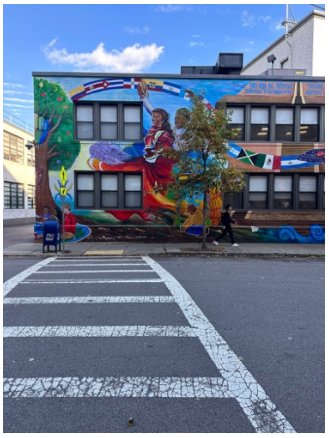
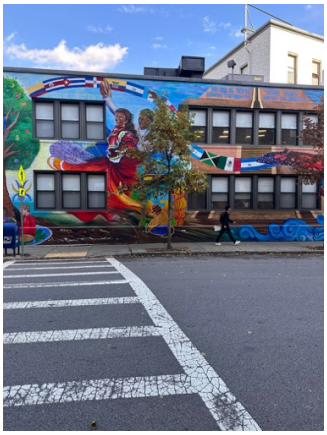
Camera Mosaic

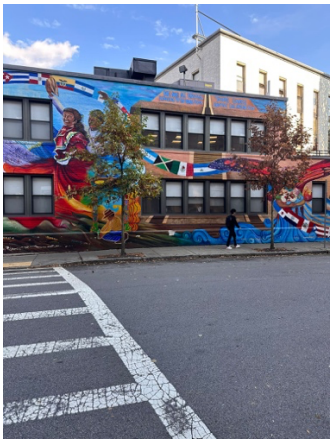
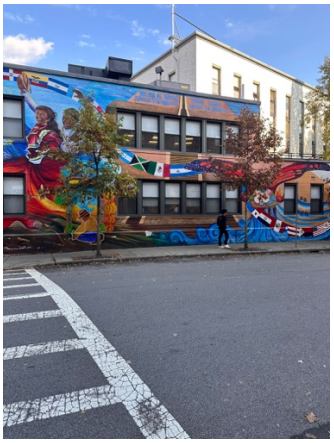
Introduction

To a person, determining if a picture is of a cat or a dog, a human or an automobile, or a green light or a red light is rather simple. At any one time, our eyes and brains are intrinsically capable of processing and describing an image, or group of images, to assess and form inferences about what is happening in the scene. Applying these image processing, description, and analysis procedures to robotic applications is a constantly developing challenge that computer vision applications address. In this study, we used the Harris Corner Detection method to obtain interest locations and their feature descriptors across images.

Dataset 1: LSC Mosaic

The first set of images we took was of the Latin History Mural near Ruggles. We took six images spanning across the whole mural, overlapping by about 85%. The images are displayed below:

Figures 1 – 6: Dataset 1 images

The first step in aligning the images is locating the interest points in the image. Using the Harris Corner Detection algorithm, examples of the top “N” detected corners in images 7 to 12 are shown below:

Figures 7 – 12: Detected Harris Corner

The provided image showcases a sequence of six grayscale photographs overlaid with yellow points, representing Harris corners detected in each frame. These corners are critical features used for image stitching, indicating areas with significant intensity changes in all directions, ideal for aligning multiple images into a single panoramic view. The high density of detected features on the building and ground markings suggests a textured scene ideal for demonstrating the efficacy of the Harris corner detection algorithm.

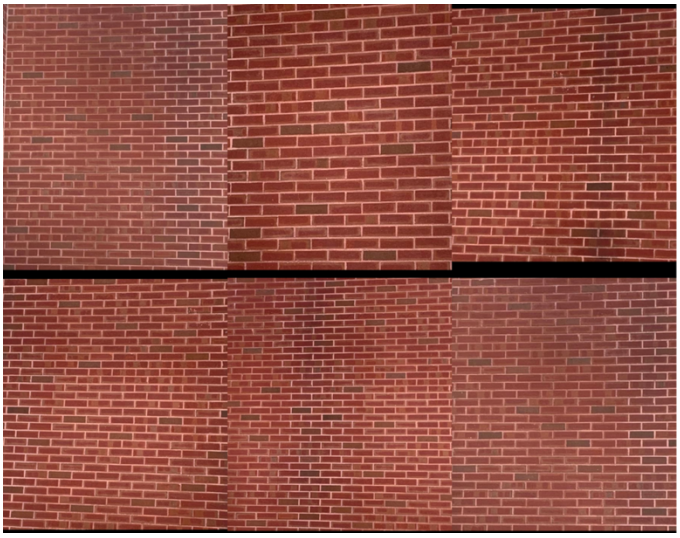
By extracting the feature descriptors for each of these points, we were able to match individual features, estimate the transformation between each neighboring image pair, and align then all together to create a final mural, shown below in Figure 13:

Figure 13: Latin Mural Panorama

The images were properly aligned and fully display. I didn't have to increase the number of interest points in the Harris method outputted. There were no changes made.

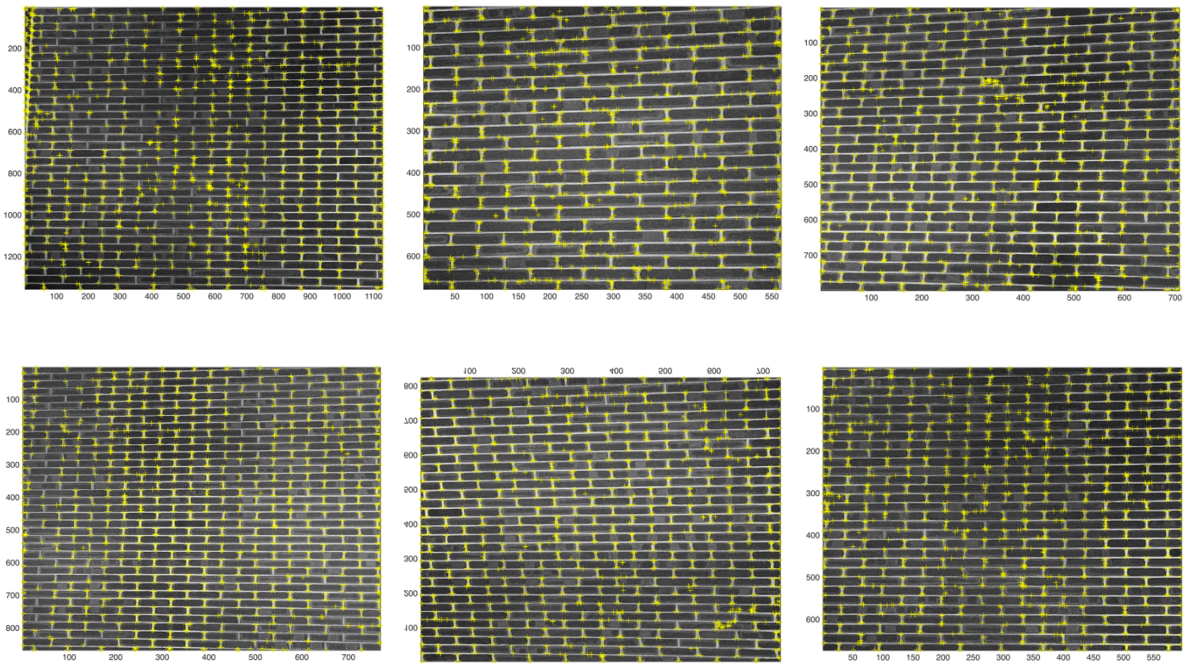
Dataset 2: Cinder Block/Brick Wall “Mosaic”

The second set of images we took was of the Cinder Brick Wall. We took six images spanning across the whole mural, overlapping by about 85%. The images are displayed below:

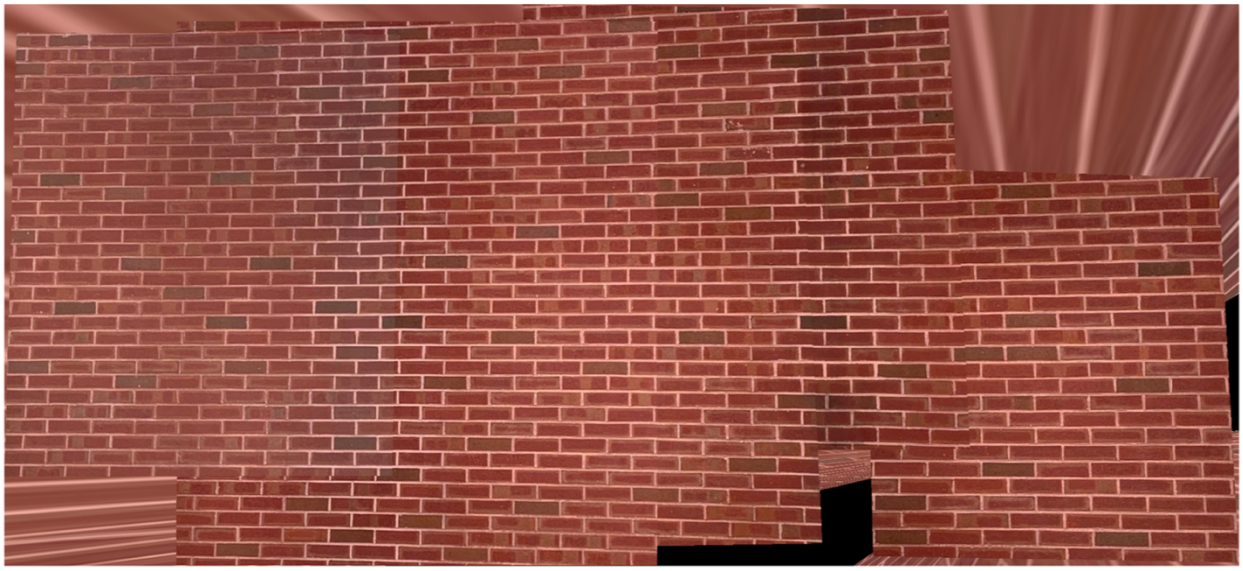


Figures 13 - 19: Dataset 2 images

The first step in aligning the images is locating the interest points in the image. Using the Harris Corner Detection algorithm, examples of the top “N” detected corners in images 20 to 25 are shown below:



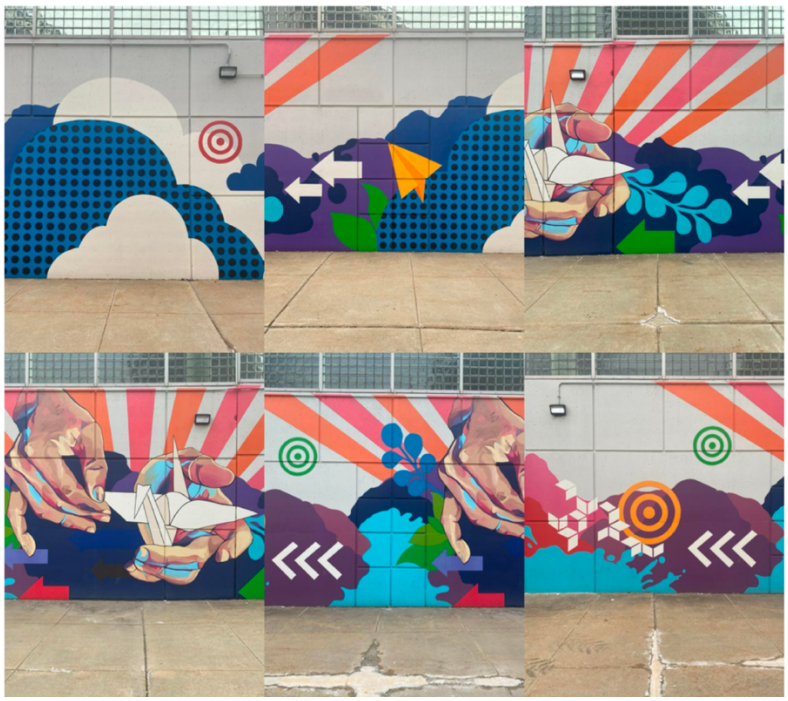
Figures 20 - 25: Detected Harris Corner



Figures 26: Cinder Block Wall Panorama

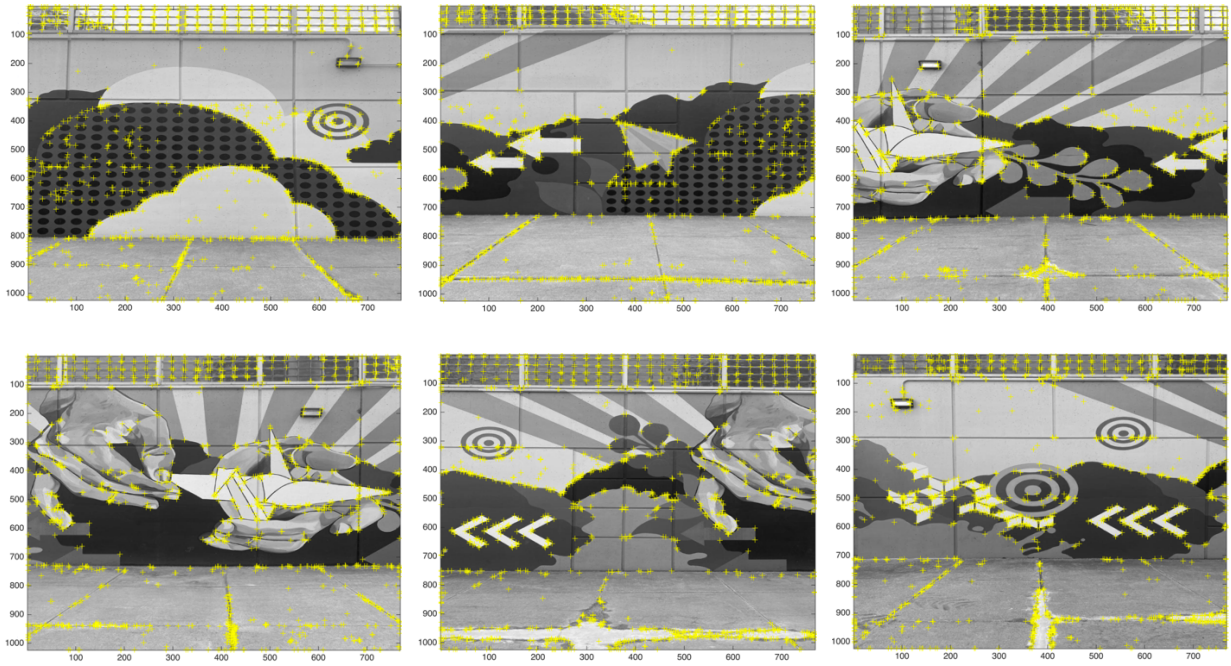
Here in the Cinder Block/Brick Wall to get the images to align well and fully display, I had to increase the number of points the Harris method outputted. Increasing this value allowed there to be enough matches between the images, and an increase in the quality of image alignment.

Dataset 3: Third “Mosaic”

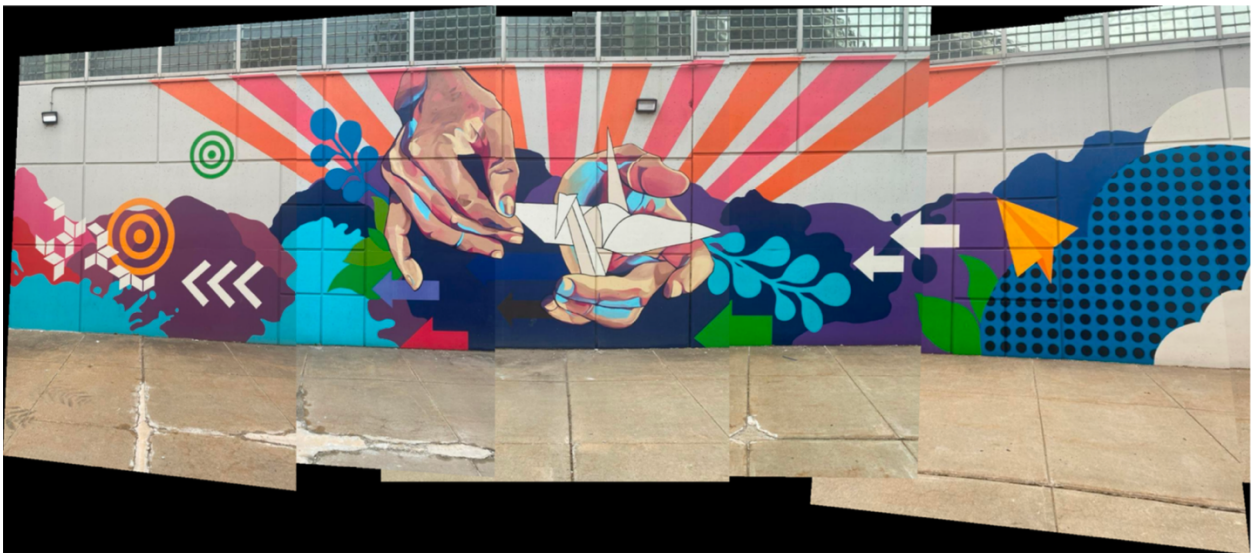


Figures 27 – 32: Dataset 3 images 50%

The third sets of images were taken from outside the Ruggles Station. We took six set of images as shown in the above images and using the Harris detection algorithm, the top "N" detected corners in images 33 to 38 are shown below:



Figures 33 – 38: Detected Harris Corner 50%

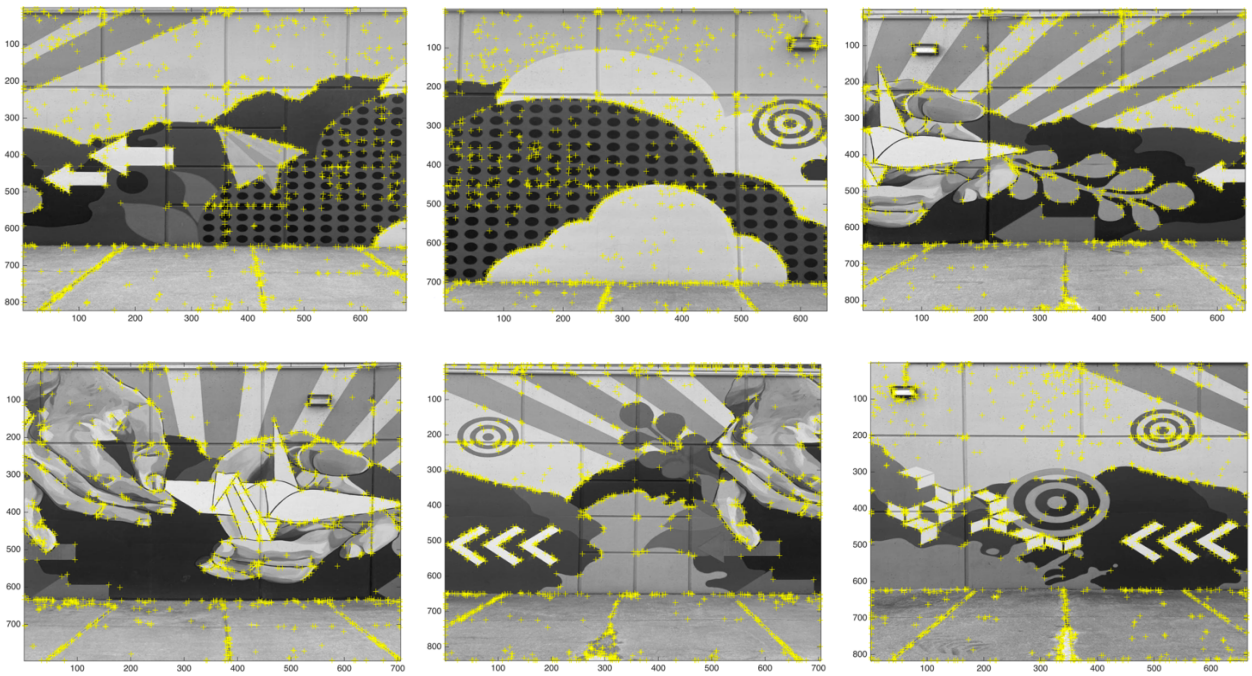


Figures 39: Graffiti Art Panorama 50%

The images were properly aligned and fully display. I didn't have to increase the number of interest points in the Harris method outputted. There were no changes made.

Figures 40 – 45: Dataset 3 images 15%

The fourth sets of images were taken closer which is 15% from outside the Ruggles Station. We took six set of images as shown in the above images and using the Harris detection algorithm, the top "N" detected corners in images 46 to 51 are shown below:



Figures 46 – 51: Detected Harris Corner 15%

Figures 52: Graffiti Art Panorama 15%

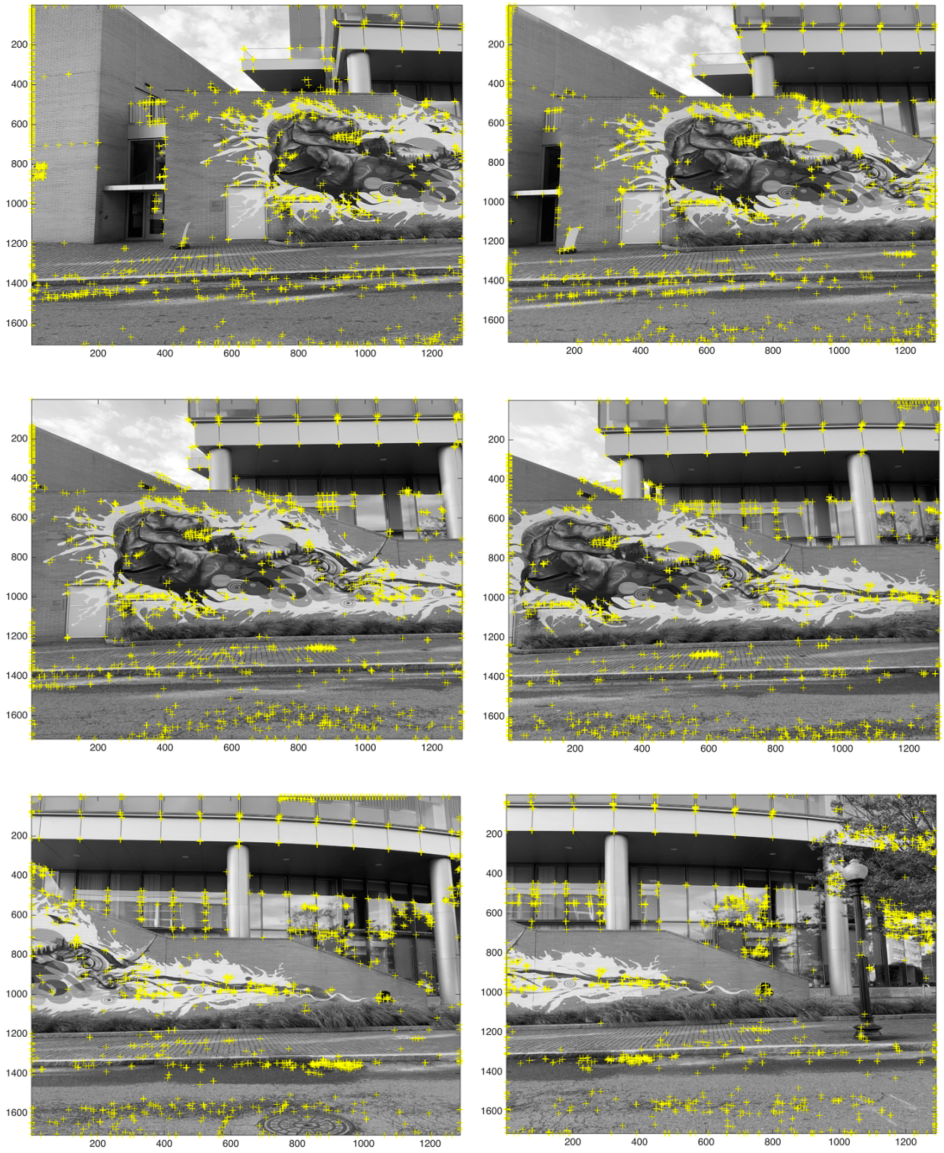
The overlap of 50% is much better than the overlap of 15%, in order to align well and fully display, I had to increase the number of points the Harris method outputted. Increasing this value allowed there to be enough matches between the images, and an increase in the quality of image alignment.

Dataset 4: TREX

The fifth set of images we took was of the TREX Dinosaur near Ruggles. We took six images spanning across the whole mural, overlapping by about 85%. The images are displayed below:

Figure 53 – 58: Dataset 4 images

The fourth sets of images were taken from outside the Ruggles Station. We took six set of images as shown in the above images and using the Harris detection algorithm, the top “N” detected corners in images 59 to 64 are shown below:



Figures 59 – 64: Harris Detected Corner

Figures 65: TREX Panorama

The images were properly aligned and fully display. I didn't have to increase the number of interest points in the Harris method outputted. There were no changes made.

Conclusion

The ability to designate interest points in images is particularly useful in a variety of robotic applications utilizing camera imaging. We were able to apply the Harris corner detection algorithm to correctly identify the orientation and position of an object, identify important interest points, and align images based on interest point matches in this study.