CS5175 Assignment - 3 Report

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1 Introduction

Image stitching (Mosaicing) is a crucial computer vision task that involves combining multiple images into a seamless panorama. This report presents the implementation and results of an image stitching algorithm developed using Python, OpenCV, and related libraries.

2 Implementation Details

2.1 Image Preprocessing

The images used in this assignment were preprocessed using the OpenCV library. The grayscale versions of the images were resized to half their original dimensions for computational efficiency.

2.2 Homography Computation

The `homography_mat` function computes the homography matrix between two images using the Scale-Invariant Feature Transform (SIFT) algorithm. The homography matrix is first created and the value of the matrix is found using SVD (Singular Value Decomposition) .

RANSAC algorithm is used to find the best H matrix . Minimum four points are required to do RANSAC. We take all the points except the ones that we used to calculate homography matrix for finding the error. If the inliers are more than a fraction of the dimension, we finalise with that homography matrix. If the total number of consensus points is greater that a certain threshold , stop and go back to the last step. Else continue for a fixed number of iteration(here 30) and choose H with maximum number of consensus.

2.3 Bilinear Interpolation

The `bilinear_interpolation` function implements bilinear interpolation for is used to fill in the pixel values.

2.4 Blending

The `avg_intensity` function is responsible for blending pixel values for smooth transitions between images. If the values are in between 0 and 255 , take the average of the values we got from bilinear interpolation in each pixel. Else put 0 (fills that pixel with black colour)

2.5 Image Stitching

The `stitch` function performs image stitching using homography matrices and bilinear interpolation. All the major functions of `homography_mat` , `bilinear interpolation` and `avg_intensity` are called in this function. We define a canvas and assign the dimensions of this canvas to be larger than the input image dimensions . Here , we keep one image as the reference and find the coordinates of the other two images. These coordinates are then filled with bilinear interpolated values which are then averaged and final intensity is filled in each pixel.

3 Results

Two sets of images were used for testing the image stitching algorithm. The results are presented below:

Figure 1: Image 1

Figure 2: Image 2

Figure 3: Image 3

Figure 4: Stitched Result 1

Figure 5: Image 1

Figure 6: Image 2

Figure 7: Image 3

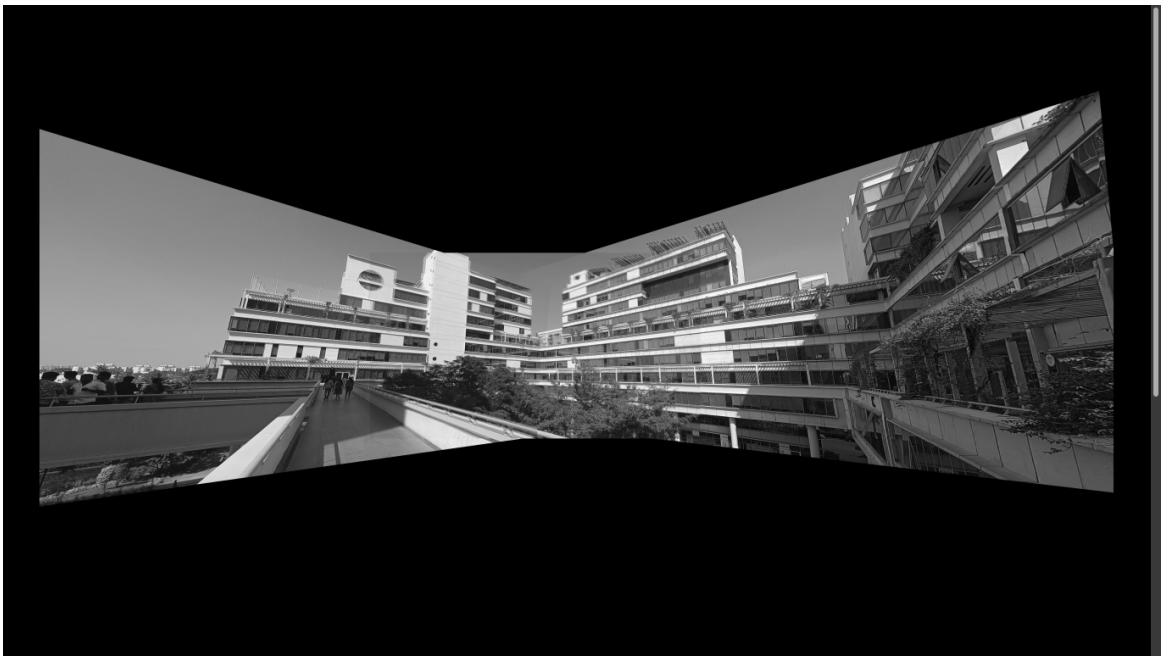

Figure 8: Stitched Result 2

4 Conclusion

The image stitching algorithm successfully combines multiple images into a single panoramic image. The homography computation, bilinear interpolation, and blending contribute to creating panoramas. Finding the proper offset and dimension of the canvas so that the image is not cropped was tricky for images with different resolution and images taken from different cameras.