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**Assignment -1 Detection of smear in the camera lens**

**Understanding:**

We need to analyse all the camera photos separately and find out which camera has a smear (Dust or dirt on the cam lens). We need to find a method and implement it through code.

**Packages required to run the code:**

* Python 2.7 or higher
* Opencv 2.4.13 or higher
* Numpy

**Approach 1:**

Initially we were on a wrong track, we tried to use canny and contour to identify the smear and draw as we have gone through few documentations in the internet.

**Approach 2:**

1. We planned to take average of all the images to make the smear region more predominate as every photo will have smear in the same pixel.
2. Though we found average image, there are plenty of difference between the pixel colours.
3. So, we want minimize the number to colour variations and noise, so we converted the average to black white (Grey image)
4. Now the smear region is clear visible, so we can draw the edge with cv2.canny and contour function of Opencv package.
5. But we were not able to clearly find the smear using this version of code. As we could find more than one contours in the image.

**Final Approach:**

1. Same as previous approach we planned to take average of all images of a camera.
2. Then we realised that canny and contour method can be used in normal image(average).
3. We then define the area of the smear using the smear characteristic function. This is done because an image will have more than one contour, so the contour will be having some characteristics.

To eliminate the minute contour or larger contour, found in the mask. We filter them.

1. If at all we find any contour in the previous step after filtering. In the next step, we will be drawing the contour on any one the image in the directory using the cv2.contour.draw function

**Characteristic assumption: After seeing the images of all camera and average image, it is evident that smear can’t be huge. So, with this assumption we have defined a characteristic to the smear.**

1. If the smear is detected, we use one of the photo of the camera to highlight the smear.
2. We have also shown the mask for the smear. To display where the smear is present in the camera

**Result:**

We have shown the result through two images, one is mask image (smear region) and the image with smear highlighted with a coloured circle(red).

We have created, average image for all the cameras, and final & masked image for the camera which have smear.

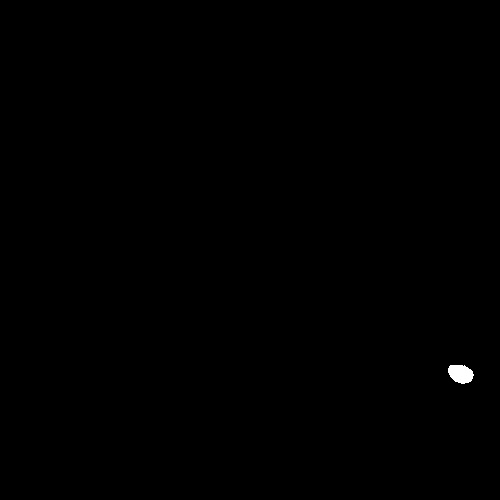
**Outcome:**

After seeing all the average image, final and masked image. The smear is detected in cam\_3. The below image with shows the smear, which is highlighted in red.



As Per the above approach we detected smear on cam\_3. As the contour in the other camera are huge and it is not possible to have that huge smear as image in all the camera are clear with very little noise. So it is not possible fir any camera to have big smear.

**Mask Image:**

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**Reference:**

These are few reference, we referred for the approach we followed part from the refence professor gave.

<http://docs.opencv.org/trunk/da/d22/tutorial_py_canny.html>

<https://pythonprogramming.net/canny-edge-detection-gradients-python-opencv-tutorial/>

<http://docs.opencv.org/3.2.0/d4/d73/tutorial_py_contours_begin.html>

<http://miriamposner.com/classes/medimages/3-use-opencv-to-find-the-average-color-of-an-image/>