REPORT

LAB 05

(IMAGE MOSAICING)

INTRODUCTION

Image mosaicing is the process of combining multiple photographic images with overlapping fields of view to produce a segmented panorama or high-resolution image. It is used extensively in fields like satellite imaging, medical imaging, microscopy, and computer vision to acquire larger images with higher resolution than is possible with a single camera. The process involves first determining the camera motion between images using features like points, edges or textures and finding correspondences between them. A geometrical transformation is then applied to warp the images into a common coordinate system.

To get a seamless mosaic, blending techniques are used for smoothing intensity variations in the overlap region. Some challenges include dealing with images taken under varying illumination conditions, images with moving objects, parallax effects, lens distortion etc. Sophisticated image mosaicing pipelines use techniques like bundle adjustment to refine camera parameters and produce visually consistent mosaics free from ghosting, blurring and visible seams Image mosaicing finds numerous applications from panoramic photography, virtual reality, to monitoring of oil spills through aerial imaging and creation of geographical maps.

In this lab, four datasets were collected with different percentages of overlapping.

- The first dataset has an overlapping of more than 50%
- The second dataset has an overlapping of about 50%
- The third dataset has an overlapping of about 15%
- The fourth dataset has an overlapping of 50%

These datasets were used to make panoramic mosaics. We used the Harris Corner Detection method to detect and align interest points as instructed.

The Harris Corner Detector is an algorithm used in computer vision and image processing for detecting interest points or corners in an image. This algorithm is widely used in various applications, including feature matching, image stitching, and object recognition. It helps detect interest points and their corresponding feature descriptors, which play a vital role in accurately aligning the overlapping images to produce the desired panoramic mosaic. It is important to first determine points that are the same between the two images to align interest points between them. However, it is necessary to understand a point's relative position in relation to the surrounding features in the image before one can describe its relative position. This relative position is known as the interest point’s feature descriptor.

MURAL ON THE LATINO STUDENT CENTRE (T-REX)

The first data set consists of five images taken at the “Latino Students Centre”. These set of images have an ovelapping percentage of more than 50%.

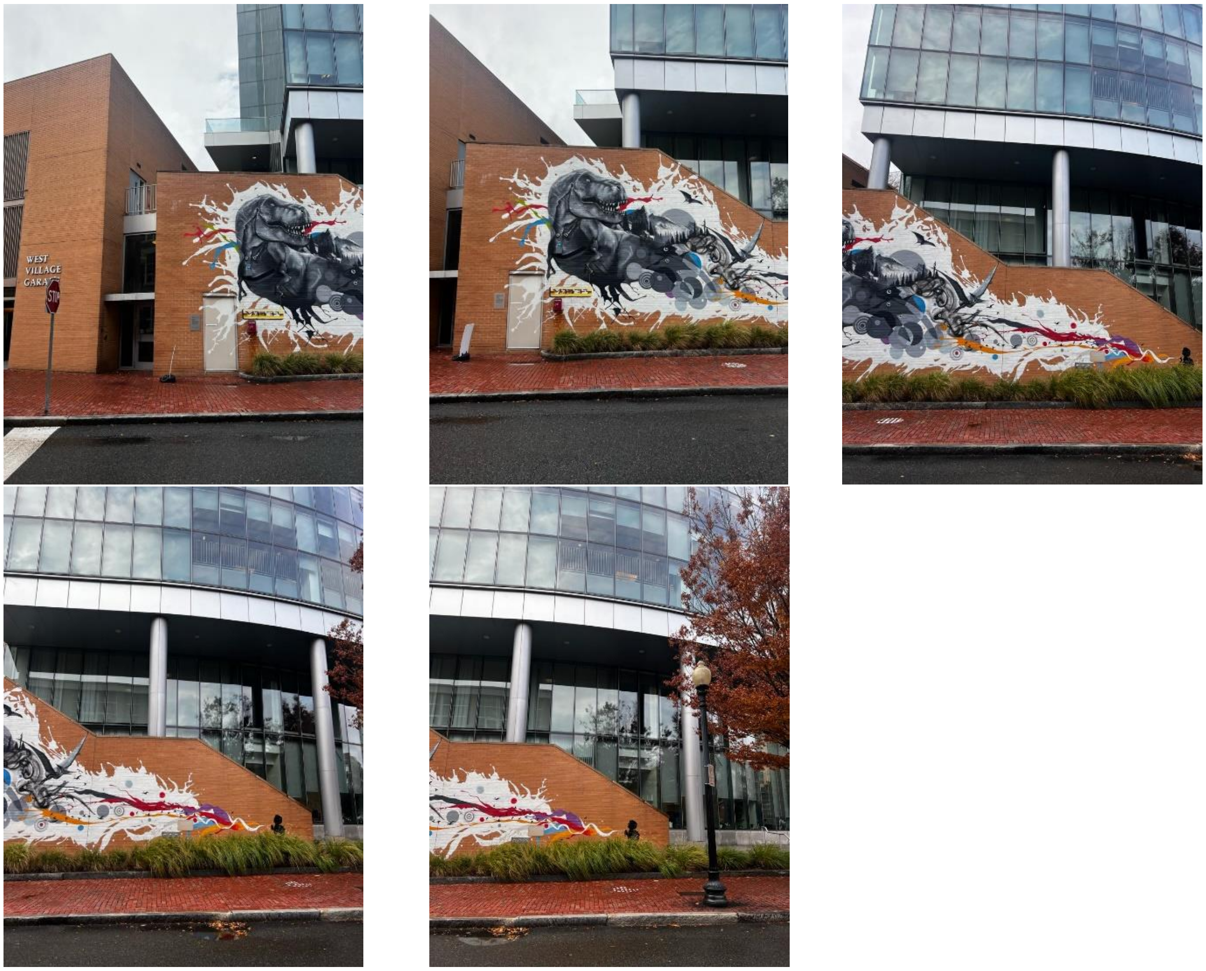

Fig 1 - 5: Images for Dataset 1 (Latino Students Centre)

The initial step to align the images is detecting the interest points in the images. As we are using the Harris Corner Detection Algorithm the value of N (maximum number of interest points to return) is set to 1000.

The analysis images are shown below:

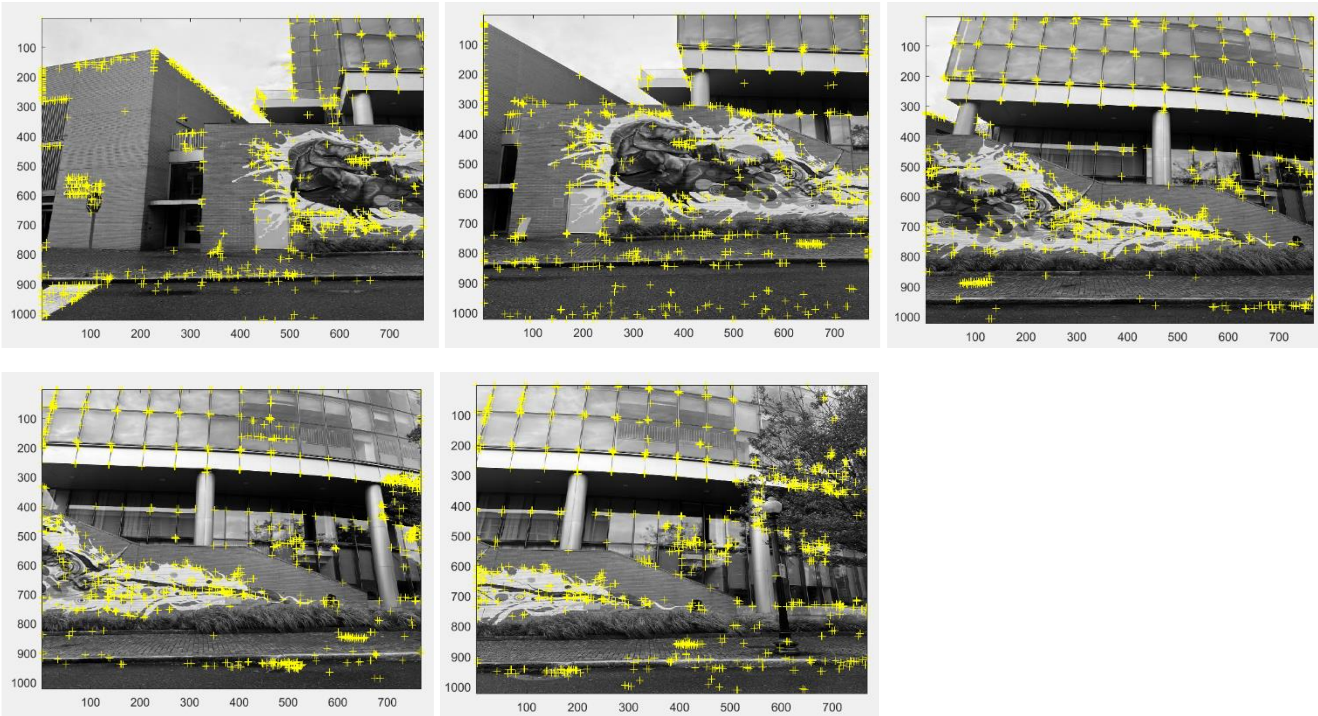

Fig 6 - 10: Interest Points of Dataset 1 (Latino Students Centre)

The process of generating a final mural involved matching specific features, estimating the transformation between adjacent image pairs, and aligning all the extracted feature descriptors for each of these points. The output after aligning the images is shown below:

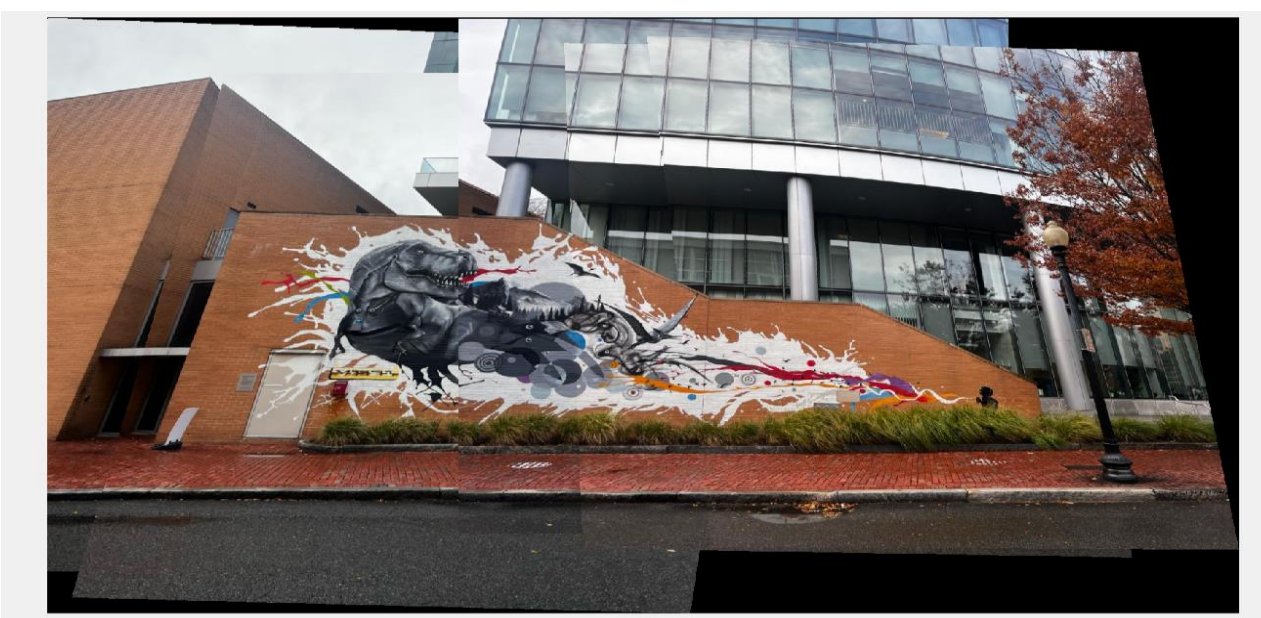

Fig 11: Panoramic Mosaic of Dataset 1

BRICK WALL:

The second data set consists of five images taken at the “Ruggles T-Station”. These set of images have an ovelapping percentage of about 50%.

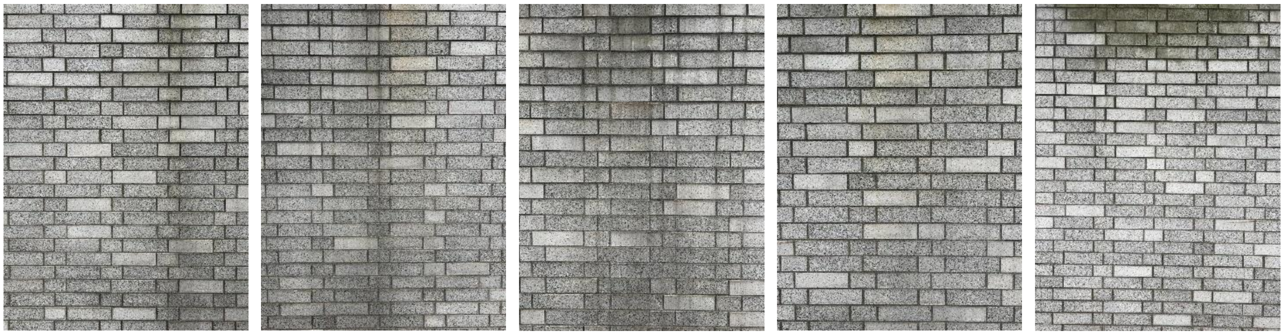

Fig 12 - 16: Images for Dataset 2

The analysis images are shown below:

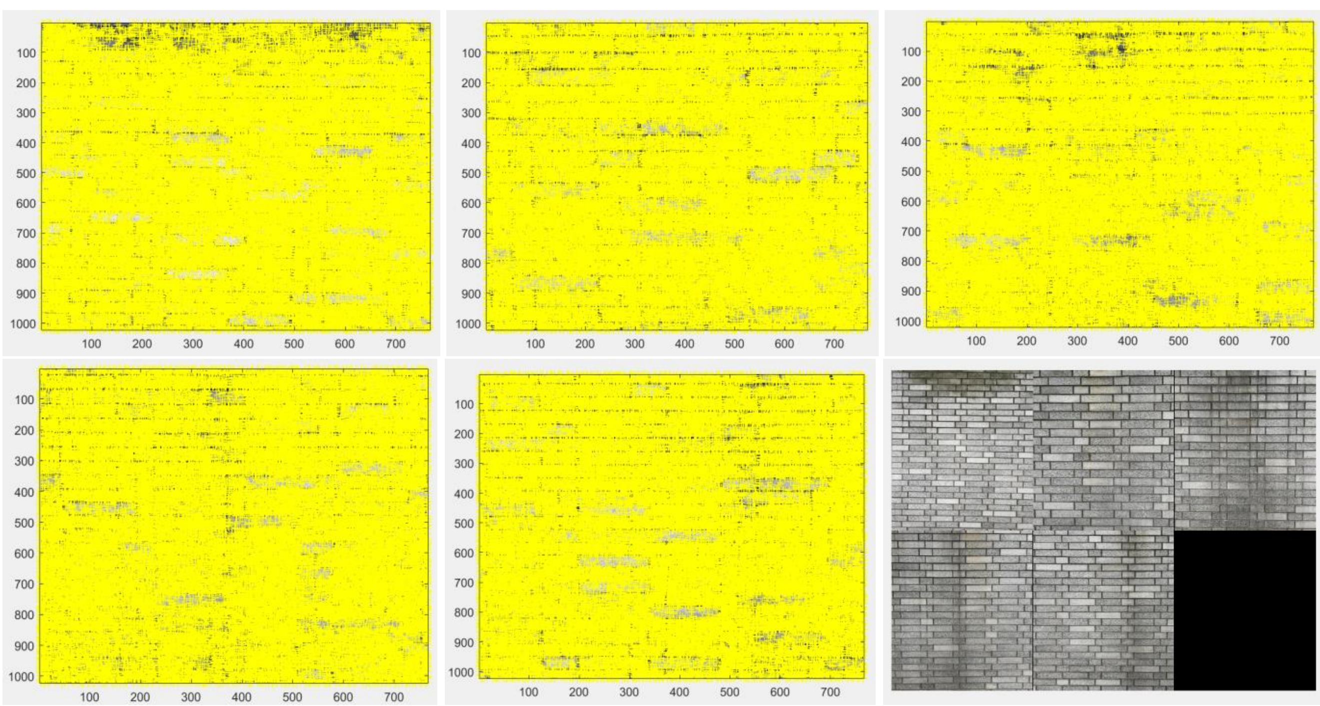

Fig 17 - 22: Interest Points of Dataset 2

The output image is as follows:

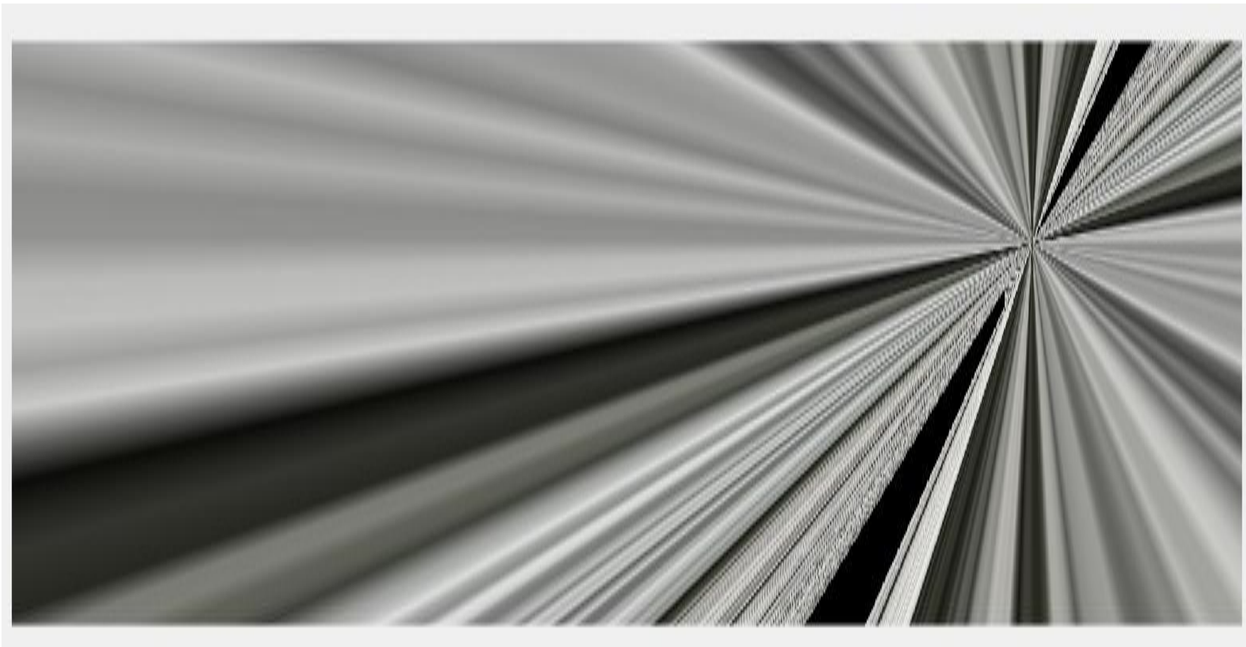

Fig 23: Panoramic Mosaic of Dataset 2

The reference points between the images would be unclear since the images are very similar to each other. Hence, even with the increase in the value of N the output image is highly unclear.

When comparing the LSC mosaic's alignment performance to that of the brick wall, we can conclude that the former one is more accurate due to several dissimilar features, which help the algorithm avoid confusion and align the images nearly perfectly. However, we can see that the alignment of the brick wall mosaic is not exact because the images have more similar features, which causes the algorithm to become confused during the alignment process.

MURAL ON RUGGLES T-STATION:

1. 15 % OVERLAPPING:

The third data set consists of five images taken at the “Ruggles T-Station”. These set of images have an ovelapping percentage of about 15%.

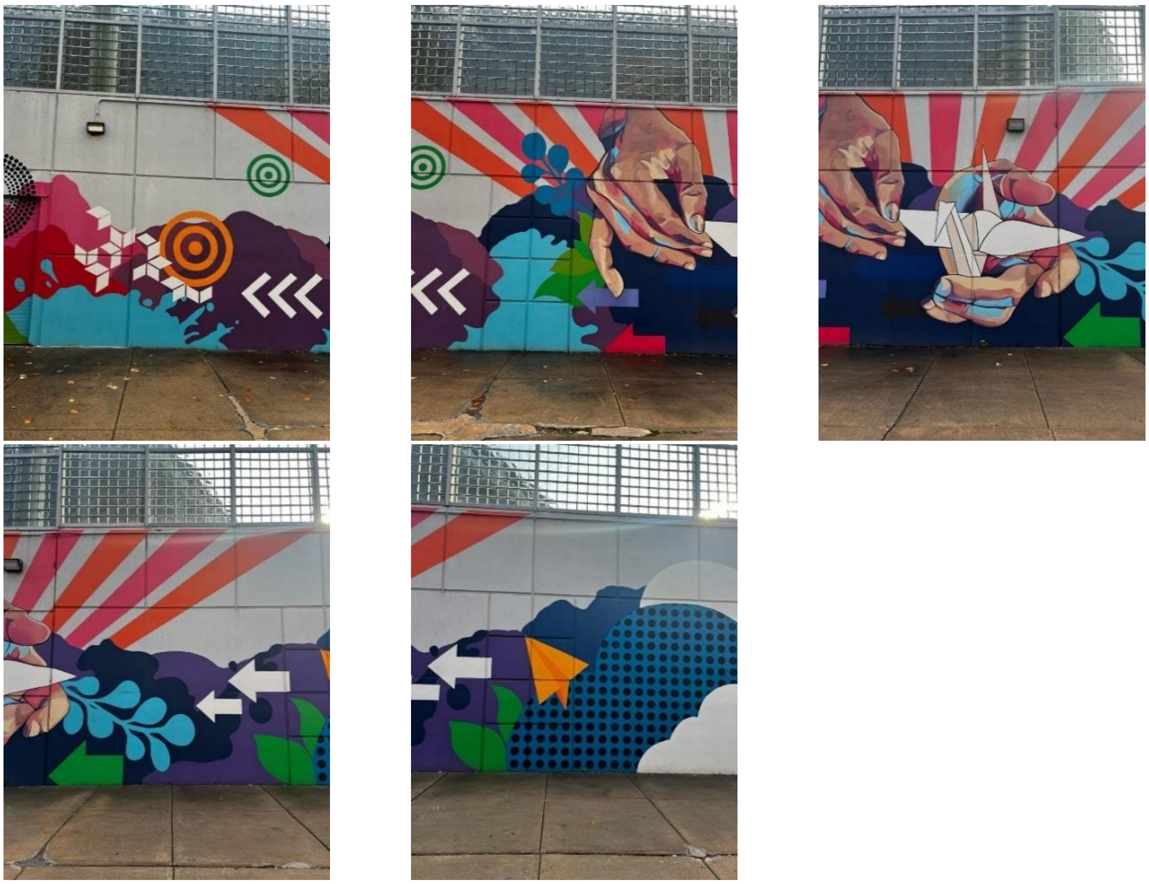

Fig 24 - 28: Images for Dataset 3 (Mural on Ruggles Wall)

Harris Corner Detection Algorithm the value of N (maximum number of interest points to return) is set to 1000.

It was observed that the image stitching is not very accurate when the number of interest points to return is set to 1000. Hence, to receive an output that is a more accurately stitched image the number of interest points to return had to be increased.

The results in both the cases are mentioned further in the report.

The analysis plots for N=1000 is as below:

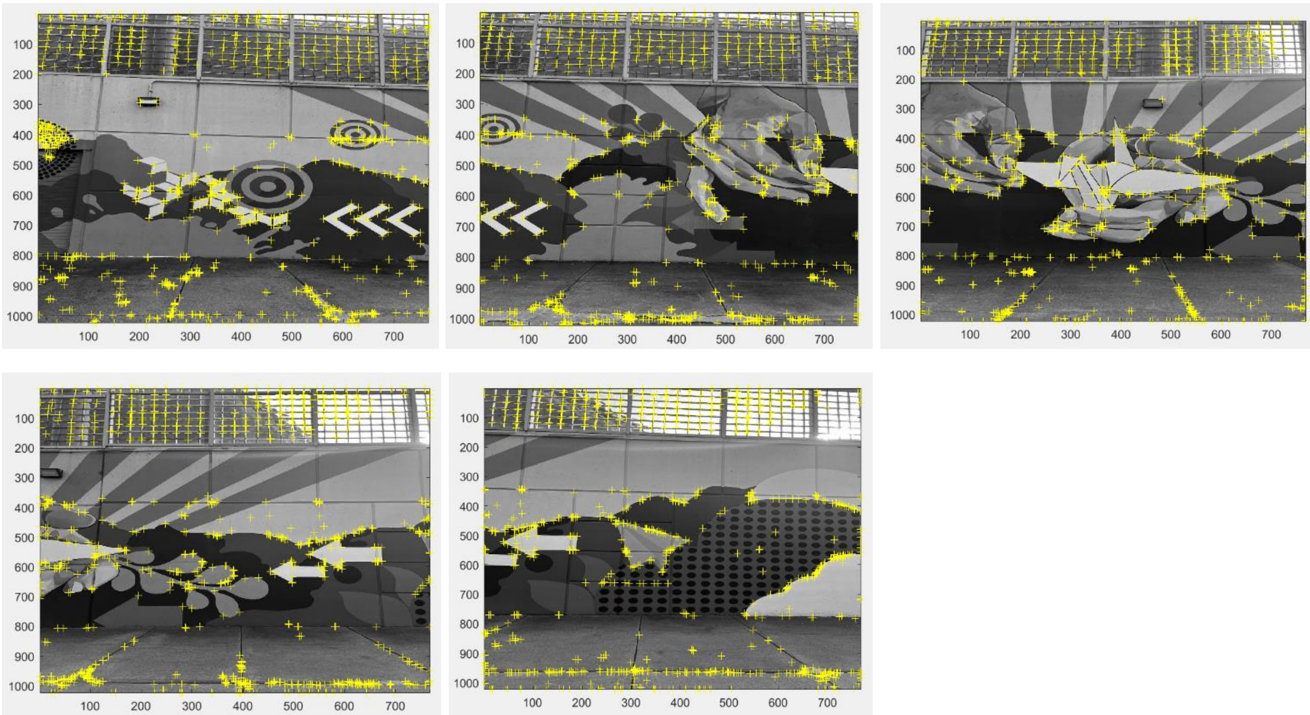

Fig 29 - 33: Interest Points of Dataset 3 (Mural on Ruggles Wall)

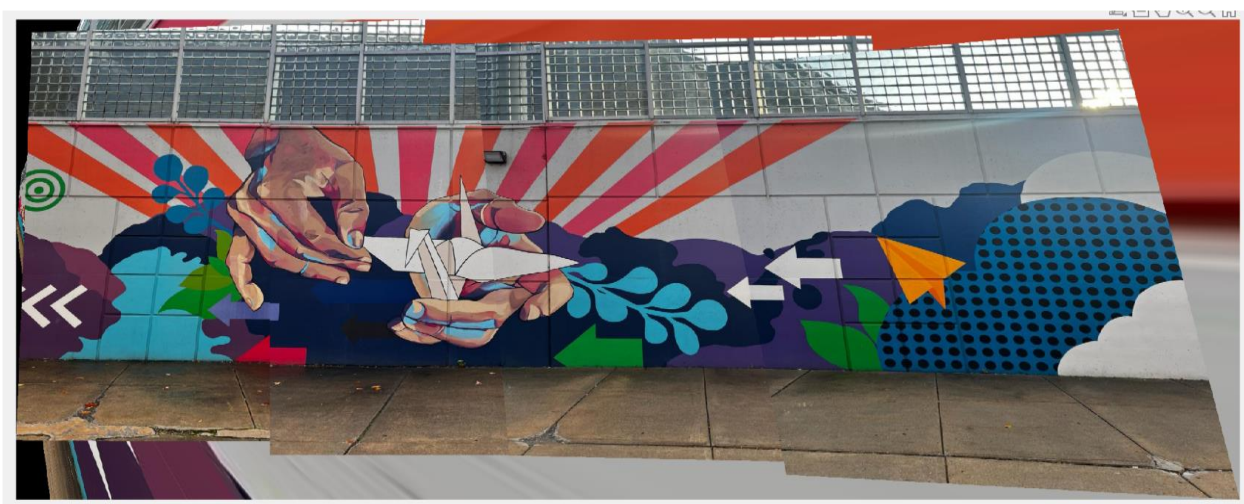

Fig 34: Panoramic Mosaic of Dataset 3 (N = 1000)

It is observed from Fig 34 that the mosaic is not perfectly stitched together. There is distortion on the top and the left of the mosaic. In order to obtain a mosaic that does not consist of any distortion, the value of N (maximum number of interest points to return) should be increased.

Since the overlap in this case is less, increasing the value of N will increase the number of interest points to compare between the two consecutive images.

When the value of N is set to 2000, the result is as below:

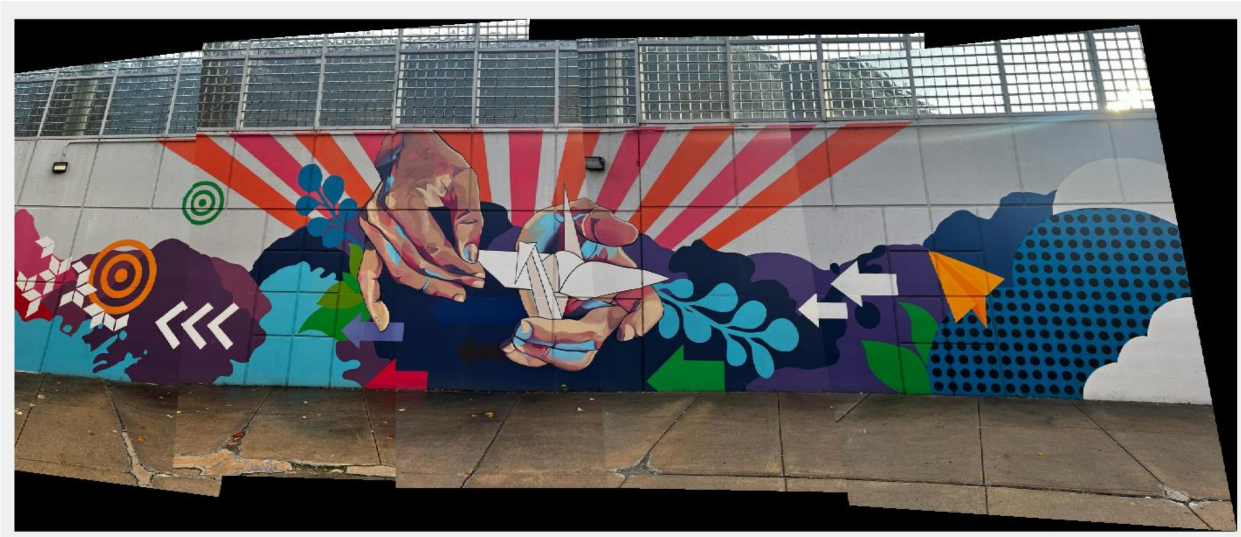

Fig 35: Panoramic Mosaic of Dataset 3 (N = 2000)

2. 50 % OVERLAPPING:

The fourth data set consists of five images taken at the “Ruggles T-Station”. These set of images have an ovelapping percentage of about 50%.

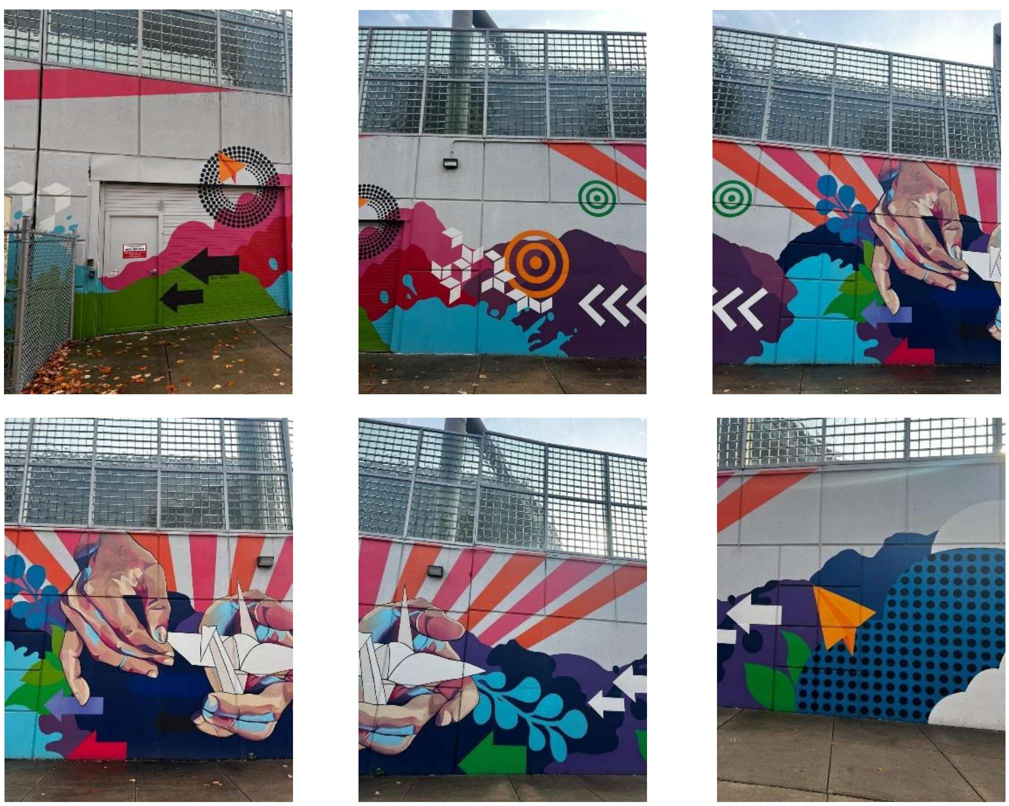

Fig 36-41: Images for Dataset 4 (Mural on Ruggles Wall)

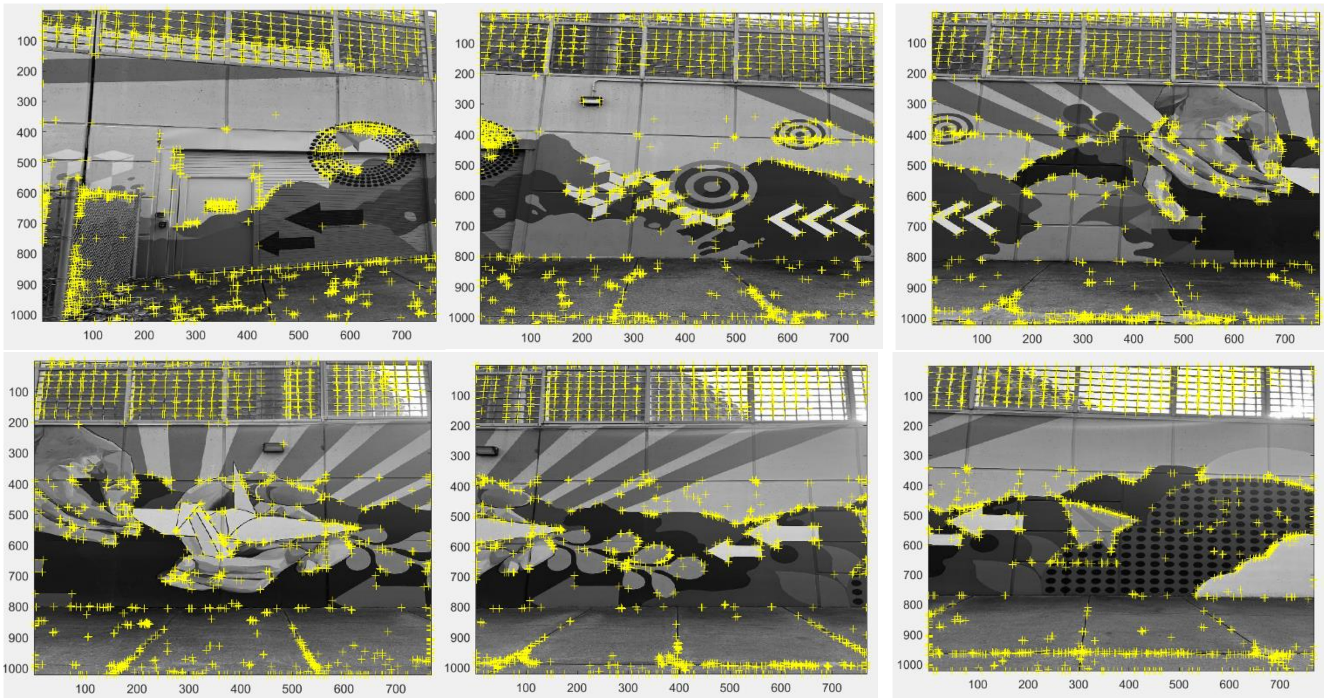

Fig 42 - 47: Interest Points of Dataset 4

Since the overlapping is 50%, the image stitching is high in accuracy. Because the comaprison between two images can be done easily in this case, the number of interest points can be lower. At 15% overlap, it shows how poorly the mosaicking method performs.

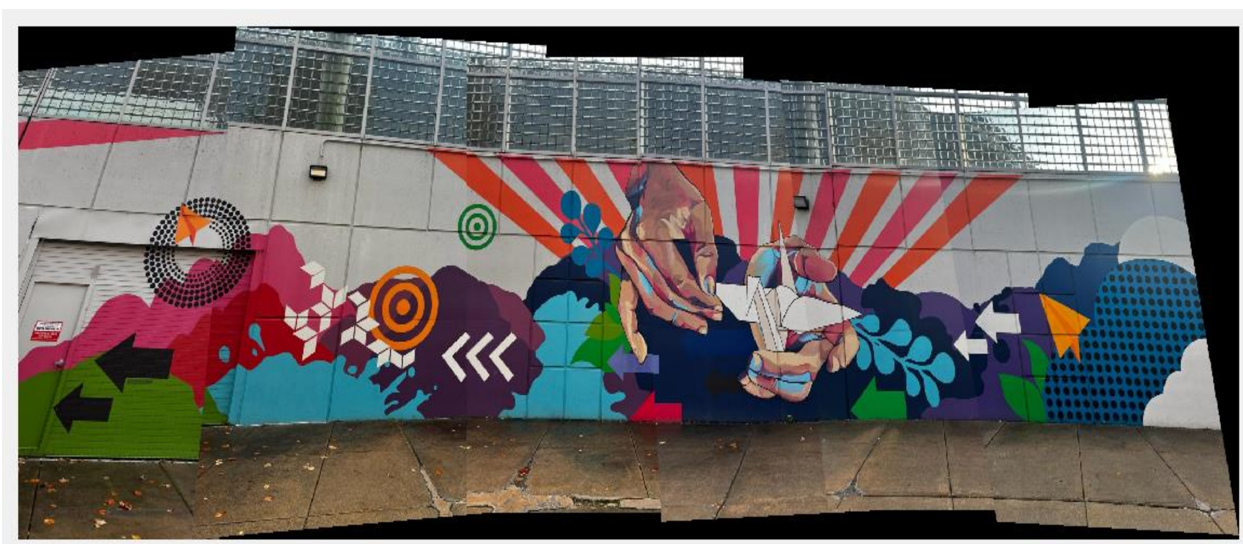

Fig 48: Images for Dataset 4 (Mural on Ruggles Wall)