Automatic Lens Smear Detection

Juhi Deshpande (A20430435)
FNU Monishaa Arulalan(A20432700)
Sonali Deshpande(A20428066)

Problem Statement

Input : A sequence of Street view images.

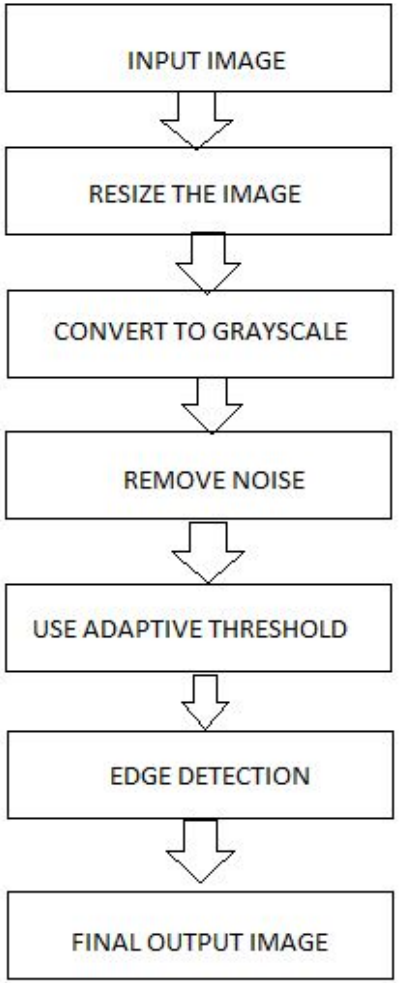
Output : A mask on the smear on the lens.

Approach

The following steps have been used to solve this challenge.

- Step 1: Collect the sequence of images and perform image averaging on these images. Then smoothen them using Gaussian filter/Gaussian blur.
- Step 2: Using the Gaussian filtered image as input apply adaptive thresholding to it.
- Step 3: Detect the edges of the smear using Canny Edge detector.
- Step 4: : Draw contours across the edges detected to highlight the smear.

Block Diagram representing our approach:



STEP 1 : Image Averaging

- ➔ Image Averaging is used to eliminate pixel vibrations or random noise caused due to random fluctuations in the video or a captured image.
- ➔ The algorithm operates by computing an average or arithmetic mean of the intensity values for each pixel position in a set of captured images from the same scene or viewfield.
- ➔ Hence, in the final image the noise can be significantly reduced, creating smoother, less grainy images.
- ➔ It increases the signal to noise ratio(SNR) enhancing the bit depth of the image, making the signal component to have a strong influence over the noise component.

STEP 2: Adaptive Threshold

- ➔ In simple thresholding, if a given pixel has value greater than the threshold it will be given white colour otherwise it is assigned black colour
- ➔ But due to different lighting conditions in different areas we use adaptive thresholding
- ➔ Adaptive thresholding calculates dynamically threshold for the overall image
- ➔ It takes grayscale or colour image as an input and gives the output as a binary image that calculates the threshold for the image

Step 3: Edge Detection

- ➔ Canny edge detection algorithm is used widely in computer vision systems and reduce the amount of data to be processed
- ➔ cv2.Canny(arg1, arg2,arg3) is a function and it accurately identifies the image.
- ➔ The first argument is input image
- ➔ The second and third argument are minVal and maxVal.
- ➔ The next argument is the aperture size.It is the size of Sobel kernel used for find image gradients.

Optimize the Code

- If the Average Image and the Mask Image of a given folder of images such as cam_0/ cam_1/ cam_2/ cam_3/ cam_5 already exists, then we can use the existing average and mask images to find the smear on an image.
- Hence, if the mask for that particular folder exists, then if will display:-

```
C:\Users\sonal\Documents\GSV>python pass.py C:/Users/sonal/Documents/GSV/sample_drive/cam_0
Processing images from the path provided for smear detection
No of files are :- 4240
Mean Image was found filename :- Mean_cam_0.jpg
Smear is detected for source.
```

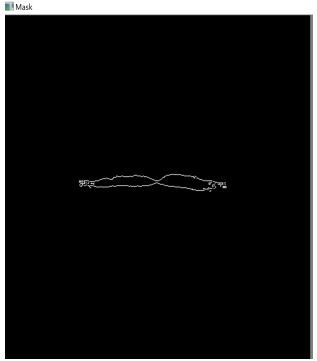
Final Result

(These images are taken for cam_0 folder)

Average Image

Gaussian image

Adaptive Threshold



Edge Detection

Final Output :