

CS174B Assignment 2 Report

Introduction

In this assignment, feature extraction and matching is performed to find matches between three images. Using the matching point, geometric relation between images can be deduced. Transformation based on geometric relation is then applied to images, so that images can be stitched to together.

Main Component

1. Correspondence

Corner Point Extraction

I used `cornermetric` in matlab to find corner points, and I filter these corner points using a method provided online.

Feature Extraction

Feature Description Extraction is done based on a method provided online, calling `extractFeatureDescriptors` will extract descriptor based on points provided.

Feature Matching

Feature matching is done by calculating the SSD difference between every descriptor matrix in two images. Those with smallest SSD difference will be chosen as candidates of correspondent points.

2. Model Estimation

Homography Transformation

Since the images taken have homography relation (we are going to make a panorama using these images), we calculate the homography transformation matrix between two images provided points.

Calling `getHomographyTransform` will generate a homography matrix for you based on source points and target points. To find Homography Transformation matrix is to find a solution that satisfies:

$$[x_2, y_2, 1]' \sim H * [x_1, y_1, 1]$$

With at least 4 set of points provided, Homography Transformation matrix can be calculated. After the application of transformation matrix to the source image, image stitching can be preliminarily done.

3. Robust Model Estimation

Homography with RANSAC

Since there might be errors when putative matching is performed, a RANSAC algorithm is needed to get rid of outliers.

In the code, `ransac_projective` takes in source points and target points, and use `getInliers` function to get rid of outlier points. Finally it uses inlier points to calculate Homography Transformation Matrix.

`getInlier` function is quite straightforward. It takes in source point and target points, and calculate homography transformation matrix based on all these points, and check whether the difference between the transformed points and target points location is under the threshold value. If it is, we consider that set of points as an inlier match.

Inlier points will be returned and the final Homography Transformation Matrix will be calculated based on these.

4. Stitching

Stitching is done with the aids of MATLAB's example code in stitching images.

5. Result

The Image Mosaic result is shown below:

