Introduction

- Dirt or smear on camera lenses are important artifacts in digital imaging system.
- Since cleaning the lens is impractical for existing images, we need to detect the smear and make a mask of the smear on each lens.

Method

- Input: a sequence of street view images
- Use Gaussian filter to smooth the images and eliminate noise
- Add all the images together and convert the average image to gray scale
- Binary the image using cv2.adaptiveThreshold which gives adaptive threshold in one image and has a better performance than using a fixed value of threshold.
- Detect edges with canny operator. There are two threshold in canny algorithm which are minimum and maximum threshold.

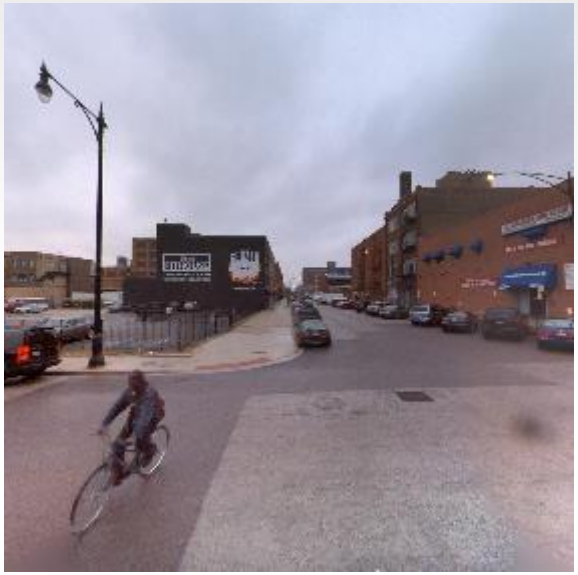
Method

- Use cv2.findContours to find contours of the image
- Use contours area and tangential circle similarity to find the smear area on the lens and make a mask of it.

Results

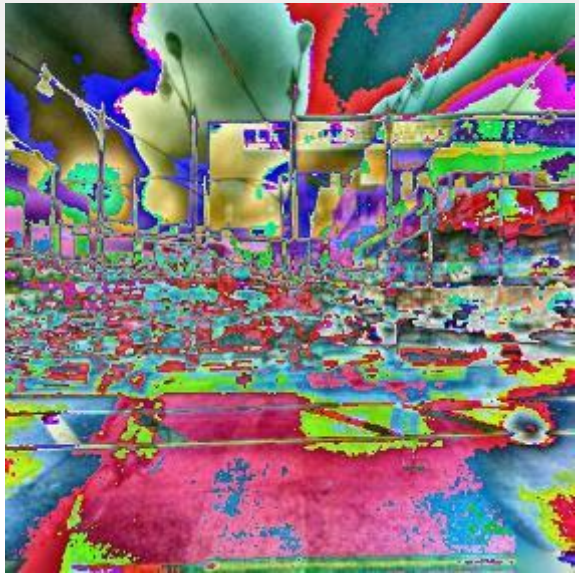
- Inputs





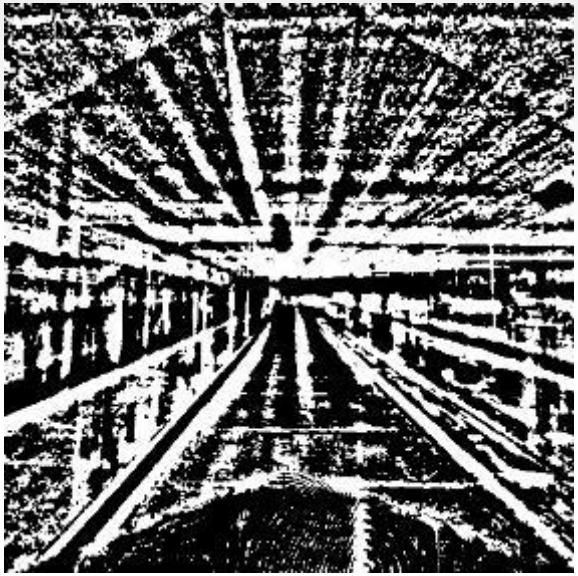
Results

- Average images



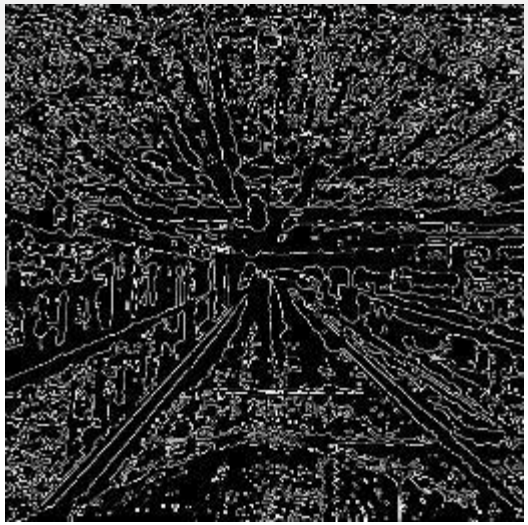
Results

- Binary images

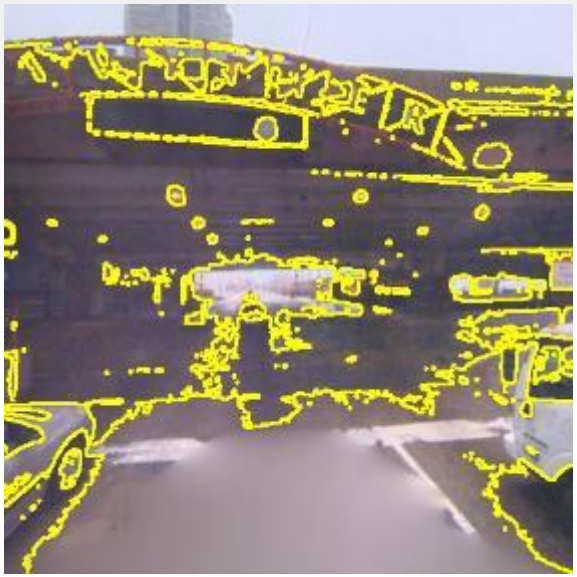

Results

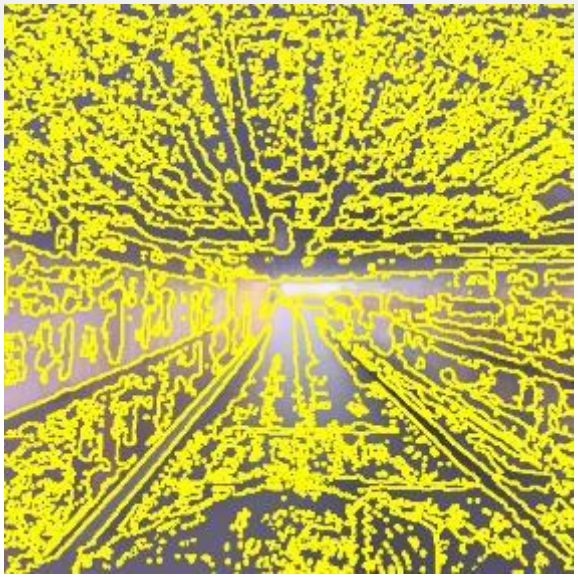
- Edge detection

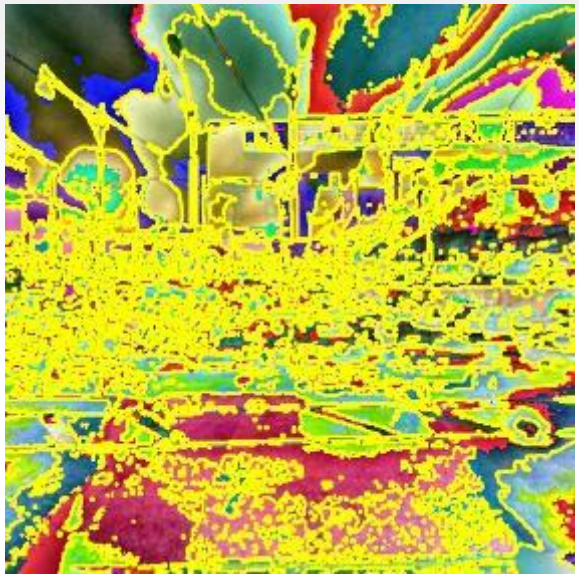




Results

- Contours

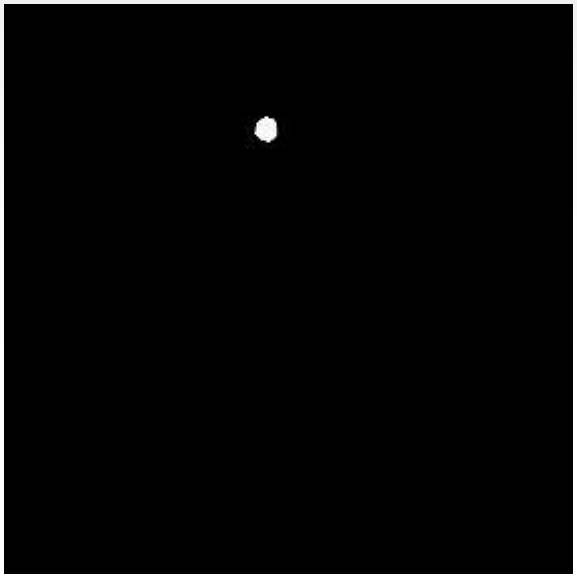
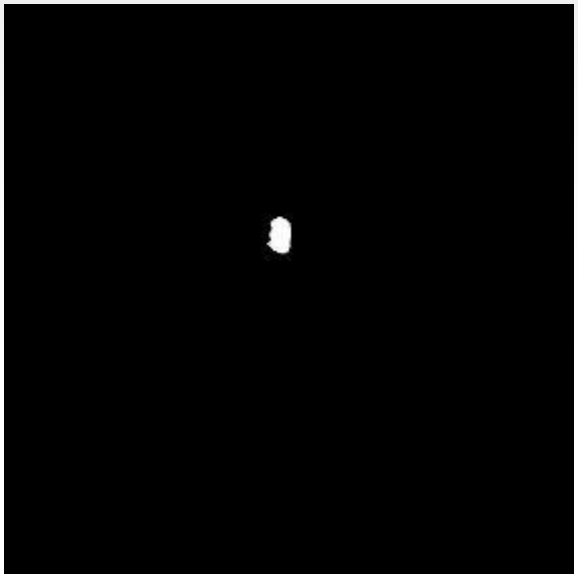
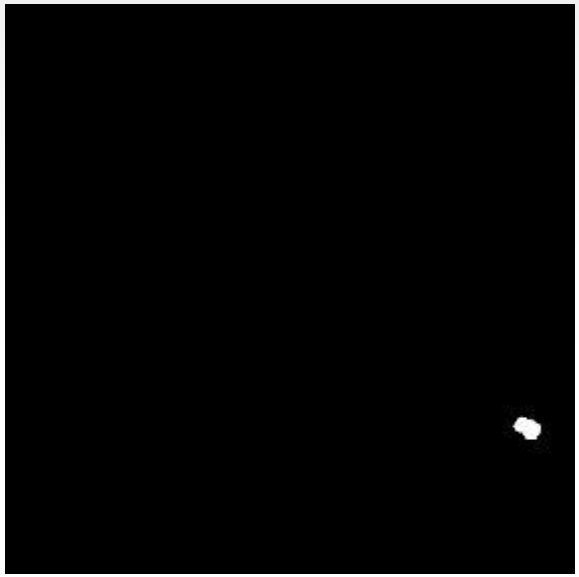






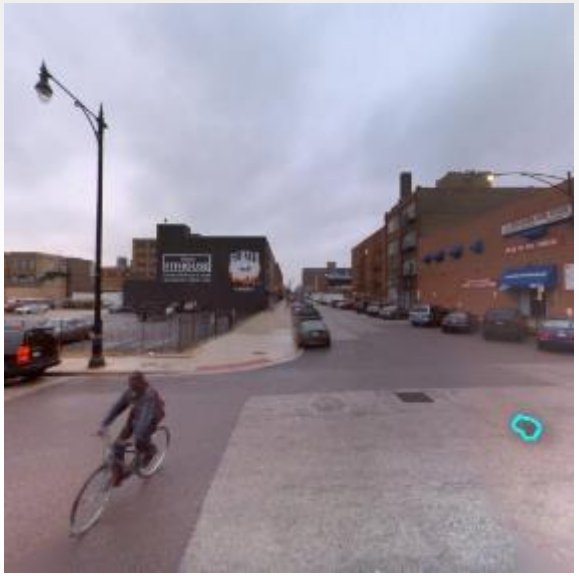
Results

- Mask

Results

- Contours of smear



Analysis and Conclusion

- In the process of getting the final result, we need to fine tuning parameters like the parameters in canny edge detection, image binarization and in finding the specific contour of the smear.
- For different lens, the performance of the mask varies. We need to find appropriate parameters to find different types of smear on the lens.
- The results are good and we successfully detect the smears on different lens. The region is circled in blue.