Panorama Creation

Dataset

- 5 sets of 8-9 images each are captured.
- While capturing the images in a set, the camera is only rotated and not translated.
- The scene captured is static.
- There is more than 30% overlap between consequent images.

Algorithm

The algorithm consists of 5 main steps:

1. Detect keypoints and find local invariant descriptors.
2. Find k best matches for each descriptor of a query image (kNN match).
3. Estimate homography between matched feature vectors. RANSAC is used to find robust matches.
4. Applying warping transformation using the homography matrix.
5. Stitching the images together.

- The images in dataset are of size (3000,4000). They are converted to grayscale and resized to (300,400).
- SURF feature descriptors and keypoints are computed for each image.
- Two images are considered which need to be stitched – 'img1' and 'img2'. It is assumed that they are captured from left to right.

Left

Right

Two image panorama

- For each feature descriptor of img1, Euclidean distance is calculated with all feature descriptors of img2 and best two are returned. David Lowe's ratio test is used to remove the false positives form the matches. Ratio used = 0.75.
- The keypoints corresponding to the descriptors which pass the David Lowe's test are obtained. RANSAC is used to find the best 4 matches among them (best is decided by computing distance of projected points of img1 and points of img2). 4 keypoints are randomly sampled from the list and homography is computed.
- Final panorama is created by combining the panoramas to the left and right of the middle image. The middle image is used in both left and right panorama.
- Right panorama – img2 is warped using the homography matrix computed. Size of warped image is double in width than original image. Output image is generated by placing img1 into warped image and removing extra black area. Output image is used as img1 for next iteration where img2 is next right image.

Right Panorama

- Left panorama – img1 is warped using inverse of homography matrix computed. Output is generated similar to right panorama but by placing img2 in warped image.

Left Panorama

Complete Panorama

Results:

References:

- https://stackoverflow.com/questions/53861636/how-can-i-implement-opencvs-perspectivetransform-in-python
- https://kushalvyas.github.io/stitching.html
- https://www.pyimagesearch.com/2016/01/11/opencv-panorama-stitching/
- https://github.com/anas-899/understanding_homography_estimation_by_ransac

- https://github.com/opencv/opencv/blob/master/modules/imgproc/src/imgwarp.cpp