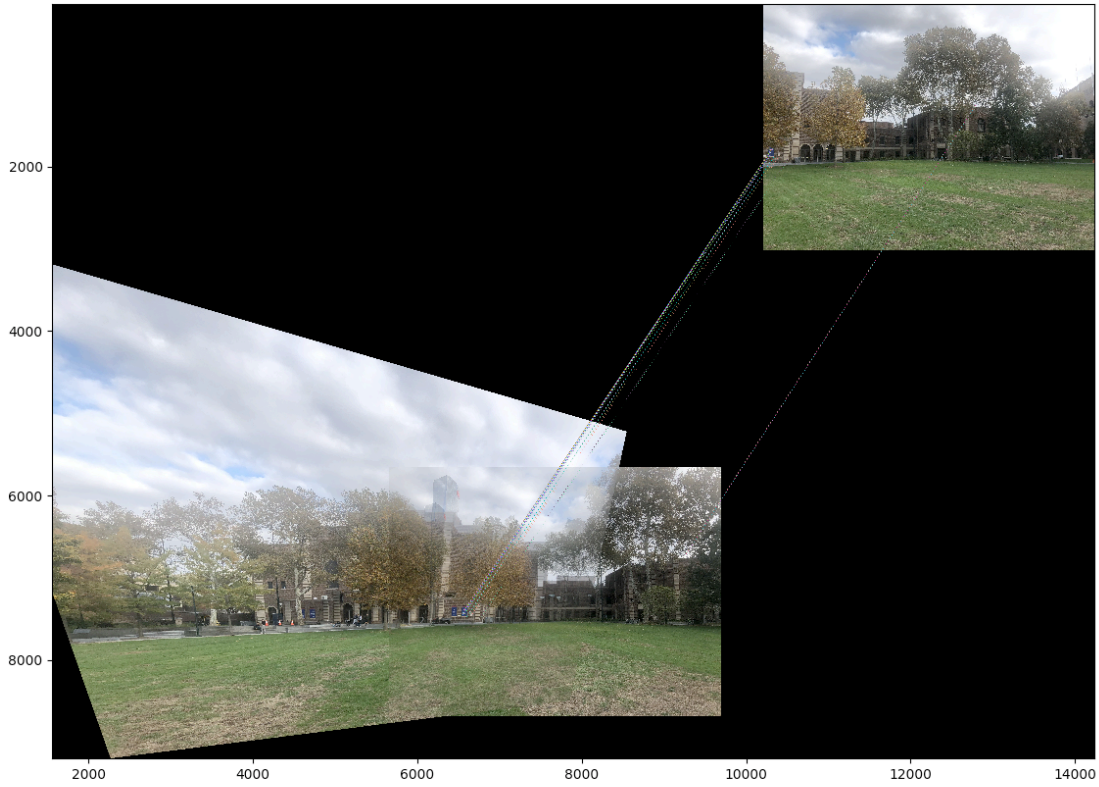

Figure 9: Feature Matching of Combined (Left, Middle) and Right Images AFTER RANSAC

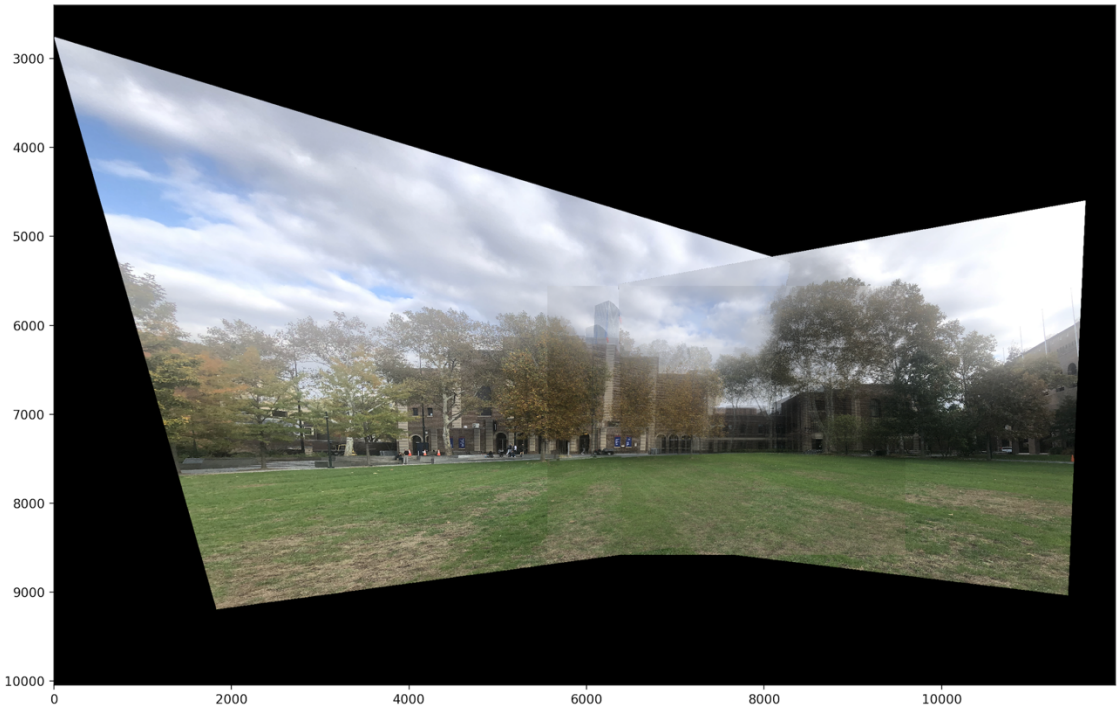

Figure 10: Final Panorama Image Set 1 without Seam Carving

Original Image Set 2 — Philly:

This set of images was taken by Weiyi and Zhiyuan for testing purposes

Figure 11: Left Image

Figure 12: Middle Image

Figure 13: Right Image

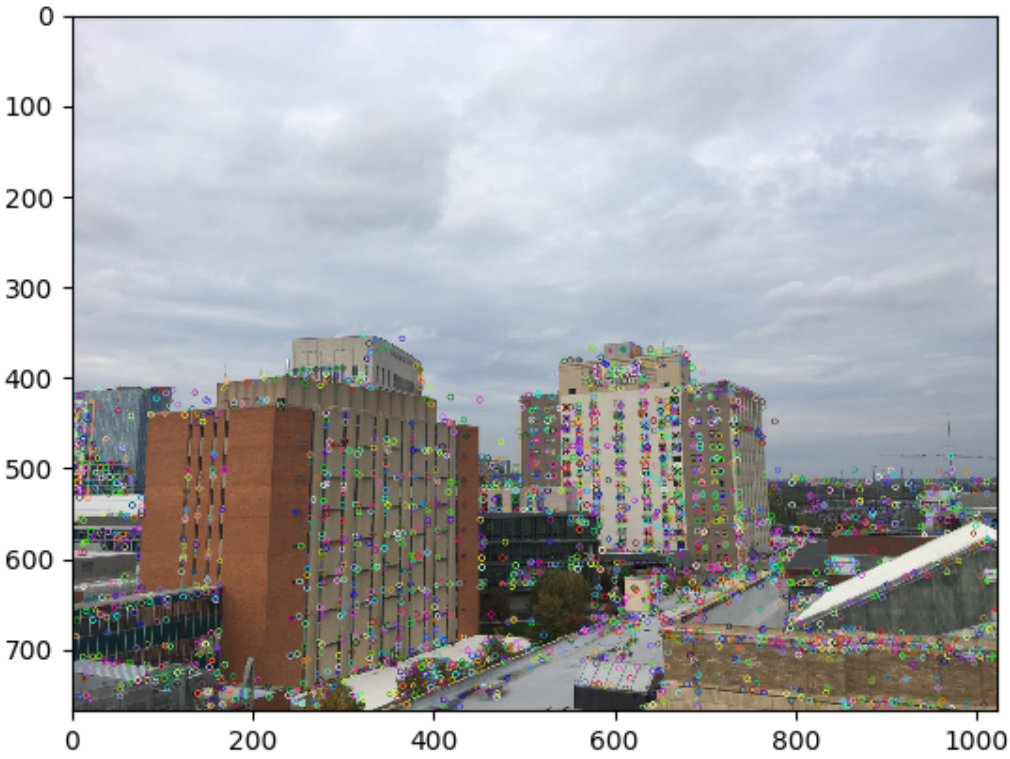

Figure 14: Feature Corner Detection of Left Image

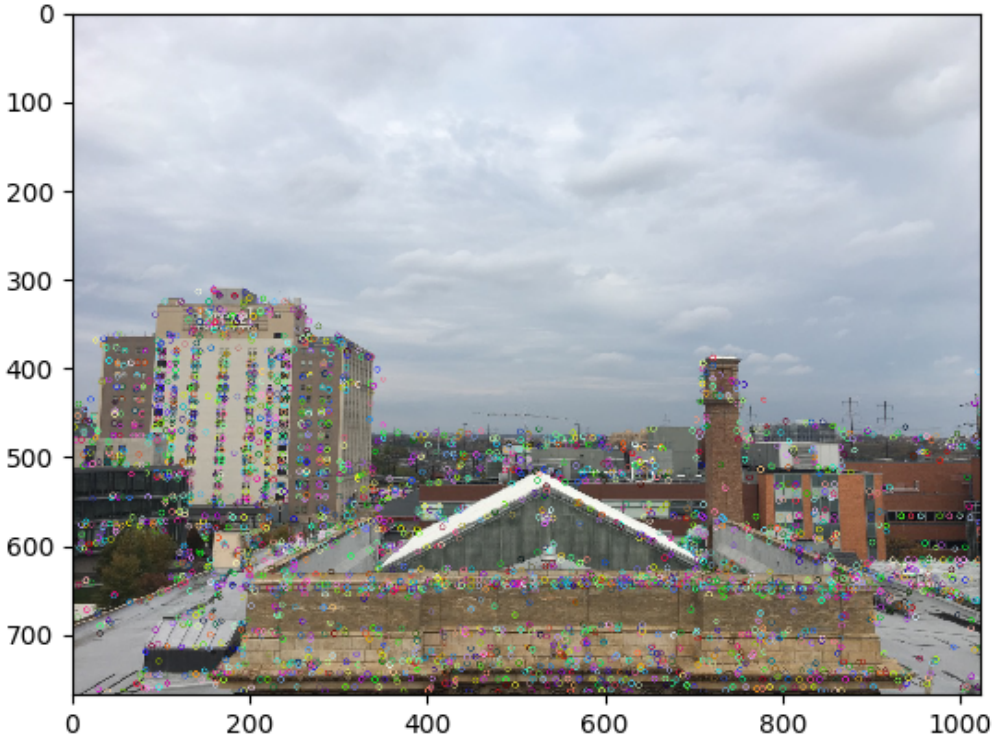

Figure 15: Feature Corner Detection of Middle Image

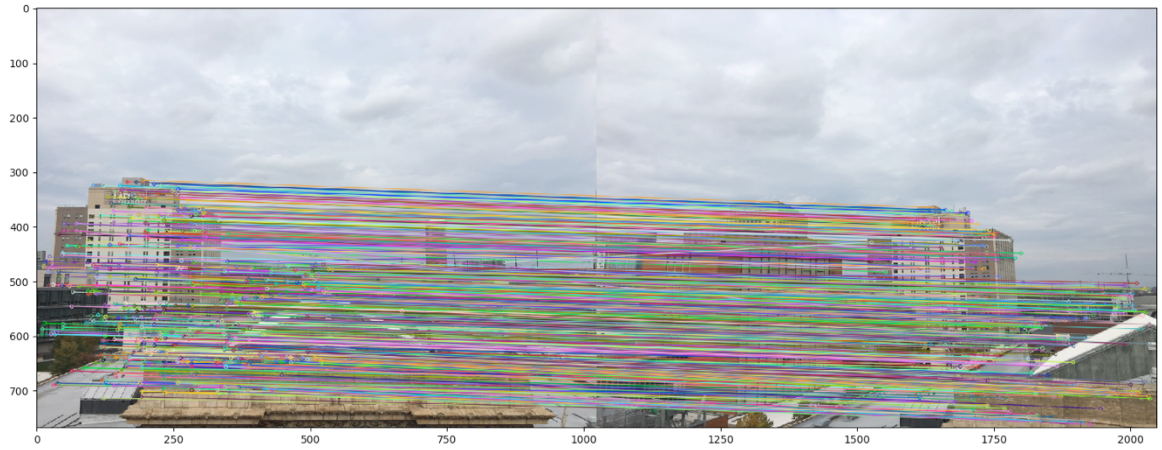

Figure 16: Feature Matching of Left and Middle Images BEFORE RANSAC

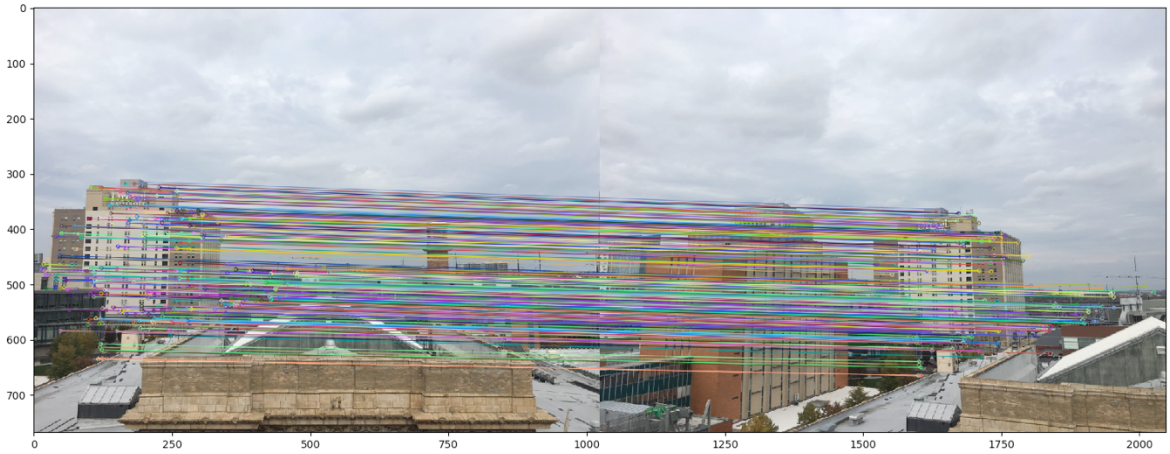

Figure 17: Feature Matching of Left and Middle Images AFTER RANSAC

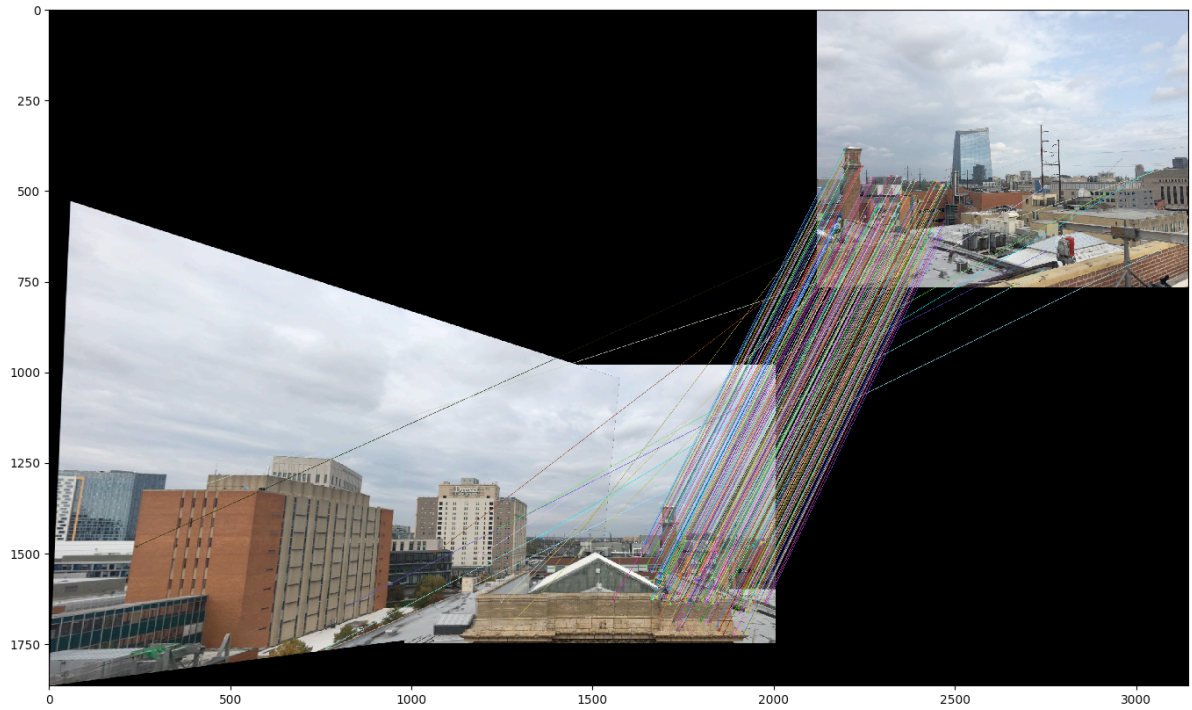

Figure 18: Feature Matching of Combined (Left, Middle) and Right Images BEFORE RANSAC

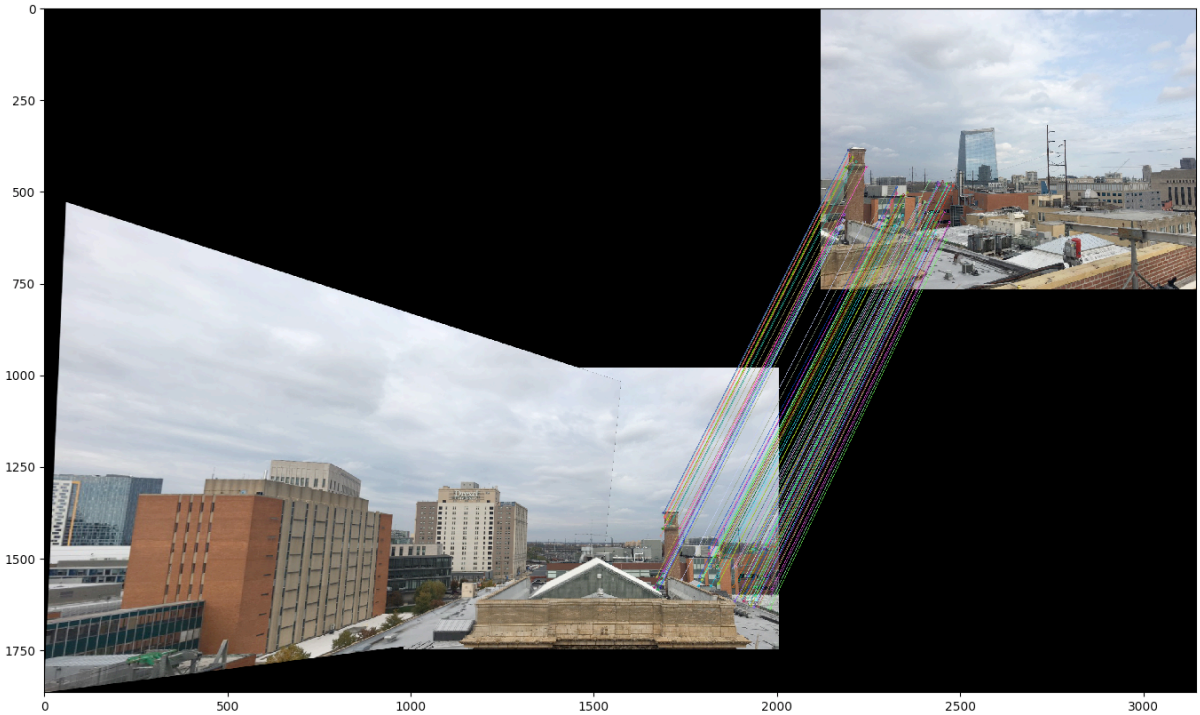

Figure 19: Feature Matching of Combined (Left, Middle) and Right Images AFTER RANSAC

Figure 20: Final Panorama Result Image Set 2 without Seam Carving

Image Stitching with Seam Carving

This part will show Panorama Image with seam carving. A paragraph of comparison will be analyzed at the end of this report. Since feature match and descriptors are basically the same, we will only show the images that generate differences with seam carving.

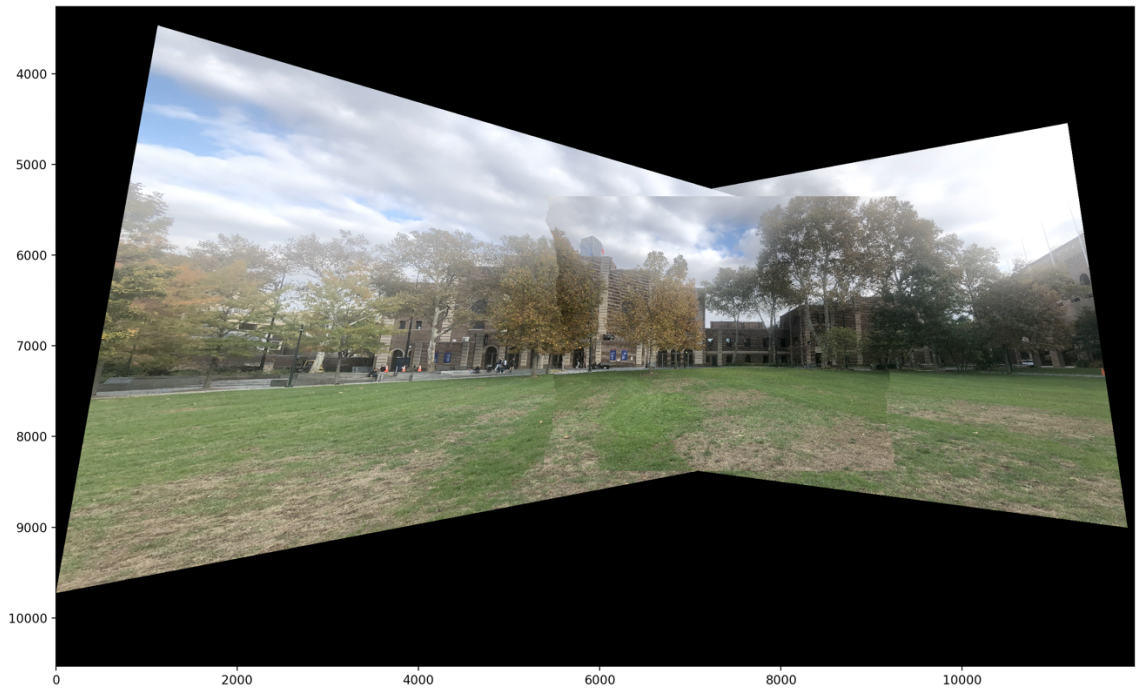

Figure 21: Final Panorama Result Image Set 1 with Seam Carving

Figure 22: Final Panorama Result Image Set 2 with Seam Carving

Figure 23: Final Panorama Result Image Set 1 without Seam Carving. Red circle shows “ghosting” area because of linear interpolation

Figure 24: Final Panorama Result Image Set 2 without Seam Carving. Red circle shows "cutting"area because of linear interpolation

Comparison & Analysis

Our approach is to locate the two distances for left carving and right carving on the middle image first. After the middle image was carved on both left and right sides, we warped left and right images. Finally, we stitched all three images by padding images in the order of warped left image, carved middle image, and warped right image (seen in Figure 21 & 22), though the most accurate way is to carve final panorama images instead of original images.

We found it hard to identify the carving start points of the final images since three images left, middle and right can be overlapped at very different positions for different test image sets. Therefore, the result of our approach is not very perfect. For example, some part of our final mosaic image was been cutoff. Moreover, the carved edge can clearly be identified in the final image as well. However, adding the technique of seam carving did eliminate the defects of image caused by linear interpolation (seen in Figure 23 & 24). If images of left, middle and right have better perspectives, then the final mosaic will demonstrate a better result, which can be observed by compare image set 1 & 2. Overall, image set 2 has a better outcome. In the future, we need to learn how to carve images on the final mosaic image.

Notes & References:

- All generated images are included in the corresponding folders in the Image Stitching folder.
- Noted that SIFT class already perform Adaptive Non-Maximal Suppression, but we did write the anms.py for the grading purpose.
- OpenCV SIFT Reference: https://docs.opencv.org/3.4/d5/d3c/classcv_1_1xfeatures2d_1_1SIFT.html
- OpenCV DrawKeypoints Reference: https://docs.opencv.org/master/d4/d5d/group__features2d__draw.html
- OpenCV DrawMatches Reference: https://docs.opencv.org/3.4/d4/d5d/group__features2d__draw.html
- OpenCV WarpPerspective Reference: https://docs.opencv.org/2.4/modules/imgproc/doc/geometric_transformations.html#void%20warpPerspective(InputArray%20src,%20OutputArray%20dst,%20InputArray%20M,%20Size%20dsize,%20int%20flags,%20int%20borderMode,%20const%20Scalar&%20borderValue)