COL780-Assignment2

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1 Image Stitching

Image stitching or photo stitching is the process of combining multiple photographic images with overlapping fields of view to produce a segmented panorama or high-resolution image. Commonly performed through the use of computer software, most approaches to image stitching require nearly exact overlaps between images and identical exposures to produce seamless results, although some stitching algorithms actually benefit from differently exposed images by doing high-dynamic-range-imaging in regions of overlap.Some digital cameras can stitch their photos internally.

1.1 Feature Detection

In computer vision and image processing feature detection includes methods for computing abstractions of image information and making local decisions at every image point whether there is an image feature of a given type at that point or not. The resulting features will be subsets of the image domain, often in the form of isolated points, continuous curves or connected regions.

SIFT - Scale Invariant Feature Transform has been used in the algorithm to find the key points.

SIFT Key points

1.2 Feature Matching

Feature matching is done using Flann KNN Matcher. Also, multiple K-Trees are used to run in parallel which gives performance benefits. Further, RANSAC is used to compute pair-wise homographies.

Feature Matches

1.3 Global Alignment and Stitching

A match-matrix is constructed using the number of matches between each image pair. The algorithm used to find the left to right sequence is described below.

Algorithm:

- Initialise the base image to be the firstImage, leftImage and rightImage.
- Find the best match of the base image which is yet available and add it to the right of baseImage.
- Proceed recursively to find the best match for the left and right image in the sequence yet made.

- Set the center of sequence to be the base image and repeat 1,2,3 twice.
- Finally determine the sequence to be L-R or R-L by checking the relative position of projected centers of two consecutive images

  Laplacian Blending is used to blend the images and histogram equalization is done on the intensity channel of each of the color images.

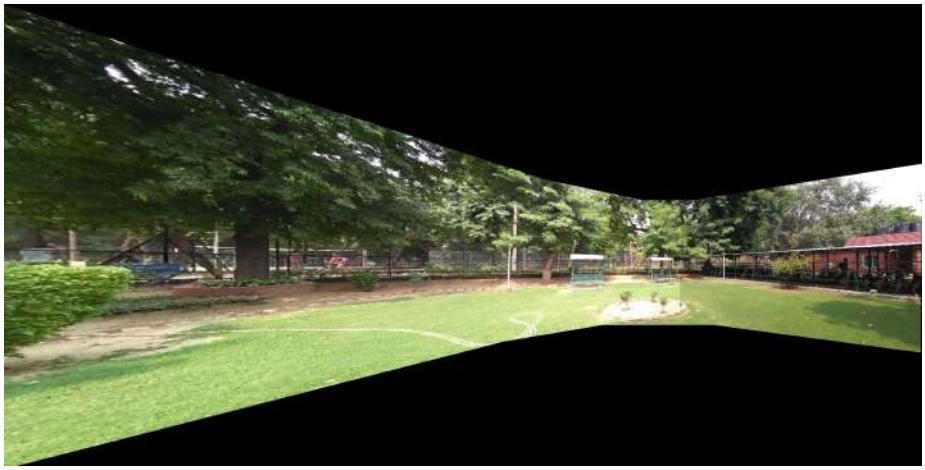


Image Stitching

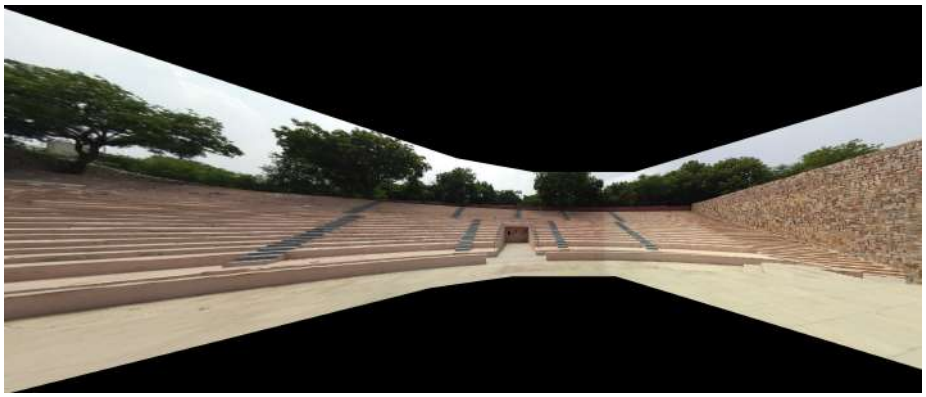
Image Stitching with Laplacian Blending

Image Stitching with Laplacian Blending and Histogram Equalization

1.4 More Panoramas

Dataset 2 Without Blending

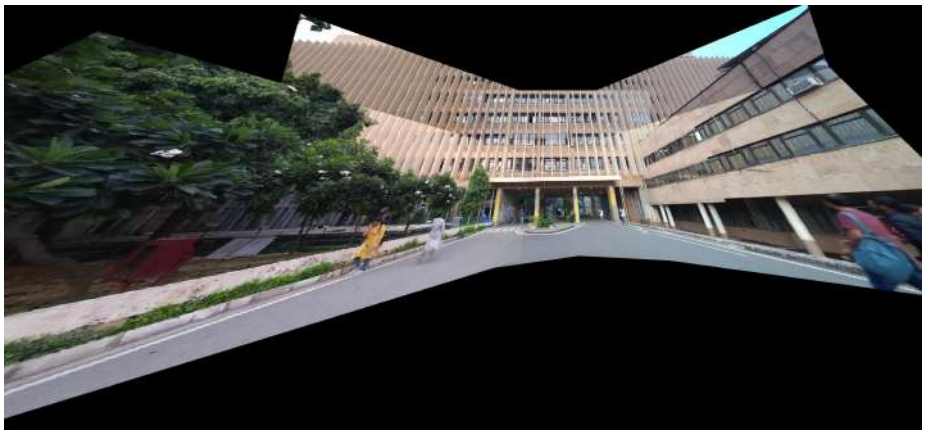
Dataset 2 With Blending



Dataset 3

Dataset 4 without Blending

Dataset 4 with Blending

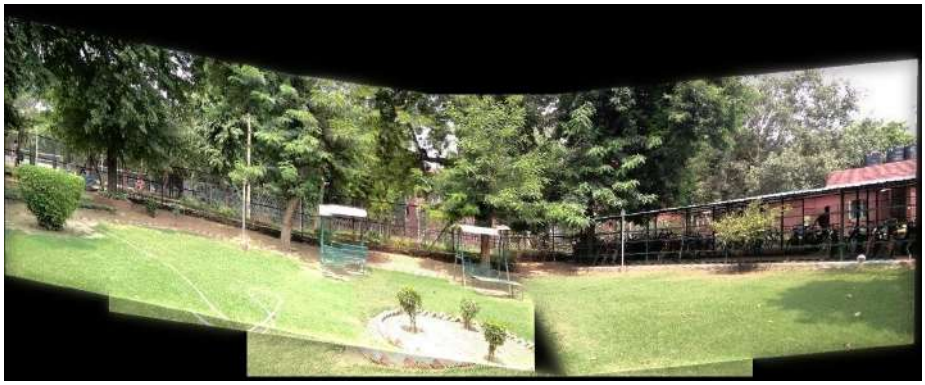


Dataset 5 (2-D Stitching)

Laplacian blending didn't work very well when there is a large exposure difference between images.

1.5 Perspective to Affine Transformation

While using Affine Transformations, we can deal with the problem of images stretching too much on the sides but it will be difficult to learn accurate transformations. The Affine Transformation has inherent property of maintaining parallel lines due to which they can't be warped to get aligned. Hence, it is not suitable for panorama stitching in our formulation which is also evident below.



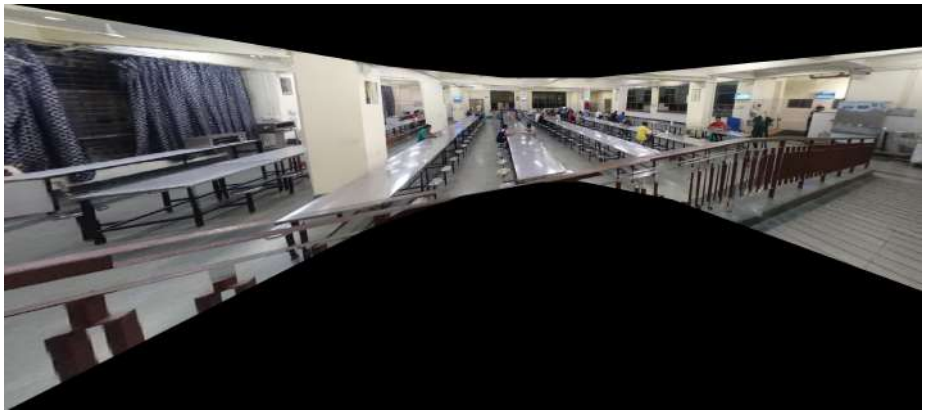
Dataset 1

Dataset 2

Dataset 3

Dataset 4

1.6 Out Sample Panorama Examples



Dataset with 7 images showing good results

Dataset with 5 images showing bad results

In the first dataset above, the contrast difference between consecutive images is low due to uniform lighting and the number of samples for panning this angle is also large, this is the reason we get such good results here.

In the latter case, the lighting difference is high across views and hence visible seams. For some of the views, the homography calculations are error prone which are attributed to high angle difference between a consecutive pair which gives wrong homography calculation.