System overview

The model is mainly built with openCV to detect lens flare in the images.

Outline of algorithm

The model can deal with two kinds of images which has lens flare, the first one is lens flares with small blobs, the second one is lens flare with very strong light. At first, the model will preprocess the image, blur the image and convert the image to grayscale. And then the model set the threshold (lightness 220) and inverse the binary to filter the noise and leave the blob (compare.jpg). After the preprocess, the canny edge detector is used to detect the ellipse blob. In this part, the detector may detect some ellipse blobs which are not produced by lens flare, I tune the length-width-ratio to less than 2 and fitted pixel in the contour to 150 to filter some long and narrow ellipse blobs (noise.jpg) and get the desired ellipse blobs (mark the blob.jpg). If these blobs produced by lens flare are detected (mark the blob.jpg), the model decides the lens flare occurs. For those lens flare with very strong light, the model checks the mean lightness of the whole images. If the mean lightness of image is bigger than a threshold (150), the model decides the lens flare occurs.

Intuition behind the algorithm

The lens flare happens through light scattered by the imaging mechanism itself, the reason for these images is internal and scattering from lens. And the lens flare always comes with the small blobs. This phenomenon can be detected by check the appearance of these small blobs. For some images that has strong lens flare phenomenon, we can not see the blob clearly. For this situation, since the strong light in the whole image which prevents us from seeing the object, we can detect the mean lightness of the whole image to detect the lens flare.

Summary of results

This model can detect 18 out 25 lens flare images, which has 72% accuracy. The main reason for some lens flare images can not be detected is that the small blobs are not very clear.

The model can detect 24 out of 25 good images, which has 96% accuracy. The only one image that is classified to the lens flare image is because the model detects an object which has very similar shape to the lens flare blob.

Potential future work

At the beginning, I got two ideas to detect the lens flare. The first one is to analyze the sunlight part. I can separate the sun light edge and rock edge by edge detection, if the sun light cover or penetrate the rock, we can decide the lens flare happens. Another idea is to use the machine learning, like CNN. The features can be lightness, light position, if blob occurs and so on. The only problem for this method is few training data. The method to deal with it can be flipping, rotation, scaling, resizing and so on. Another method is transfer learning. We can use the model built on other training data and only change the last few layers, like classifier. So more time given, I will try these methods to enhance the model.