In [1]:
```
# import the necessary packages
import numpy as np
import cv2
import math
import sys
import pandas as pd #To work with Dataframe
import matplotlib.pyplot as plt #To plot the Images
import os
import warnings
warnings.filterwarnings("ignore", category=FutureWarning)
from sklearn.neighbors import KNeighborsClassifier
from sklearn.linear_model import LogisticRegression
import skimage.filters.rank
import skimage.morphology
import skimage.io
```

In [2]:
```
##################******** EDA  *****  EDA ***** EDA  ***** EDA  ###############
#############
```

In [56]:
```
def detection_of_lensflare(file):
# load the image#
    image = cv2.imread('C:/Users/Anm Faisal/Flare image/flare_train/flare/G001
3390.JPG')
    # blur the image to make it easier to detect objects
    blur_image = cv2.medianBlur(image, 3)
    # convert the image to grayscale
    gray = cv2.cvtColor(blur_image, cv2.COLOR_BGR2GRAY)
    # set the lightness threshold to filter the lenflare (small blob)
    ret, thresh2 = cv2.threshold(gray, 220, 255, cv2.THRESH_BINARY_INV)
    img = thresh2
    # use canny to detect the lens flare edge
    imgray = cv2.Canny(img, 600, 100, 3)
    # set the threshold
    ret, thresh = cv2.threshold(imgray, 127, 255, cv2.THRESH_BINARY)
    # find the lensflare contour
    contours, hierarchy = cv2.findContours(thresh, cv2.RETR_TREE, cv2.CHAIN_AP
PROX_SIMPLE)
    for cnt in contours:
        # set the fit number
        if len(cnt) > 150:
            S1 = cv2.contourArea(cnt)
            ell = cv2.fitEllipse(cnt)
            S2 = math.pi*ell[1][0]*ell[1][1]
            if (S1/S2) > 0.2 and ell[1][0] / ell[1][1] < 2 and ell[1][1] / ell
[1][0] < 2:
                # lensflare
                return 1
    # no lensflare
        return 0
```

In [4]:
```
print(os.listdir("C:/Users/Anm Faisal/Flare image/flare_train/flare"))
```

```
['G0013390.JPG', 'G0013459.JPG', 'G0014017.JPG', 'G0014057.JPG', 'G0014063.JP
G', 'G0014099.JPG', 'G0014732.JPG', 'G0014758.JPG', 'G0014793.JPG', 'G001481
7.JPG', 'G0014859.JPG', 'G0014862.JPG', 'G0014866.JPG', 'G0014894.JPG', 'G001
4973.JPG', 'G0014979.JPG', 'G0015010.JPG', 'G0015053.JPG', 'G0015057.JPG', 'G
0015071.JPG', 'G0015072.JPG', 'G0015106.JPG', 'G0015116.JPG', 'G0015120.JPG',
'G0015139.JPG', 'G0015142.JPG', 'G0015150.JPG', 'G0015154.JPG', 'G0015159.JP
G', 'G0015191.JPG', 'G0015328.JPG', 'G0015414.JPG', 'G0015550.JPG', 'G001565
5.JPG', 'G0015673.JPG', 'G0045817.JPG', 'G0045833.JPG', 'G0045835.JPG', 'G004
5844.JPG', 'G0056351.JPG']
```

In [5]:
```
kk = ['G0013390.JPG', 'G0013459.JPG', 'G0014017.JPG', 'G0014057.JPG', 'G001406
3.JPG', 'G0014099.JPG',
      'G0014732.JPG', 'G0014758.JPG', 'G0014793.JPG', 'G0014817.JPG', 'G001485
9.JPG', 'G0014862.JPG',
      'G0014866.JPG', 'G0014894.JPG', 'G0014973.JPG', 'G0014979.JPG', 'G001501
0.JPG', 'G0015053.JPG',
      'G0015057.JPG', 'G0015071.JPG', 'G0015072.JPG', 'G0015106.JPG', 'G001511
6.JPG', 'G0015120.JPG',
      'G0015139.JPG', 'G0015142.JPG', 'G0015150.JPG', 'G0015154.JPG', 'G001515
9.JPG', 'G0015191.JPG',
      'G0015328.JPG', 'G0015414.JPG', 'G0015550.JPG', 'G0015655.JPG','G001567
3.JPG', 'G0045817.JPG',
      'G0045833.JPG', 'G0045835.JPG', 'G0045844.JPG', 'G0056351.JPG']


flr=[]
for k in kk:
    img1 = cv2.imread('C:/Users/Anm Faisal/Flare image/flare_train/flare/'+ k)

    hls = cv2.cvtColor(img1, cv2.COLOR_BGR2HLS)
    h, l, s = cv2.split(hls)

    print('image number', k)
    print('-------------------------------------')
    print('Mean lightness = %s' %np.mean(l))
    print('-------------------------------------')
    image = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)
    print ( image.size)
    plt.imshow(image,'gray')
    n_white_pix = np.sum(image == 255)
    n_black_pix = np.sum(image == 0)
    print('Number of white pixels:', n_white_pix)
    print('Number of black pixels:', n_black_pix)

    if np.mean(l) > 100:
    # lensflare
        flare= 1
    # use detection_of_lensflare model to detect
    else:
        flare = detection_of_lensflare("C:/Users/Anm Faisal/Flare image/flare_
train/flare/" + k)
        flr.append(flare)
    print ((flare),k)

    flr
```

```
image number G0013390.JPG
--------------------------------------
Mean lightness = 160.40890625
--------------------------------------
480000
Number of white pixels: 61368
Number of black pixels: 0
1 G0013390.JPG
image number G0013459.JPG
--------------------------------------
Mean lightness = 35.801920833333334
--------------------------------------
480000
Number of white pixels: 3417
Number of black pixels: 0
0 G0013459.JPG
image number G0014017.JPG
--------------------------------------
Mean lightness = 64.99509166666667
--------------------------------------
480000
Number of white pixels: 7050
Number of black pixels: 0
0 G0014017.JPG
image number G0014057.JPG
--------------------------------------
Mean lightness = 94.91003541666667
--------------------------------------
480000
Number of white pixels: 14518
Number of black pixels: 0
0 G0014057.JPG
image number G0014063.JPG
--------------------------------------
Mean lightness = 121.38447083333334
--------------------------------------
480000
Number of white pixels: 27605
Number of black pixels: 0
1 G0014063.JPG
image number G0014099.JPG
--------------------------------------
Mean lightness = 95.14734375
--------------------------------------
480000
Number of white pixels: 2546
Number of black pixels: 0
0 G0014099.JPG
image number G0014732.JPG
--------------------------------------
Mean lightness = 119.37539375
--------------------------------------
480000
Number of white pixels: 11008
Number of black pixels: 0
1 G0014732.JPG
image number G0014758.JPG
```

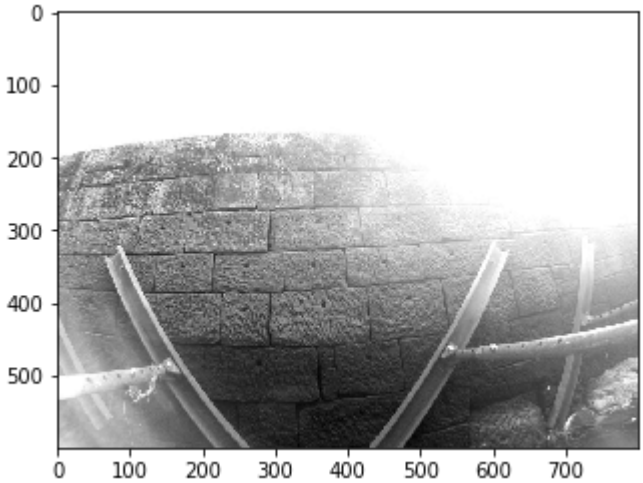
```
-------------------------------------
Mean lightness = 104.24903125
-------------------------------------
480000
Number of white pixels: 30962
Number of black pixels: 0
1 G0014758.JPG
image number G0014793.JPG
-------------------------------------
Mean lightness = 216.42874375
-------------------------------------
480000
Number of white pixels: 130094
Number of black pixels: 0
1 G0014793.JPG
image number G0014817.JPG
-------------------------------------
Mean lightness = 101.06469375
-------------------------------------
480000
Number of white pixels: 16590
Number of black pixels: 0
1 G0014817.JPG
image number G0014859.JPG
-------------------------------------
Mean lightness = 212.22756041666668
-------------------------------------
480000
Number of white pixels: 136610
Number of black pixels: 0
1 G0014859.JPG
image number G0014862.JPG
-------------------------------------
Mean lightness = 191.07756041666667
-------------------------------------
480000
Number of white pixels: 77196
Number of black pixels: 0
1 G0014862.JPG
image number G0014866.JPG
-------------------------------------
Mean lightness = 77.26800833333333
-------------------------------------
480000
Number of white pixels: 12334
Number of black pixels: 0
0 G0014866.JPG
image number G0014894.JPG
-------------------------------------
Mean lightness = 127.46912083333333
-------------------------------------
480000
Number of white pixels: 27614
Number of black pixels: 0
1 G0014894.JPG
image number G0014973.JPG
-------------------------------------
```

```
Mean lightness = 226.51151875
-------------------------------------
480000
Number of white pixels: 126474
Number of black pixels: 0
1 G0014973.JPG
image number G0014979.JPG
-------------------------------------
Mean lightness = 90.02247916666667
-------------------------------------
480000
Number of white pixels: 50
Number of black pixels: 0
0 G0014979.JPG
image number G0015010.JPG
-------------------------------------
Mean lightness = 119.79935
-------------------------------------
480000
Number of white pixels: 18500
Number of black pixels: 0
1 G0015010.JPG
image number G0015053.JPG
-------------------------------------
Mean lightness = 104.05072708333333
-------------------------------------
480000
Number of white pixels: 18925
Number of black pixels: 0
1 G0015053.JPG
image number G0015057.JPG
-------------------------------------
Mean lightness = 98.14736666666667
-------------------------------------
480000
Number of white pixels: 17423
Number of black pixels: 0
0 G0015057.JPG
image number G0015071.JPG
-------------------------------------
Mean lightness = 87.0586125
-------------------------------------
480000
Number of white pixels: 9707
Number of black pixels: 0
0 G0015071.JPG
image number G0015072.JPG
-------------------------------------
Mean lightness = 88.1300125
-------------------------------------
480000
Number of white pixels: 14206
Number of black pixels: 0
0 G0015072.JPG
image number G0015106.JPG
-------------------------------------
Mean lightness = 91.20447708333333
```

```
--------------------------------------
480000
Number of white pixels: 12488
Number of black pixels: 0
0 G0015106.JPG
image number G0015116.JPG
--------------------------------------
Mean lightness = 97.45032083333334
--------------------------------------
480000
Number of white pixels: 14400
Number of black pixels: 0
0 G0015116.JPG
image number G0015120.JPG
--------------------------------------
Mean lightness = 104.4253625
--------------------------------------
480000
Number of white pixels: 23786
Number of black pixels: 0
1 G0015120.JPG
image number G0015139.JPG
--------------------------------------
Mean lightness = 102.18053958333333
--------------------------------------
480000
Number of white pixels: 19173
Number of black pixels: 0
1 G0015139.JPG
image number G0015142.JPG
--------------------------------------
Mean lightness = 104.58686875
--------------------------------------
480000
Number of white pixels: 22879
Number of black pixels: 0
1 G0015142.JPG
image number G0015150.JPG
--------------------------------------
Mean lightness = 101.86311041666667
--------------------------------------
480000
Number of white pixels: 20930
Number of black pixels: 0
1 G0015150.JPG
image number G0015154.JPG
--------------------------------------
Mean lightness = 92.25225
--------------------------------------
480000
Number of white pixels: 11685
Number of black pixels: 0
0 G0015154.JPG
image number G0015159.JPG
--------------------------------------
Mean lightness = 134.35254166666667
--------------------------------------
```

```
480000
Number of white pixels: 17712
Number of black pixels: 0
1 G0015159.JPG
image number G0015191.JPG
--------------------------------------
Mean lightness = 95.9558125
--------------------------------------
480000
Number of white pixels: 22827
Number of black pixels: 0
0 G0015191.JPG
image number G0015328.JPG
--------------------------------------
Mean lightness = 55.58915208333333
--------------------------------------
480000
Number of white pixels: 1141
Number of black pixels: 78
0 G0015328.JPG
image number G0015414.JPG
--------------------------------------
Mean lightness = 123.415625
--------------------------------------
480000
Number of white pixels: 45354
Number of black pixels: 0
1 G0015414.JPG
image number G0015550.JPG
--------------------------------------
Mean lightness = 217.60659166666667
--------------------------------------
480000
Number of white pixels: 133636
Number of black pixels: 0
1 G0015550.JPG
image number G0015655.JPG
--------------------------------------
Mean lightness = 37.687814583333335
--------------------------------------
480000
Number of white pixels: 62
Number of black pixels: 283
0 G0015655.JPG
image number G0015673.JPG
--------------------------------------
Mean lightness = 108.05534166666666
--------------------------------------
480000
Number of white pixels: 26512
Number of black pixels: 0
1 G0015673.JPG
image number G0045817.JPG
--------------------------------------
Mean lightness = 121.66043125
--------------------------------------
480000
```

```
Number of white pixels: 36693
Number of black pixels: 0
1 G0045817.JPG
image number G0045833.JPG
--------------------------------------
Mean lightness = 84.52080208333334
--------------------------------------
480000
Number of white pixels: 11836
Number of black pixels: 0
0 G0045833.JPG
image number G0045835.JPG
--------------------------------------
Mean lightness = 130.44623125
--------------------------------------
480000
Number of white pixels: 43221
Number of black pixels: 0
1 G0045835.JPG
image number G0045844.JPG
--------------------------------------
Mean lightness = 99.184575
--------------------------------------
480000
Number of white pixels: 27314
Number of black pixels: 0
0 G0045844.JPG
image number G0056351.JPG
--------------------------------------
Mean lightness = 219.78282083333335
--------------------------------------
480000
Number of white pixels: 173028
Number of black pixels: 0
1 G0056351.JPG
```



In [6]:
```
print(os.listdir("C:/Users/Anm Faisal/Flare image/good_train/good"))
```

```
['G0011262.JPG', 'G0011540.JPG', 'G0011953.JPG', 'G0013475.JPG', 'G0013535.JP
G', 'G0014071.JPG', 'G0014136.JPG', 'G0014859.JPG', 'G0014860.JPG', 'G001488
5.JPG', 'G0015551.JPG', 'G0015658.JPG', 'G0015691.JPG', 'G0015777.JPG', 'G003
4158.JPG', 'G0034609.JPG', 'G0035062.JPG', 'G0035096.JPG', 'G0035144.JPG', 'G
0035148.JPG', 'G0035149.JPG', 'G0035239.JPG', 'G0035241.JPG', 'G0035251.JPG',
'G0035263.JPG', 'G0045857.JPG', 'G0045867.JPG', 'G0055569.JPG', 'G0055678.JP
G', 'G0055679.JPG', 'G0055680.JPG', 'G0055708.JPG', 'G0056025.JPG', 'G005606
6.JPG', 'G0056111.JPG', 'G0056281.JPG', 'G0056282.JPG', 'G0056287.JPG', 'G005
6339.JPG', 'G0056423.JPG']
```

In [7]:
```
kk = ['G0011262.JPG', 'G0011540.JPG', 'G0011953.JPG', 'G0013475.JPG', 'G001353
5.JPG', 'G0014071.JPG',
      'G0014136.JPG', 'G0014859.JPG', 'G0014860.JPG', 'G0014885.JPG', 'G001555
1.JPG', 'G0015658.JPG',
      'G0015691.JPG', 'G0015777.JPG', 'G0034158.JPG', 'G0034609.JPG', 'G003506
2.JPG', 'G0035096.JPG',
      'G0035144.JPG', 'G0035148.JPG', 'G0035149.JPG', 'G0035239.JPG', 'G003524
1.JPG', 'G0035251.JPG',
      'G0035263.JPG', 'G0045857.JPG', 'G0045867.JPG', 'G0055569.JPG', 'G005567
8.JPG', 'G0055679.JPG',
      'G0055680.JPG', 'G0055708.JPG', 'G0056025.JPG', 'G0056066.JPG', 'G005611
1.JPG', 'G0056281.JPG',
      'G0056282.JPG', 'G0056287.JPG',
      'G0056339.JPG', 'G0056423.JPG']


flr=[]
for k in kk:
    img1 = cv2.imread('C:/Users/Anm Faisal/Flare image/good_train/good/'+ k)

    hls = cv2.cvtColor(img1, cv2.COLOR_BGR2HLS)
    h, l, s = cv2.split(hls)

    print('image number', k)
    print('-------------------------------------')
    print('Mean lightness = %s' %np.mean(l))
    print('-------------------------------------')
    image = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)
    print ( image.size)
    plt.imshow(image,'gray')
    n_white_pix = np.sum(image == 255)
    n_black_pix = np.sum(image == 0)
    print('Number of white pixels:', n_white_pix)
    print('Number of black pixels:', n_black_pix)

    if np.mean(l) > 100:
    # lensflare
        flare= 1
    # use detection_of_lensflare model to detect
    else:
        flare = detection_of_lensflare("C:/Users/Anm Faisal/Flare image/good_t
rain/good/" + k)
        flr.append(flare)
    print ((flare),k)

    flr
```

```
image number G0011262.JPG
--------------------------------------
Mean lightness = 73.10243958333334
--------------------------------------
480000
Number of white pixels: 5940
Number of black pixels: 87
0 G0011262.JPG
image number G0011540.JPG
--------------------------------------
Mean lightness = 169.78712291666668
--------------------------------------
480000
Number of white pixels: 137186
Number of black pixels: 0
1 G0011540.JPG
image number G0011953.JPG
--------------------------------------
Mean lightness = 81.56558125
--------------------------------------
480000
Number of white pixels: 25213
Number of black pixels: 1
0 G0011953.JPG
image number G0013475.JPG
--------------------------------------
Mean lightness = 50.95919583333333
--------------------------------------
480000
Number of white pixels: 0
Number of black pixels: 0
0 G0013475.JPG
image number G0013535.JPG
--------------------------------------
Mean lightness = 101.5407125
--------------------------------------
480000
Number of white pixels: 12075
Number of black pixels: 0
1 G0013535.JPG
image number G0014071.JPG
--------------------------------------
Mean lightness = 62.89904791666667
--------------------------------------
480000
Number of white pixels: 3861
Number of black pixels: 0
0 G0014071.JPG
image number G0014136.JPG
--------------------------------------
Mean lightness = 106.96696875
--------------------------------------
480000
Number of white pixels: 643
Number of black pixels: 2
1 G0014136.JPG
image number G0014859.JPG
```

```
--------------------------------------
Mean lightness = 89.81024583333334
--------------------------------------
480000
Number of white pixels: 8229
Number of black pixels: 6
0 G0014859.JPG
image number G0014860.JPG
--------------------------------------
Mean lightness = 97.2897125
--------------------------------------
480000
Number of white pixels: 29011
Number of black pixels: 4
0 G0014860.JPG
image number G0014885.JPG
--------------------------------------
Mean lightness = 108.6985875
--------------------------------------
480000
Number of white pixels: 51422
Number of black pixels: 0
1 G0014885.JPG
image number G0015551.JPG
--------------------------------------
Mean lightness = 94.43751041666667
--------------------------------------
480000
Number of white pixels: 7994
Number of black pixels: 0
0 G0015551.JPG
image number G0015658.JPG
--------------------------------------
Mean lightness = 34.15229791666667
--------------------------------------
480000
Number of white pixels: 2506
Number of black pixels: 343
0 G0015658.JPG
image number G0015691.JPG
--------------------------------------
Mean lightness = 31.33155
--------------------------------------
480000
Number of white pixels: 267
Number of black pixels: 253
0 G0015691.JPG
image number G0015777.JPG
--------------------------------------
Mean lightness = 48.5703125
--------------------------------------
480000
Number of white pixels: 2139
Number of black pixels: 248
0 G0015777.JPG
image number G0034158.JPG
--------------------------------------
```

```
Mean lightness = 102.50354583333333
-------------------------------------
480000
Number of white pixels: 1461
Number of black pixels: 13
1 G0034158.JPG
image number G0034609.JPG
-------------------------------------
Mean lightness = 73.60086666666666
-------------------------------------
480000
Number of white pixels: 11157
Number of black pixels: 17
0 G0034609.JPG
image number G0035062.JPG
-------------------------------------
Mean lightness = 94.51092916666667
-------------------------------------
480000
Number of white pixels: 12148
Number of black pixels: 0
0 G0035062.JPG
image number G0035096.JPG
-------------------------------------
Mean lightness = 86.99863541666667
-------------------------------------
480000
Number of white pixels: 4243
Number of black pixels: 0
0 G0035096.JPG
image number G0035144.JPG
-------------------------------------
Mean lightness = 87.34230833333334
-------------------------------------
480000
Number of white pixels: 13463
Number of black pixels: 0
0 G0035144.JPG
image number G0035148.JPG
-------------------------------------
Mean lightness = 94.73853541666666
-------------------------------------
480000
Number of white pixels: 15296
Number of black pixels: 1
0 G0035148.JPG
image number G0035149.JPG
-------------------------------------
Mean lightness = 92.97337083333333
-------------------------------------
480000
Number of white pixels: 13063
Number of black pixels: 0
0 G0035149.JPG
image number G0035239.JPG
-------------------------------------
Mean lightness = 95.89071041666666
```

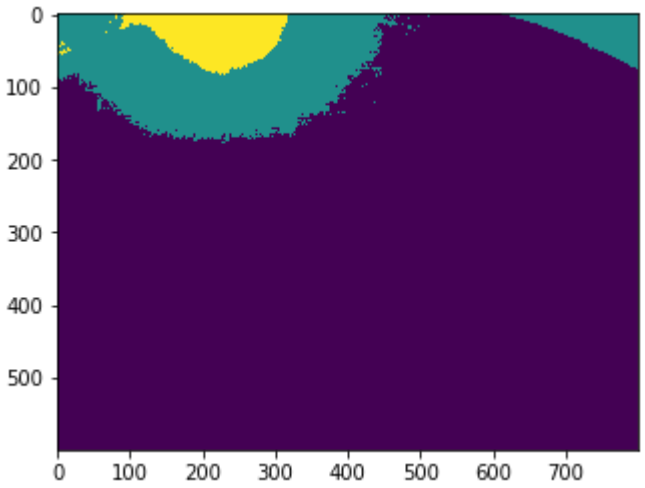
```
--------------------------------------
480000
Number of white pixels: 5222
Number of black pixels: 0
0 G0035239.JPG
image number G0035241.JPG
--------------------------------------
Mean lightness = 98.94679583333334
--------------------------------------
480000
Number of white pixels: 6216
Number of black pixels: 0
0 G0035241.JPG
image number G0035251.JPG
--------------------------------------
Mean lightness = 102.2903
--------------------------------------
480000
Number of white pixels: 13040
Number of black pixels: 0
1 G0035251.JPG
image number G0035263.JPG
--------------------------------------
Mean lightness = 95.83670208333334
--------------------------------------
480000
Number of white pixels: 3167
Number of black pixels: 1
0 G0035263.JPG
image number G0045857.JPG
--------------------------------------
Mean lightness = 84.73277916666666
--------------------------------------
480000
Number of white pixels: 7129
Number of black pixels: 0
0 G0045857.JPG
image number G0045867.JPG
--------------------------------------
Mean lightness = 84.89373958333333
--------------------------------------
480000
Number of white pixels: 8835
Number of black pixels: 0
0 G0045867.JPG
image number G0055569.JPG
--------------------------------------
Mean lightness = 71.69833125
--------------------------------------
480000
Number of white pixels: 6138
Number of black pixels: 97
0 G0055569.JPG
image number G0055678.JPG
--------------------------------------
Mean lightness = 93.42659166666667
--------------------------------------
```

```
480000
Number of white pixels: 33705
Number of black pixels: 958
0 G0055678.JPG
image number G0055679.JPG
--------------------------------------
Mean lightness = 78.309325
--------------------------------------
480000
Number of white pixels: 6526
Number of black pixels: 390
0 G0055679.JPG
image number G0055680.JPG
--------------------------------------
Mean lightness = 71.64403541666667
--------------------------------------
480000
Number of white pixels: 3703
Number of black pixels: 339
0 G0055680.JPG
image number G0055708.JPG
--------------------------------------
Mean lightness = 85.10036458333333
--------------------------------------
480000
Number of white pixels: 39300
Number of black pixels: 296
0 G0055708.JPG
image number G0056025.JPG
--------------------------------------
Mean lightness = 86.88577291666667
--------------------------------------
480000
Number of white pixels: 2689
Number of black pixels: 46
0 G0056025.JPG
image number G0056066.JPG
--------------------------------------
Mean lightness = 92.31719791666667
--------------------------------------
480000
Number of white pixels: 13033
Number of black pixels: 14
0 G0056066.JPG
image number G0056111.JPG
--------------------------------------
Mean lightness = 116.40102916666666
--------------------------------------
480000
Number of white pixels: 21880
Number of black pixels: 0
1 G0056111.JPG
image number G0056281.JPG
--------------------------------------
Mean lightness = 30.1736
--------------------------------------
480000
```

```
Number of white pixels: 1094
Number of black pixels: 455
0 G0056281.JPG
image number G0056282.JPG
--------------------------------------
Mean lightness = 52.196395833333334
--------------------------------------
480000
Number of white pixels: 1631
Number of black pixels: 204
0 G0056282.JPG
image number G0056287.JPG
--------------------------------------
Mean lightness = 47.06228125
--------------------------------------
480000
Number of white pixels: 12544
Number of black pixels: 657
0 G0056287.JPG
image number G0056339.JPG
--------------------------------------
Mean lightness = 76.70348541666667
--------------------------------------
480000
Number of white pixels: 47663
Number of black pixels: 1
0 G0056339.JPG
image number G0056423.JPG
--------------------------------------
Mean lightness = 67.702
--------------------------------------
480000
Number of white pixels: 12074
Number of black pixels: 656
0 G0056423.JPG
```

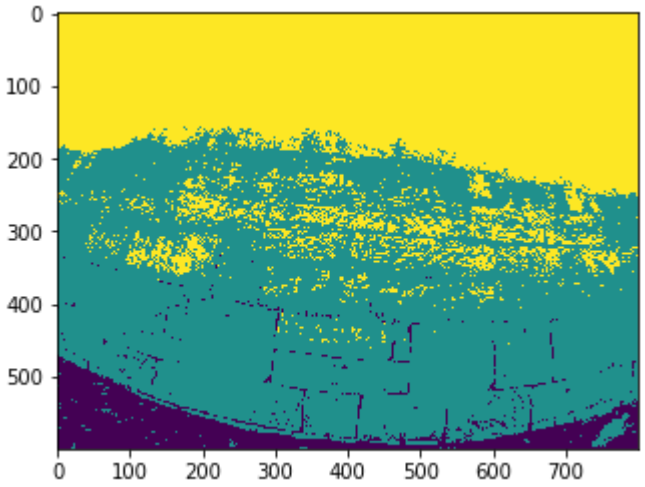
In [8]:
```
import numpy
# convert image to a uint8 image which only has 0, 128 and 255 values
# the source  has other levels in it so it needs to be thresholded - adjust th
reasholding
img_raw = skimage.io.imread('C:/Users/Anm Faisal/Flare image/flare_train/flar
e/G0013459.jpg', as_gray=True)
img = numpy.zeros_like(img_raw, dtype=numpy.uint8)
img[:,:] = 128
img[ img_raw < 0.25 ] = 0
img[ img_raw > 0.75 ] = 255

# define "next to" - this may be a square, diamond, etc
selem = skimage.morphology.disk(1)

# create masks for the two kinds of edges
black_gray_edges = (skimage.filters.rank.minimum(img, selem) == 0) & (skimage.
filters.rank.maximum(img, selem) == 128)
gray_white_edges = (skimage.filters.rank.minimum(img, selem) == 128) & (skimag
e.filters.rank.maximum(img, selem) == 255)

# create a color image
img_result = numpy.dstack( [img,img,img] )

# assign colors to edge masks
img_result[ black_gray_edges, : ] = numpy.asarray( [ 0, 255, 0 ] )
img_result[ gray_white_edges, : ] = numpy.asarray( [ 255, 0, 0 ] )

plt.imshow(img)
```

Out[8]: <matplotlib.image.AxesImage at 0x51c497de08>



In [9]:
```
# convert image to a uint8 image which only has 0, 128 and 255 values
# the source png image provided has other levels in it so it needs to be thres
holded - adjust the thresholding method for your data
img_raw = skimage.io.imread('C:/Users/Anm Faisal/Flare image/good_train/good/G
0011540.JPG', as_gray=True)
img = numpy.zeros_like(img_raw, dtype=numpy.uint8)
img[:,:] = 128
img[ img_raw < 0.25 ] = 0
img[ img_raw > 0.75 ] = 255

# define "next to" - this may be a square, diamond, etc
selem = skimage.morphology.disk(1)

# create masks for the two kinds of edges
black_gray_edges = (skimage.filters.rank.minimum(img, selem) == 0) & (skimage.
filters.rank.maximum(img, selem) == 128)
gray_white_edges = (skimage.filters.rank.minimum(img, selem) == 128) & (skimag
e.filters.rank.maximum(img, selem) == 255)

# create a color image
img_result = numpy.dstack( [img,img,img] )

# assign colors to edge masks
img_result[ black_gray_edges, : ] = numpy.asarray( [ 0, 255, 0 ] )
img_result[ gray_white_edges, : ] = numpy.asarray( [ 255, 0, 0 ] )

plt.imshow(img)
```

Out[9]: <matplotlib.image.AxesImage at 0x51c6c9ce08>



In [10]:
```
####ML mode####
### Logistic Regression ###
####The Mean Lightness and Number of white+pixels in Train_flare is more than
 100(approx) and 15000 ( approx)
### and in Train_good less than 100 and 15000 ###
```

In [123]:
```
#load data. We made a CSV file from the Flare_Image_Data and Good_image_Data w
ith the various feature output
flare_data=pd.read_csv("C:/Users/Anm Faisal/Flare image/Feature_Response_Data_
Obtained.csv")
flare_data.head()
```

Out[123]:

	Sl	Image Number	Mean L	Numb_Wpix	Numb_Bpix	imsize	Garea	Response
0	1	GOO11262.JPG	73.102000	5940	87	480000	473973	0
1	2	G0011540.JPG	169.787000	137186	0	480000	342814	1
2	3	G0011953.JPG	81.565581	25213	1	480000	454786	0
3	4	G0013475.JPG	50.959196	0	0	480000	480000	0
4	5	G0013535.JPG	101.540712	12075	0	480000	467925	1

In [124]:
```
col_names=['Image Number','Mean L','Numb_Wpix','Numb_Bpix','imsize','Garea','R
esponse']
```

In [125]:
```
##### Selecting features
#split dataset in features and target variable
feature_cols = ['Mean L','Numb_Wpix','Numb_Bpix','Garea']
X = flare_data[feature_cols] # Features
y = flare_data.Response # Target variable
```

In [126]:
```
print (X.shape)
print(y.shape)
```

```
(41, 4)
(41,)
```

In [127]:
```
# split X and y into training and testing sets
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.21,random_state
=0)
```

In [128]:
```
# instantiate the model (using the default parameters)
logreg = LogisticRegression()
```

In [129]:
```
# fit the model with data
logreg.fit(X_train,y_train)
```

Out[129]:
```
LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                   intercept_scaling=1, l1_ratio=None, max_iter=100,
                   multi_class='warn', n_jobs=None, penalty='l2',
                   random_state=None, solver='warn', tol=0.0001, verbose=0,
                   warm_start=False)
```

In [130]:
```
#prediction
y_pred=logreg.predict(X_test)
```

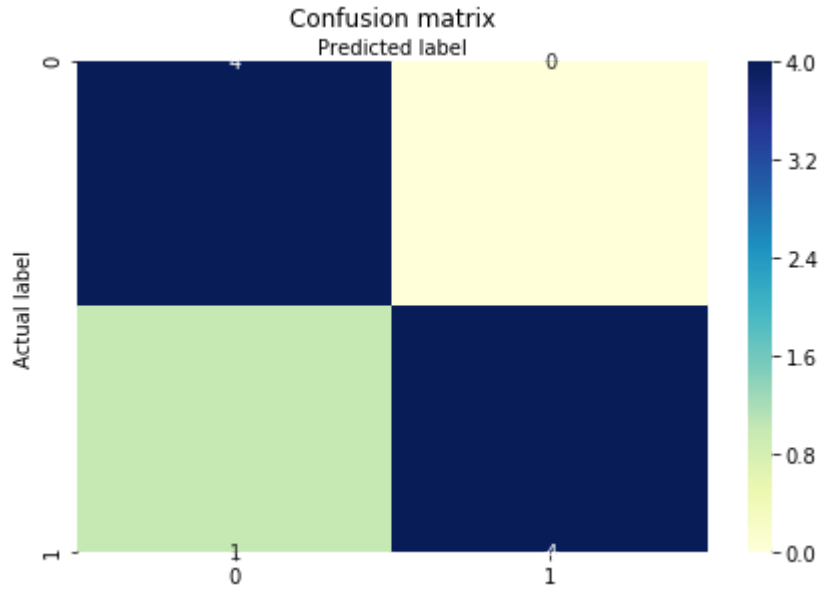
In [131]:
```
# import the metrics class
from sklearn import metrics
cnf_matrix = metrics.confusion_matrix(y_test, y_pred)
cnf_matrix
```

Out[131]:
```
array([[4, 0],
       [1, 4]], dtype=int64)
```

In [132]:
```
import seaborn as sns
%matplotlib inline
```

In [133]:
```
class_names=[0,1] # name  of classes
fig, ax = plt.subplots()
tick_marks = np.arange(len(class_names))
plt.xticks(tick_marks, class_names)
plt.yticks(tick_marks, class_names)
# create heatmap
sns.heatmap(pd.DataFrame(cnf_matrix), annot=True, cmap="YlGnBu" ,fmt='g')
ax.xaxis.set_label_position("top")
plt.tight_layout()
plt.title('Confusion matrix', y=1.1)
plt.ylabel('Actual label')
plt.xlabel('Predicted label')
```

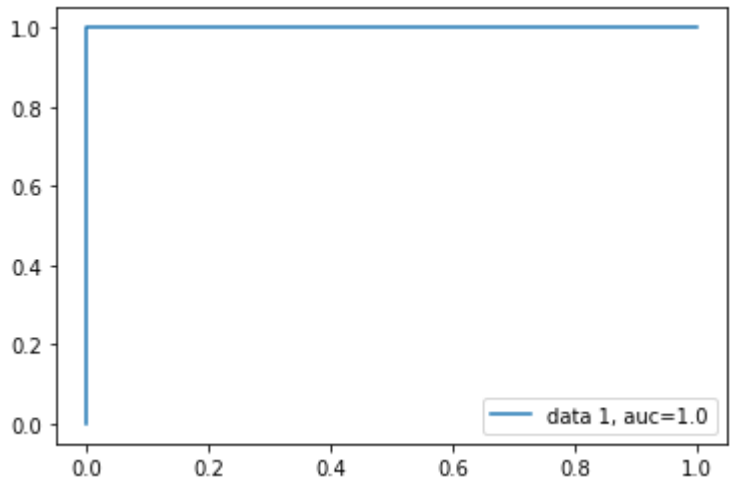
Out[133]:
```
Text(0.5, 257.44, 'Predicted label')
```



In [134]:
```
print("Accuracy:",metrics.accuracy_score(y_test, y_pred))
print("Precision:",metrics.precision_score(y_test, y_pred))
print("Recall:",metrics.recall_score(y_test, y_pred))
```

```
Accuracy: 0.8888888888888888
Precision: 1.0
Recall: 0.8
```

In [135]:
```
y_pred_proba = logreg.predict_proba(X_test)[::,1]
fpr, tpr, _ = metrics.roc_curve(y_test,  y_pred_proba)
auc = metrics.roc_auc_score(y_test, y_pred_proba)
plt.plot(fpr,tpr,label="data 1, auc="+str(auc))
plt.legend(loc=4)
plt.show()
```



In [120]:
```
#### AUC Score 1 represents a perfect classifier
##The reason behind finding the AUCcurve 100% is the feature logic is only ML
 and a vakue of Lithgtness.
###If We can increatse number of features to consider in relatioin , we may fi
nd more arguments.
####We can discuss more about adding feature of the data set.#####
```

In [ ]: