EECE5554 – Robotics Sensing and Navigation

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Lab5 Report

The data for this lab was collected using my smartphone. The phones which we use nowadays, already have an in-built calibrated camera, so we don't have to use calibration tools on the images captured by our phones. The images were collected at multiple locations within the Northeastern University campus.

Part-1: T-Rex Mosaic

I have captured six images of the T-Rex Graffiti between Centennial Common and West Village. We will apply the Harris Corner detector algorithm to this set of images and create a panoramic view of the graffiti. I took 4 steps between two images to achieve the significant overlap as shown in the below image dataset:

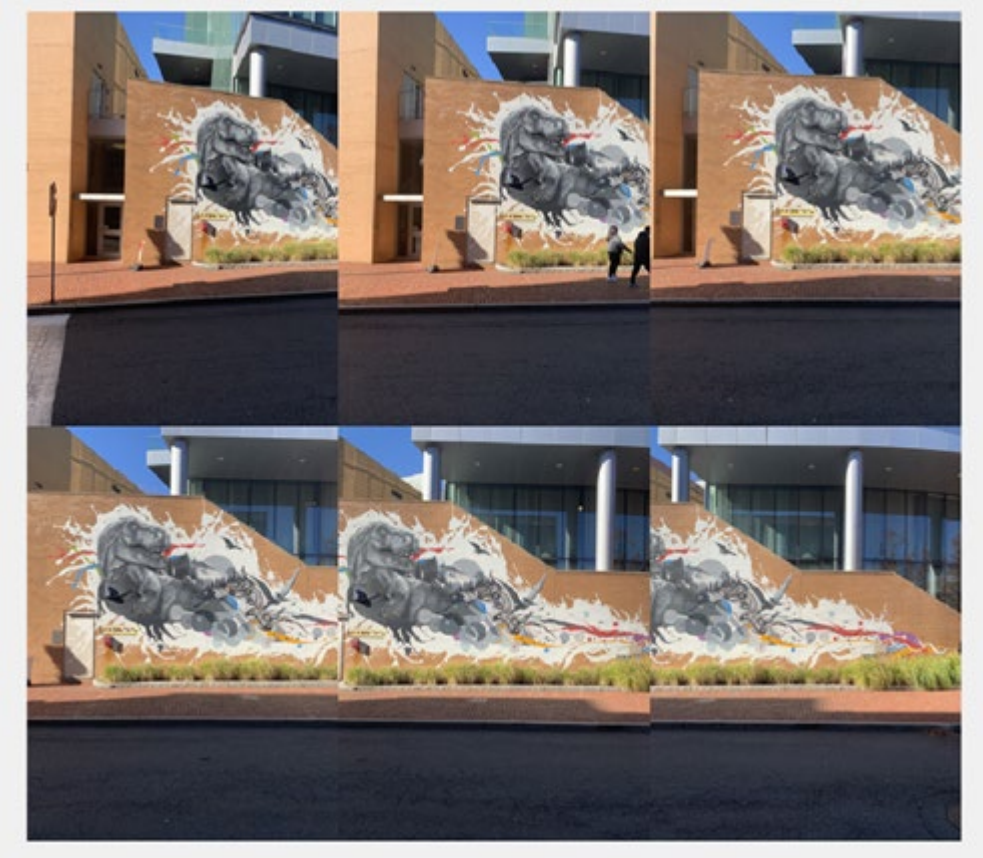


Figure 1: T-Rex Graffiti Dataset

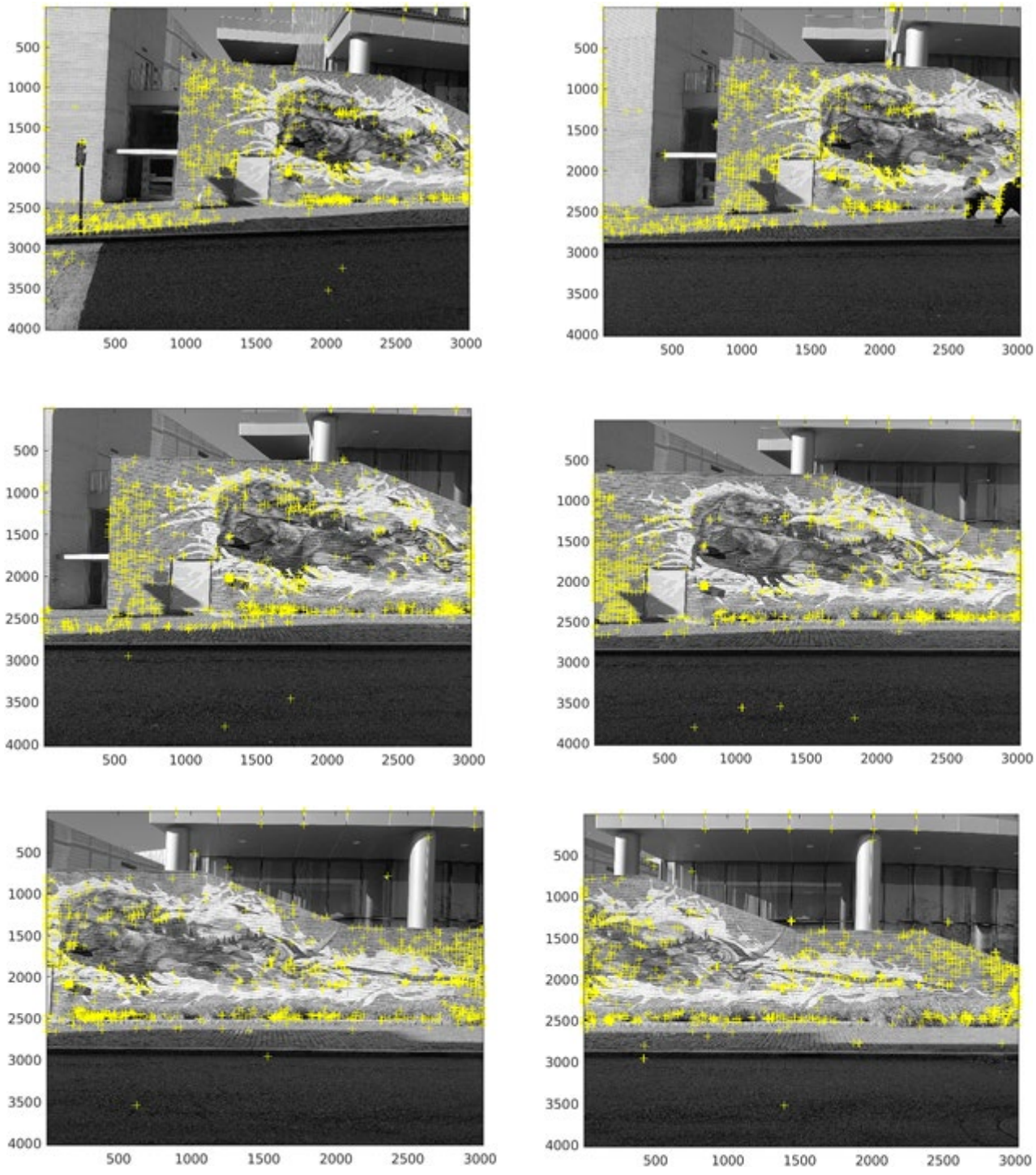


Figure 2: Harris Corner Distribution across T-Rex Dataset

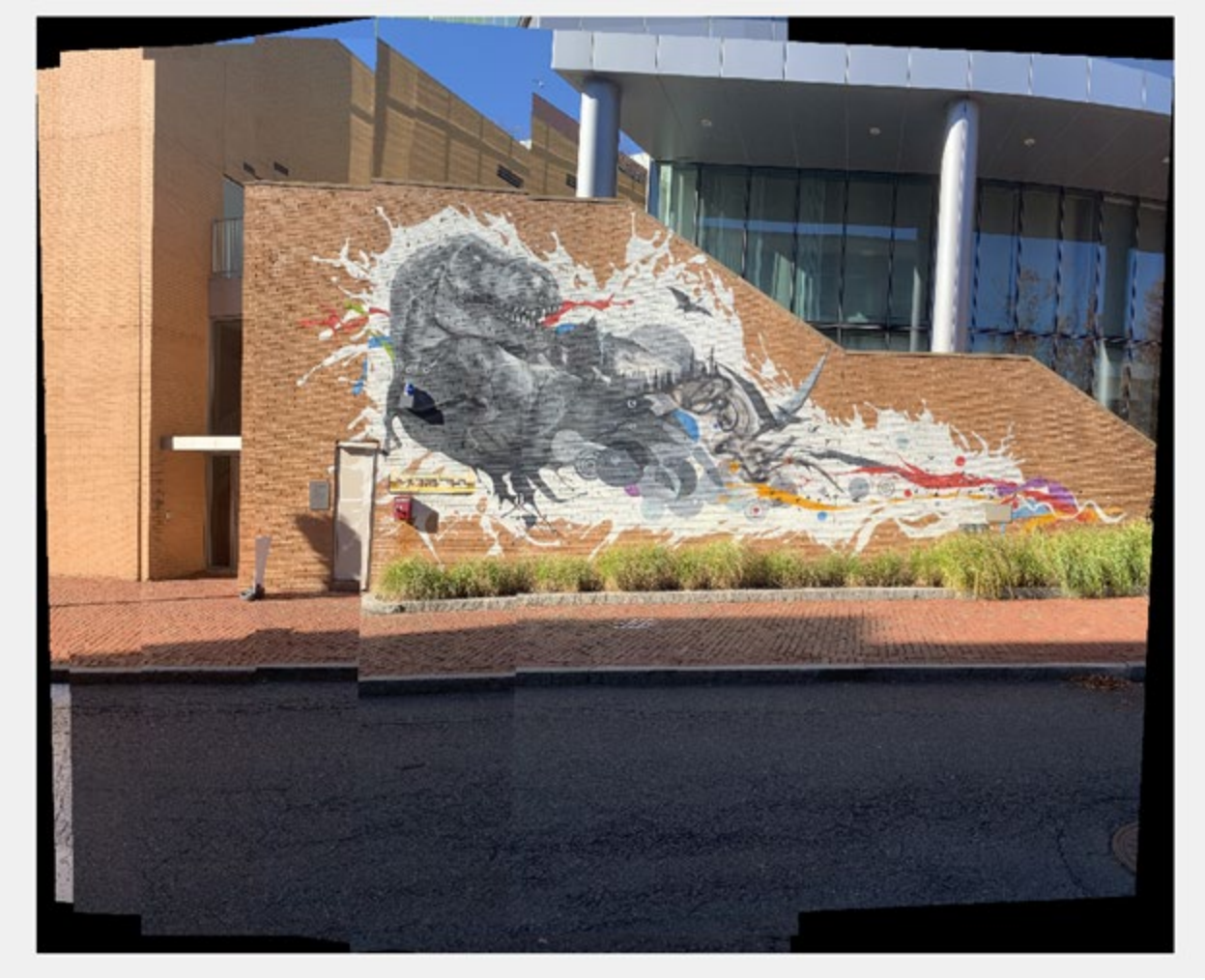


Figure 3: Final T-Rex Mosaic

By tweaking the maximum no of features (M) and the grid of tiles for feature distribution (Tiles), we can obtain a decent panoramic view of the given image dataset. In this case, there is a significant overlap in our dataset.

I have adjusted the M value to 1000, and the Tiles value to [2 2] in my code. As observed from Figure-3, the T-Rex part of the image dataset is almost perfectly stitched together. This is because the density of features in the Harris corner distribution is very high for this region, and there is significant overlap between the images which creates a good mosaic for that part. The road and the buildings on the upper-left part show dis-alignment. We can see this from the shadow of the buildings on the footwalk. There are fewer distinct features, i.e. corners, in these parts of the dataset. Harris Detector is a 2D detector algorithm, the corners of the road and the building form 3D structures which cannot be stitched well by the Harris corner method.

Part-2: Cinder Block Wall

I have captured five images of a cinder block wall behind the Shillman Hall near the Power Plant. We will apply the Harris Corner detector algorithm to this set of images and create a mosaic of the wall. I took 4 steps between two images to achieve the overlap as shown in the below image dataset:

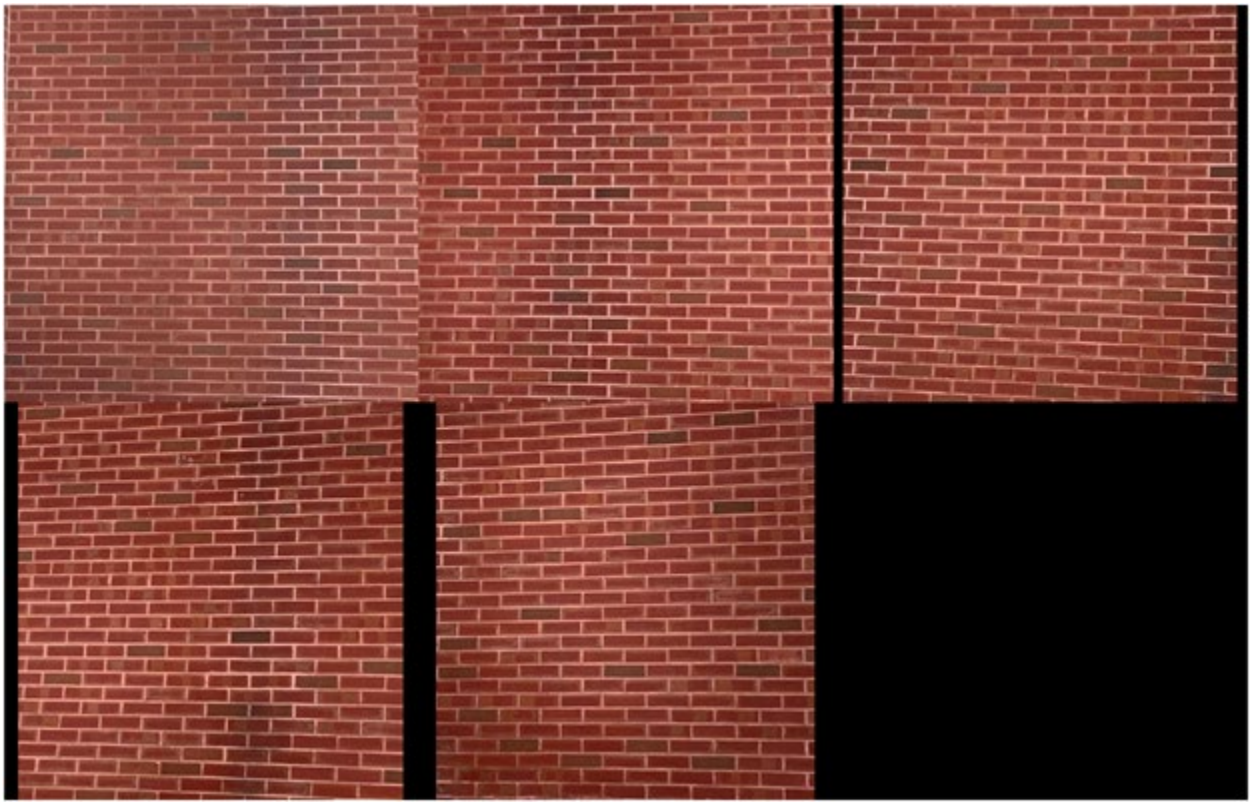
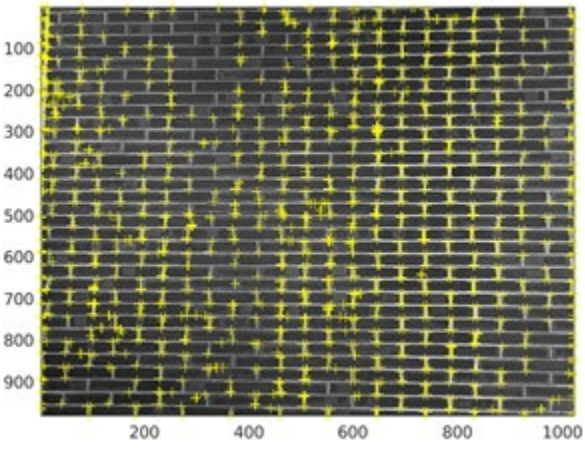
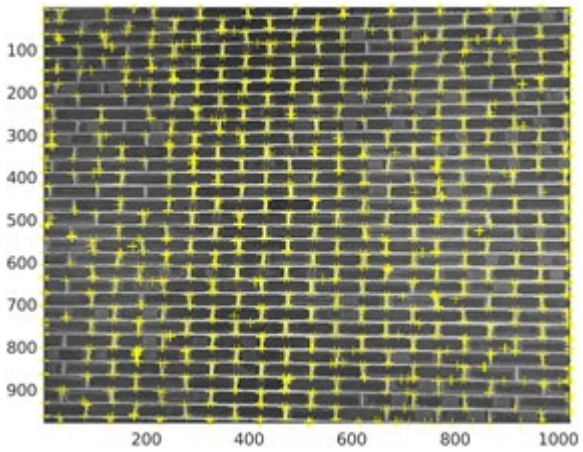


Figure-4: Cinder Block Wall Dataset





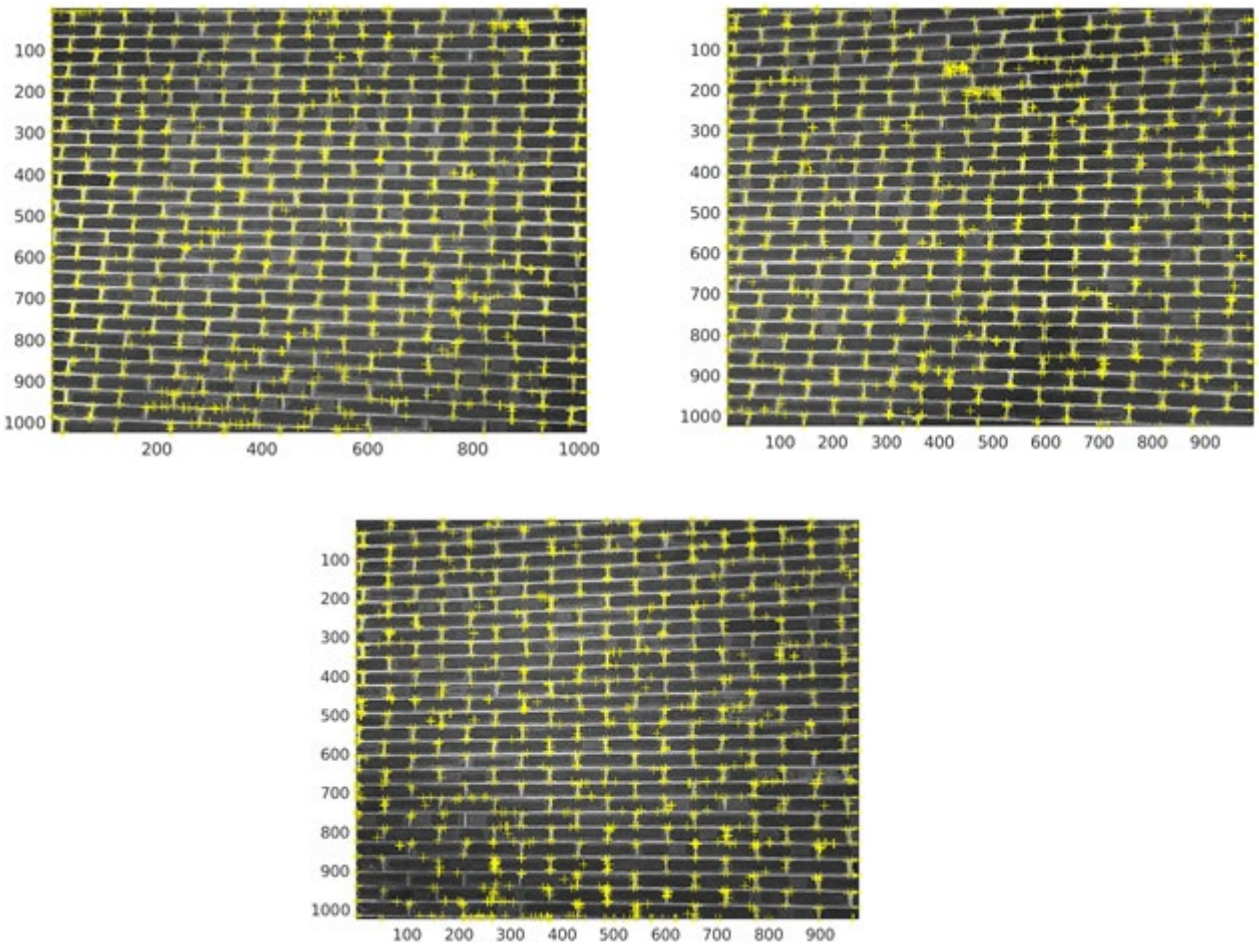


Figure 5: Harris Corner Distribution across Cinder Block Wall Dataset

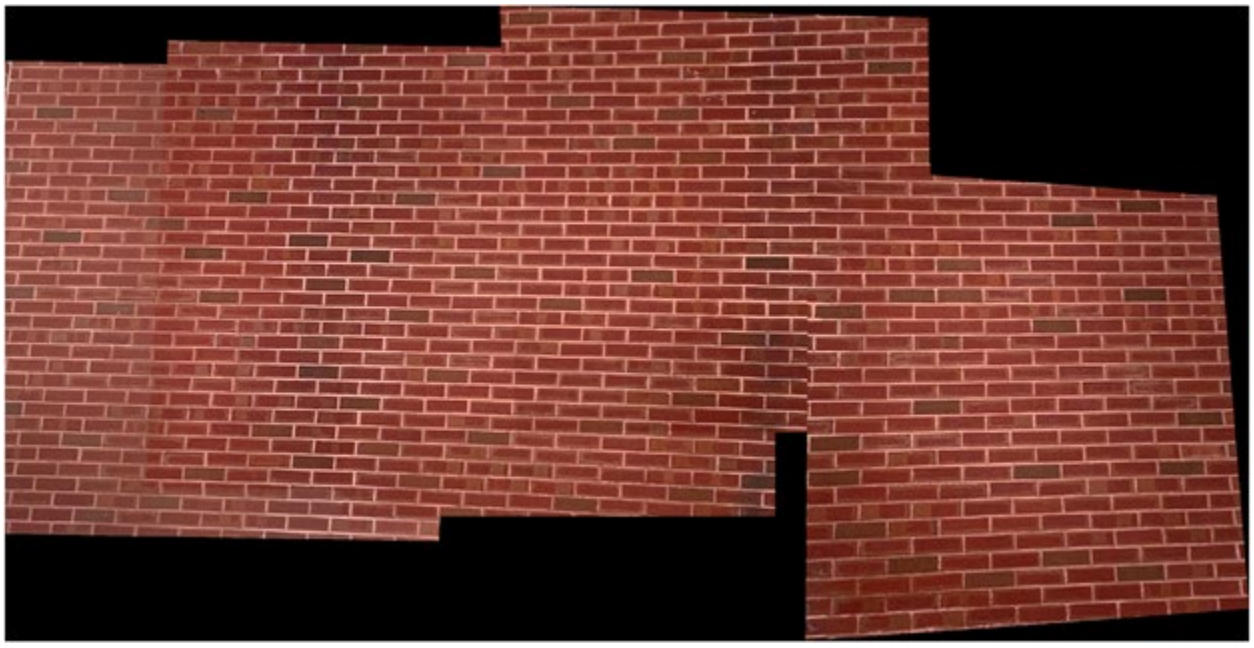


Figure 6: Cinder Block Wall Mosaic

In this case, there is 50% overlap between images in the dataset.

I have adjusted the M value to 1500, and the Tiles value to [3 3] in my code. These images are quite similar, and we need to observe very closely in order to distinguish between them. There are almost no distinct features in the images to get a perfect stitch of the dataset.

The cinder block forms a repetitive pattern as compared to the T-Rex graffiti in Part-1. This makes it hard to blend. By increasing the no. of features, we can get a good enough mosaic as seen in Figure-6. There is slight misalignment in the right side of the wall due to the edges between the last 2 images. The panorama is distorted because of the camera angle which is not aligned with the wall.

Part-3: Ruggles Mural Mosaic

I have captured six images of the mural on the Ruggles Station wall. We will apply the Harris Corner detector algorithm to this set of images and create a panoramic view of the wall. I took 7 steps between two images to achieve the small overlap as shown in the below image dataset:

Figure-7: Ruggles Mural Dataset

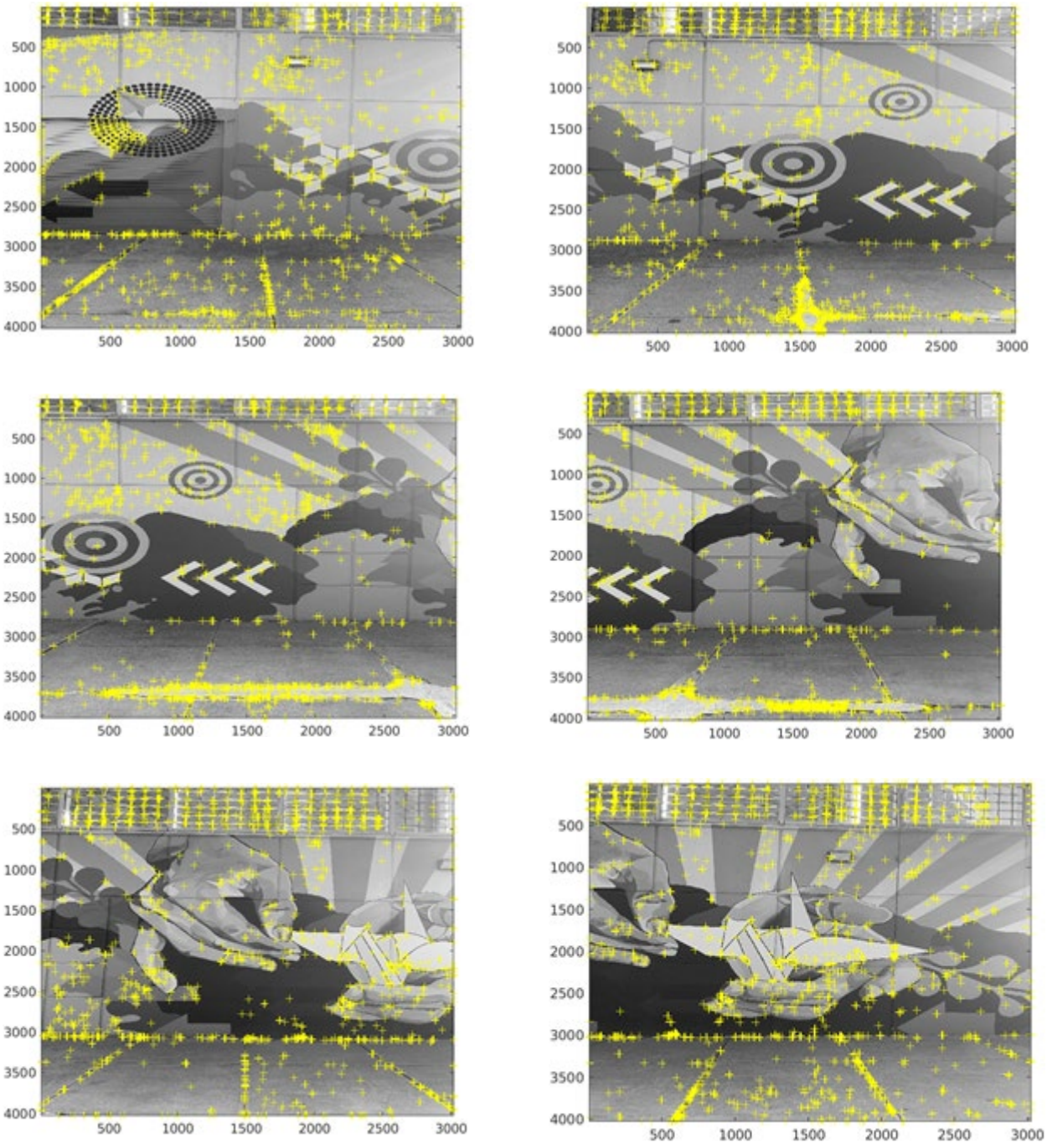


Figure-8: Harris Corner Distribution across Ruggles Mural Dataset

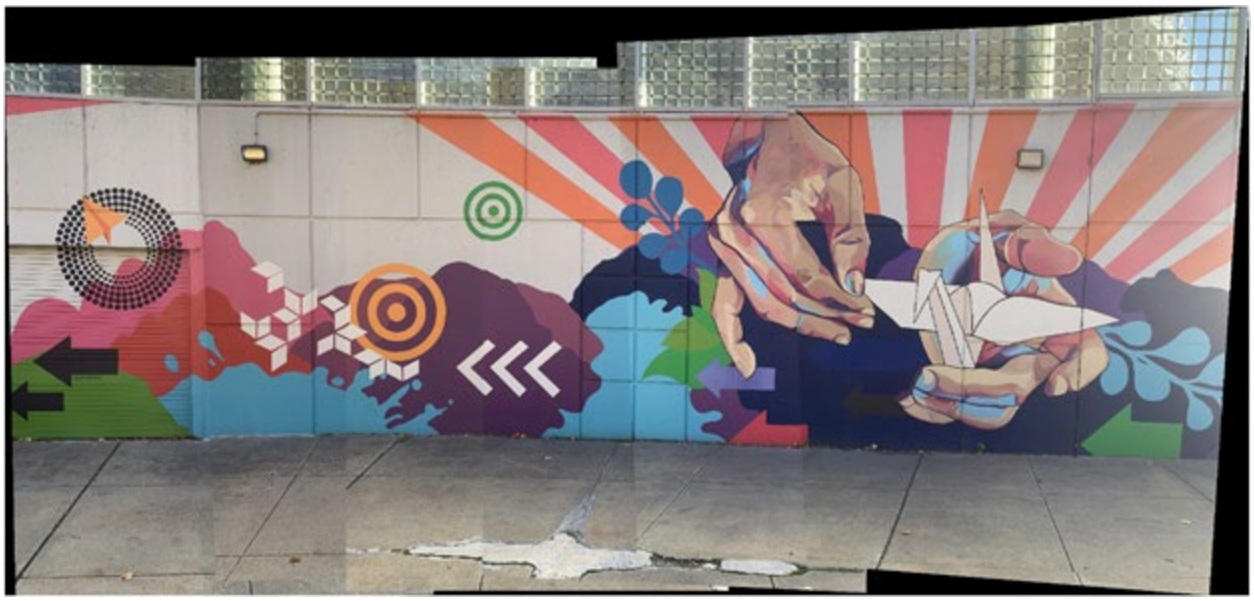


Figure-9: Ruggles Mural Mosaic

In this case, there is a 15% overlap between images in the dataset.

I have adjusted the M value to 2000, and the Tiles value to [2 2] in my code. I had to increase the number of features as compared to the T-Rex graffiti (50% overlap) because of the very small overlap between the images. For values less than 2000, the output was heavily distorted and not recognizable.

As compared to the 50% overlap T-Rex mosaic in Part-1, the Ruggles mosaic is covering a very wide area because of the smaller 15% overlap between 2 images. The overall images is quite clear, as there are several distinct features which are present in the image for accurate corner detection. The mural on the wall is perfectly stitched in the mosaic as compared to the ground, since the ground has less number of unique features. The upper part of the image has a high density of features forming a repetitive pattern similar to the cinder block wall. This causes improper stitching of images in that region. Overall, the mosaic of 50% overlap T-Rex Graffiti is far better than the mosaic of 15% overlap Ruggles graffiti for the same number of features in the Harris corner detector.