Project 1: My AutoPano

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***Abstract*—This project shows methods to create a panorama by exploring ways to generate a homography using both classical and deep learning based methods. We see how the deep learning models abstract out many of the classical models for corner detection, feature descriptors and matching. The output of both approaches is used to stitch and create a seamless panorama**

I. Phase I: Classical Approach

In this part of the project, we explore the classical methods to create a panoroma by stiching the image sequences. Each subsection explains in detail about the methodology followed and subsequent output of the images

A. Corner Detection

Idea is to draw relationship between how images using a set of features. Corners are best way to do that since they are visible from many different views. We can detect as many corners are possible from the given image and compare the features across the images. This comparison would tell us how the images are geometrically related to one another. For corner detection, we used OpenCV's Harris corners detection functionality. Following parameters are for corner detection are found to be optimal; kernel size 7, harris K parameter 0.04, harris sobel kernel size 11. Figure 1 show the corners detected across the images.

(a) Train Set3 2 (b) Harris Corners

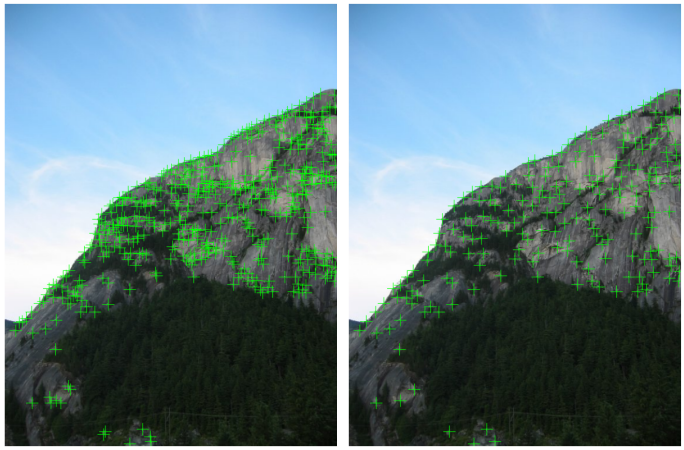
Fig. 1: image corners

B. Adaptive Non Maximal Suppression

Now that we have detected corners in each image, we need to find out "best" corners. Best corners are those which stand out among the local peer corners. Moreover, we want these corners evenly spread across the image so that we can get better homographies. To this end, we use Adaptive Non Maximal Suppression (ANMS) which does 2 parts

1) take local maxima over corners
2) consider only those corners which have a larger distance from relatively stronger corners

Point 2 is basically the main part of the ANMS which gives evenly spread out corners from a set of "clusters". Problem with harris corners or any other corner detector is that they detect a cluster of corners instead of just one corner. This makes sense since a corner is a set of pixels and based on resolution of the image many pixels can be accurately called corners. Even if we do local maxima of the image, the cluster might still persist. To circumvent this problem ANMS takes a point which is maximally distant to the other stronger corners and when we take sorted N_{best} corners we will be able to get a point from cluster. Figure 2 shows how the ANMS has decreased the cluster of corners to good corners.



(a) Test Set 2 Img 1 Harris Corners (b) ANMS output

Fig. 2: ANMS output

C. Feature Descriptor

We need to give each corner an "identity" in order to compare them across the images. This identity is called Feature Descriptor. Our appraoch to derive this unique identification is as follows

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