DVE HW2 Report

Chen-Hsi Chang, Chin-Hua Hu

Project Description

In this project, we implement parts of the "Recognising Panoramas" paper to do image stitching. Our implementation includes feature detection, feature matching, image matching, and blending.

Method

I. Feature Detection

We implement Harris corner detection, which pratically proves to have the similar performance as “autostitch” does.
First, we calculate all the derivatives of images and then compute the products of derivatives at each pixel.

$$M(x,y)=\begin{bmatrix} S_{x^2}(x,y) & S_{xy}(x,y) \\ S_{xy}(x,y) & S_{y^2}(x,y) \end{bmatrix}$$

$$R=\det M-k\left(\text{trace}M\right)^2$$

Aftering getting all Harris response at each pixel, we use non-maximum suppression to find local maximum as Harris corners. As for descriptors, we use normalized pixels around to represent it.

II. Feature Matching

Here, we calculate the L2 norm of feature descriptor between every point in two images. Each point in image1 obtain the L2 norm of it and all the point in image2. We calculate the ratio of the closet L2 norm and the second closet L2 norm, and the point with the closet L2 norm is regarded as the matched point if the ratio < 0.8.

III. Image Matching:

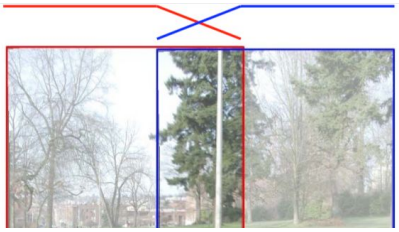
- **Projection**: First, we do the cylindrical projection to obtain the projected images in cylindrical space.

- **Feature Matching**: We use the feature matching method described above to find the matched point pairs of each two consecutive image pairs.
- **RANSAC**: We use ransac to filter out some false matched point pairs.
- **Alignment**: We use the matched point to find the parameter of translation matrix m1 and m2 by finding the minimum of the following formula.

$$E = \sum_{i=1}^{n} \left[\left(m_1 + x_i - x_i^{'} \right)^2 + \left(m_2 + y_i - y_i^{'} \right)^2 \right]$$

IV. Blending:

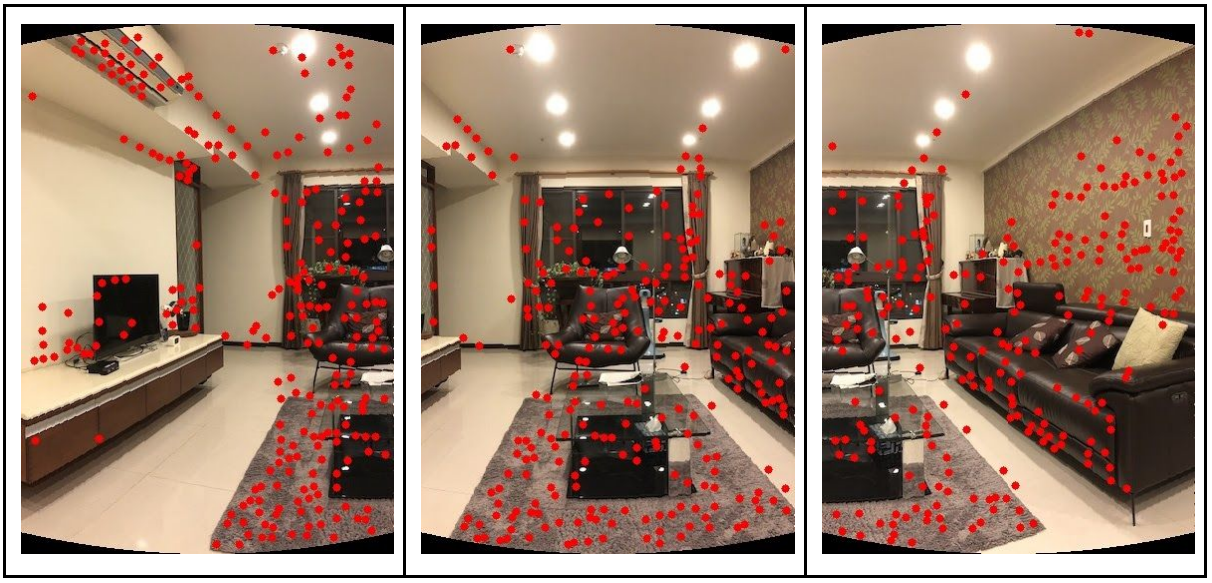
Finally, we apply a mask on the ovelapped region to smooth out the ovelapped region.



Result

Taking Photos :

Harris corners (picked 3 photos) :



Panoramic image we get :