CS 682: COMPUTER VISION

Abhishek Bodas

G01160204

HW2

Website: http://mason.gmu.edu/~abodas/vision/

Username: CS682

Password: abodas682

Ex 1.1)

Open an image from the dialog box by entering the name or selecting the file. Creating a 11x11 window and on the mouse cursor movement, displaying outer border, coordinates, BGR values, mean and standard deviation of the pixel at current cursor position.

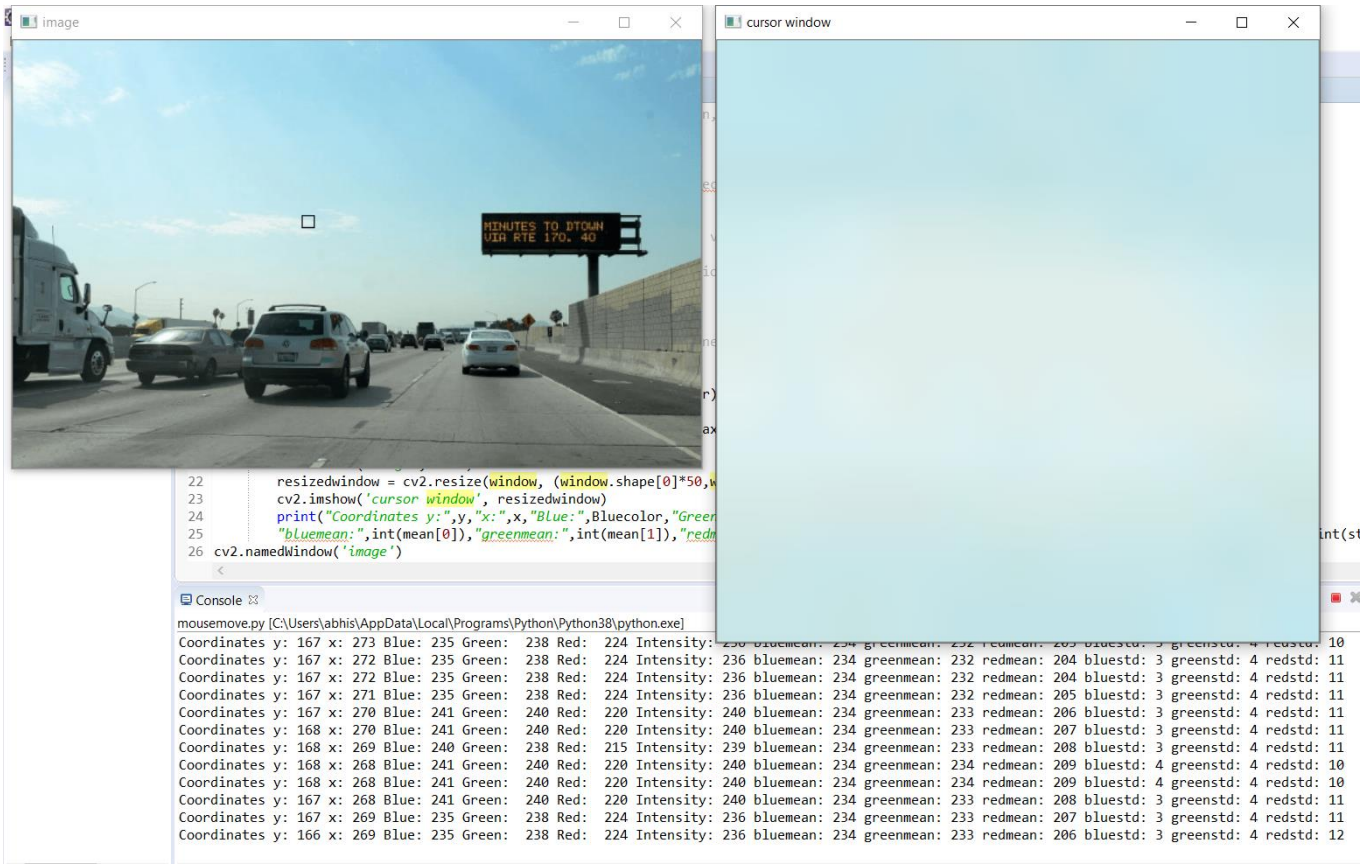
Code:

```
#Script to display BGR values,intensity,mean,standard deviation,outer border of pixel
at mouse move
import cv2
import easygui
#To open image from dialog box
path = easygui.enterbox() #"way.png" or as specified in movethecursor() #To open image
from dialog box
image = cv2.imread(path,1) #To read the image

def movethecursor(event,x,y,flags,param): #Function to compute values at mousemove
    global x_axis, y_axis
    if event == cv2.EVENT_MOUSEMOVE: #checks mouse move condition
        y_axis,x_axis = y,x
        image=cv2.imread("way.png",1)
        copy=image.copy()
        Bluecolor=copy[y,x,0] #To compute coordinates and channels of image
        Greencolor=copy[y,x,1]
        Redcolor=copy[y,x,2]
        intensity=(int(Bluecolor)+int(Greencolor)+int(Bluecolor))/3    #To    compute
intensity of pixel
        window = cv2.getRectSubPix(copy, (11, 11), (x, y))
        rect=cv2.rectangle(copy, (x_axis - 5, y_axis - 6), (x_axis + 6, y_axis + 5),
(0,0,0),1) #To create a rectangular window
        mean,std= cv2.meanStdDev(window)
        cv2.imshow('image', rect)
        resizedwindow  =  cv2.resize(window,  (window.shape[0]*50,window.shape[1]*50))
#To increase window size for better view
        cv2.imshow('cursor window', resizedwindow)
```

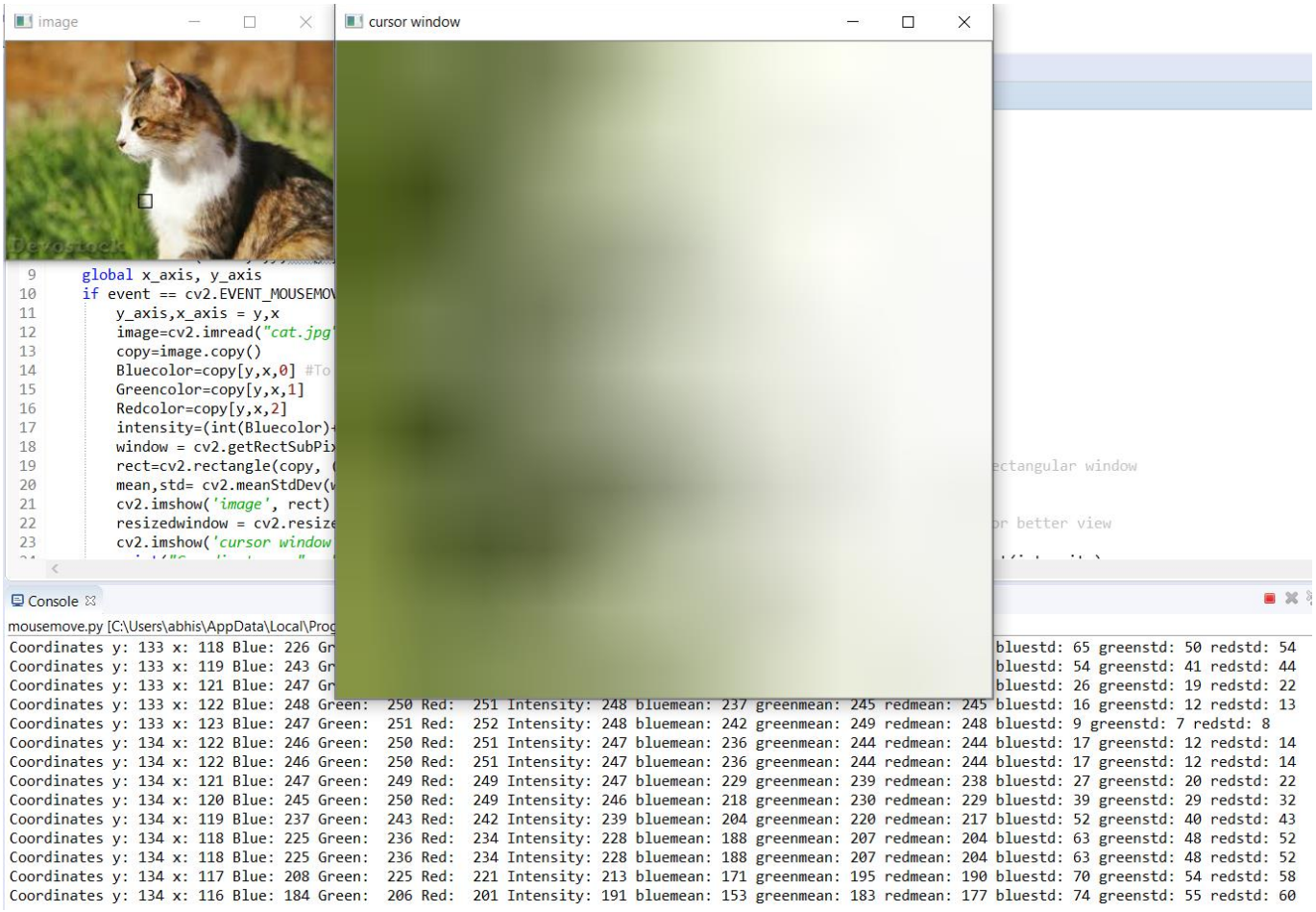
```
        print("Coordinates  y:",y,"x:",x,"Blue:",Bluecolor,"Green:  ",Greencolor,"Red:
",Redcolor,"Intensity:",int(intensity),

"bluemean:",int(mean[0]),"greenmean:",int(mean[1]),"redmean:",int(mean[2]),"bluestd:"
,int(std[0]),"greenstd:",int(std[1]),"redstd:",int(std[2]))
cv2.namedWindow('image')
cv2.imshow('image',image)
cv2.setMouseCallback('image',movethecursor) #Mouse handler for the window
key=cv2.waitKey(10000) & 0xFF #Mask for 64-bit systems
if key==27: #Press Escape key to close the image window
    cv2.destroyAllWindows()
elif key==ord('q'): #Press 'q' key to quit the image window
    cv2.destroyAllWindows()
elif key==ord('e'):#Press 'e' key to exit the image window
    cv2.destroyAllWindows()
elif key==ord('x'):#Press 'x' key to cancel the image window
    cv2.destroyAllWindows()
cv2.destroyAllWindows() #To destroy windows anyway
cv2.setMouseCallback('image',movethecursor)
```

Output images:

PNG:



JPEG:



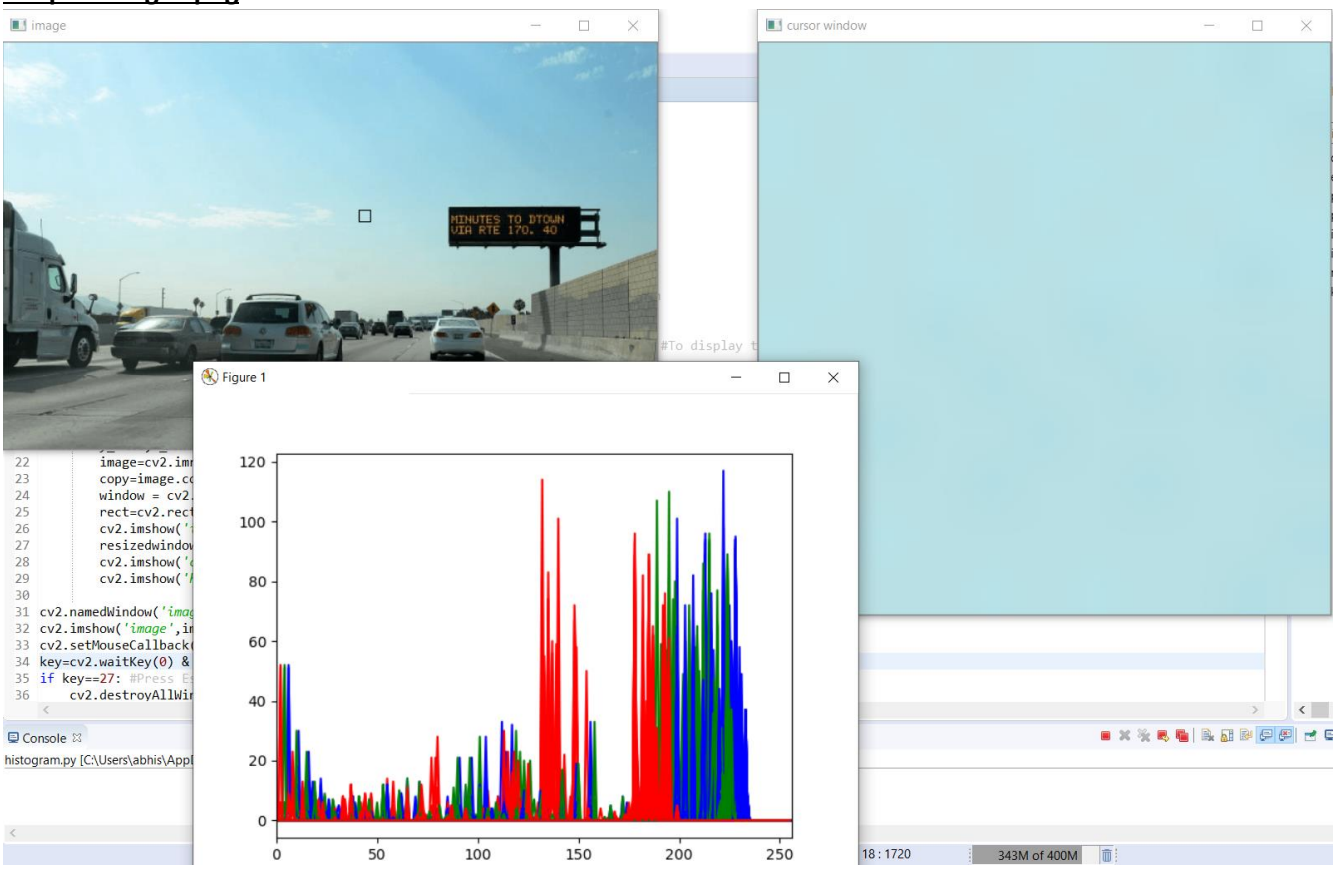
Code:

Color Histogram of all 3 channels of a .png and .jpeg image on mouse movement

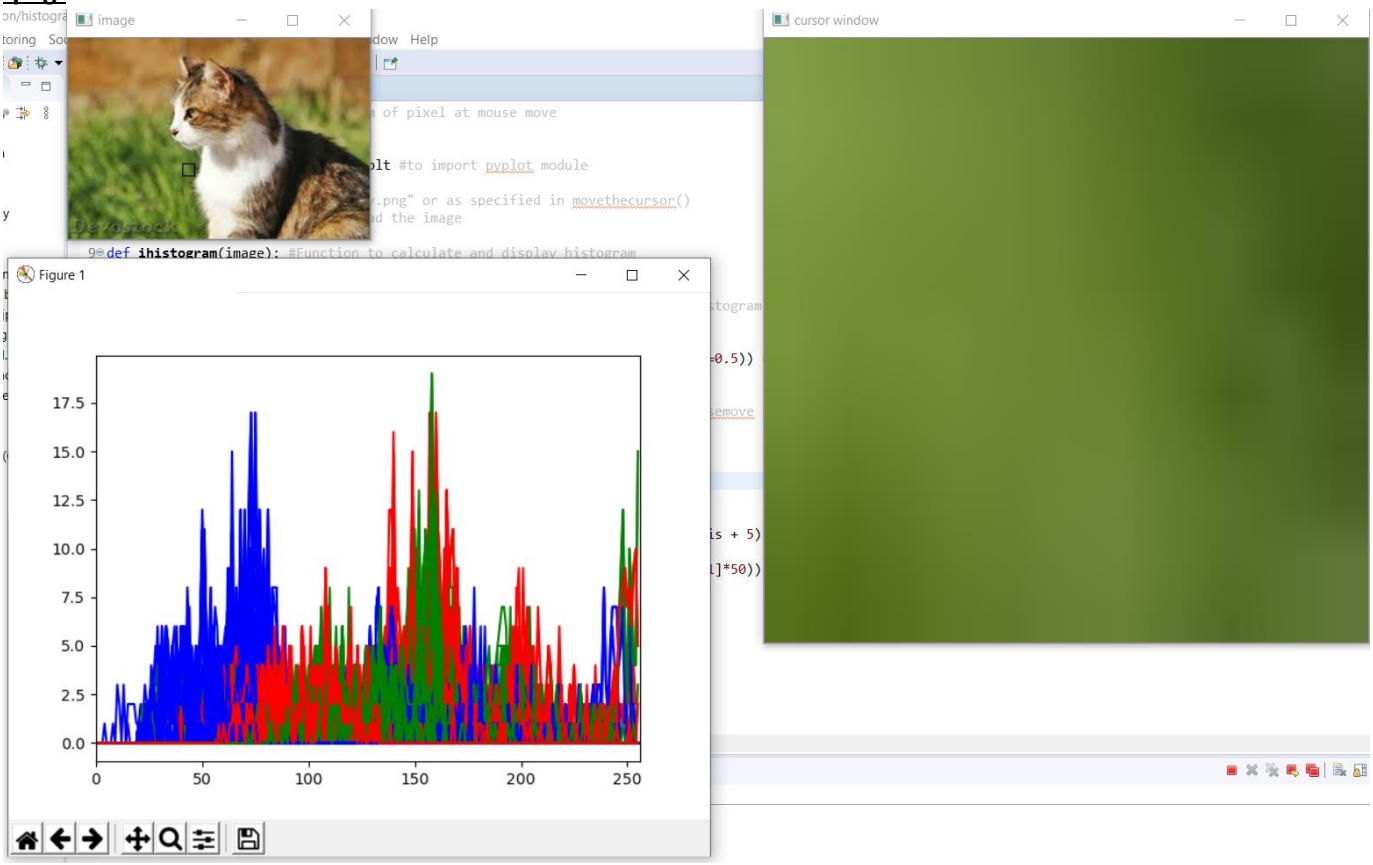
```
#Script to display color histogram of pixel at mouse move
import cv2
import easygui
from matplotlib import pyplot as plt #to import pyplot module
#To open image from dialog box
path = easygui.fileopenbox() #"way.png" or as specified in movethecursor()
image = cv2.imread(path,1) #To read the image

def ihistogram(image): #Function to calculate and display histogram
    color = ('b','g','r') #Tuple of colors
    for i,col in enumerate(color): #To plot histogram of all 3 channels
        hist = cv2.calcHist([image],[i],None,[256],[0,256]) #To calculate histogram
        plt.plot(hist,color = col)
        plt.xlim([0,256]) #To set the x limits of left and right
        plt.text(0.5, 24000,"HISTOGRAM", bbox=dict(facecolor='yellow', alpha=0.5)) #To
display text on histogram
```

```
    plt.show()

def movethecursor(event,x,y,flags,param): #Function to compute values at mousemove
    global x_axis, y_axis
    if event == cv2.EVENT_MOUSEMOVE: #checks mouse move condition
        y_axis,x_axis = y,x
        image=cv2.imread("cat.jpg",1)
        copy=image.copy()
        window = cv2.getRectSubPix(copy, (11, 11), (x, y))
        rect=cv2.rectangle(copy, (x_axis - 5, y_axis - 6), (x_axis + 6, y_axis + 5),
(0,0,0),1) #To create a rectangular window
        cv2.imshow('image', rect)
        resizedwindow  =  cv2.resize(window,  (window.shape[0]*50,window.shape[1]*50))
#To increase window size for better view
        cv2.imshow('cursor window', resizedwindow)
        cv2.imshow('h',ihistogram(window))

cv2.namedWindow('image')
cv2.imshow('image',image)
cv2.setMouseCallback('image',movethecursor) #Mouse handler for the window
key=cv2.waitKey(5000) & 0xFF #Mask for 64-bit systems
if key==27: #Press Escape key to close the image window
    cv2.destroyAllWindows()
elif key==ord('q'): #Press 'q' key to quit the image window
    cv2.destroyAllWindows()
elif key==ord('e'):#Press 'e' key to exit the image window
    cv2.destroyAllWindows()
elif key==ord('x'):#Press 'x' key to cancel the image window
    cv2.destroyAllWindows()
cv2.destroyAllWindows() #To destroy windows anyway
cv2.setMouseCallback('image',movethecursor)
```

Output-images:png



Jpeg:



HOMOGENOUS VS NON-HOMOGENOUS

By comparing the above 2 histograms of png and jpeg images, it can be observed that the histogram of png image shows homogenous distribution of image values, whereas the histogram of jpeg image a shows non-homogenous distribution of image values. It can be determined by the logic that in homogeneity, the color channels of histograms appear to be distinct, there is a certain level of uniformity. Whereas in non-homogeneity, the color channels appear to be scattered. The uniformity is not maintained.

Ex1.2)

Extracting all the images from a directory and building a colored 512-bin histograms with bit shifted operation on color values. Writing 2 histogram comparison functions: Intersection and chi squared and using these two functions, displaying a linearly scaled plot of image pairs.

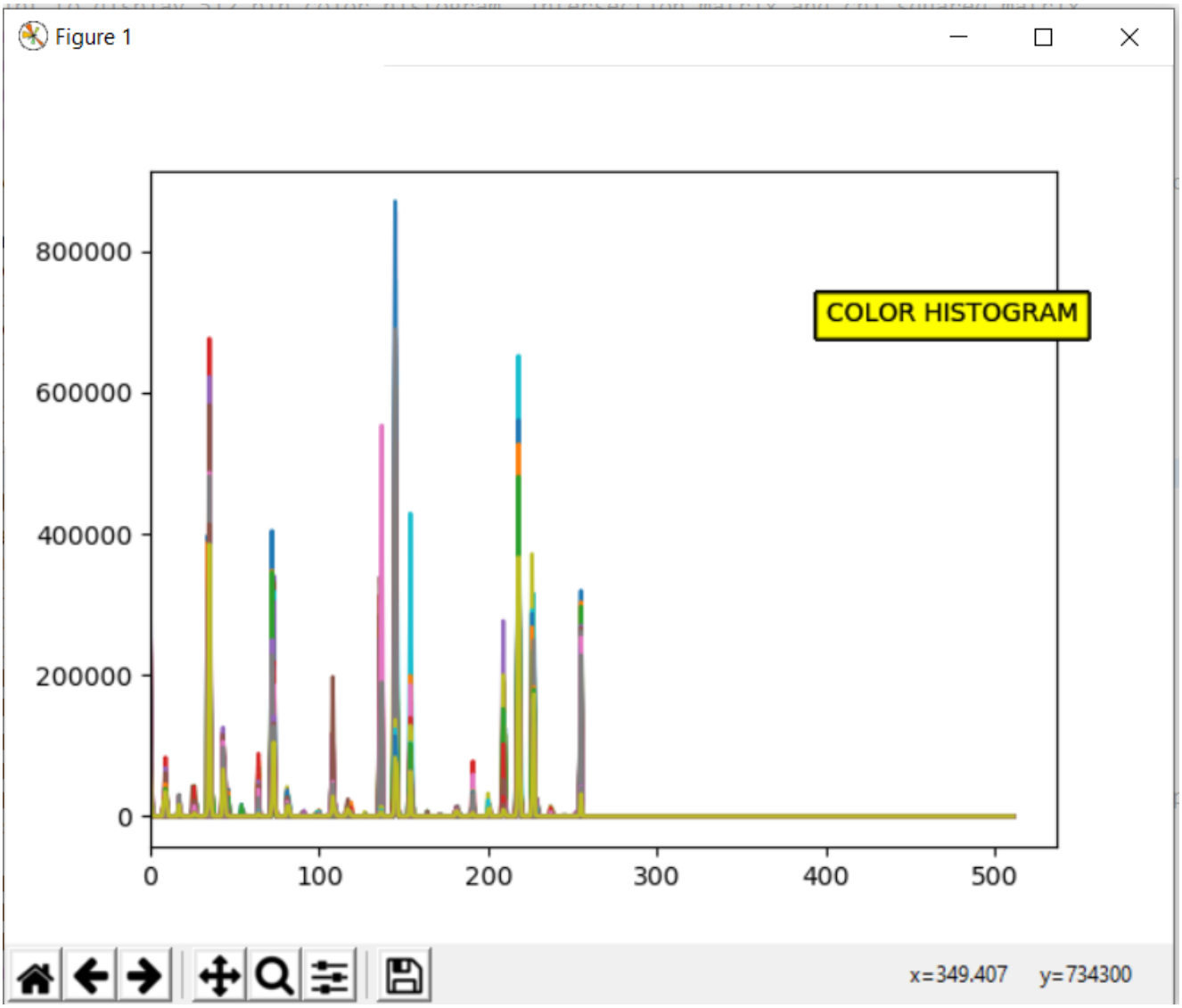
Code:

```
#Script to display 512 bin color histogram, intersection matrix and chi squared matrix
import cv2
import os #To import os module
import glob #To import glob module
import numpy as np
from matplotlib import pyplot as plt
directory = "C:/Users/abhis/OneDrive/Desktop/Projects/cvision/ST2main" #Location of
Unziped folder ST2MainHall4
path = os.path.join(directory,'*g')
allimages = glob.glob(path)
imagelist = []
for i in allimages:
    eachimage = cv2.imread(i)
    imagelist.append(eachimage) #List of all images

histlist=[]
for index, eachimage in enumerate(imagelist):
    (height, width, channels) = imagelist[index].shape
    blue=imagelist[index][:,:,0]
    green=imagelist[index][:,:,1]
    red=imagelist[index][:,:,2]
    index= np.zeros((height,width), dtype='uint8')
    index= ((red>>5)<<6) + ((green>>5)<<3) + ((blue>>5)) #bit shifts
    indexhist=cv2.calcHist([index], [0],None, [512], [0,512])
    histlist.append(indexhist) #List of all histograms
for h in histlist:
    plt.plot(h)
    plt.xlim(0)
    plt.text(400, 700000,"COLOR HISTOGRAM", bbox=dict(facecolor='yellow', alpha=0.5))
#To display text on histogram
plt.show()

def hintersection(h1,h2): #histogram comparison function by calculating intersection
    hmin = np.sum(np.minimum(h1, h2))
    hmax = np.sum(np.maximum(h1, h2))
    return float(hmin/hmax)

def hchisquared(h1,h2): #histogram comparison function by calculating chi square
    hchi=0
    for i in range(0,len(h1)):
        if (h1[i]+h2[i])>5:
            hchi+=(((h1[i]- h2[i])**2)/float(h1[i]+h2[i]))
    return hchi
#Using above functions to compare image pairs
intmatrix = np.zeros((99, 99), dtype='uint8' )
```

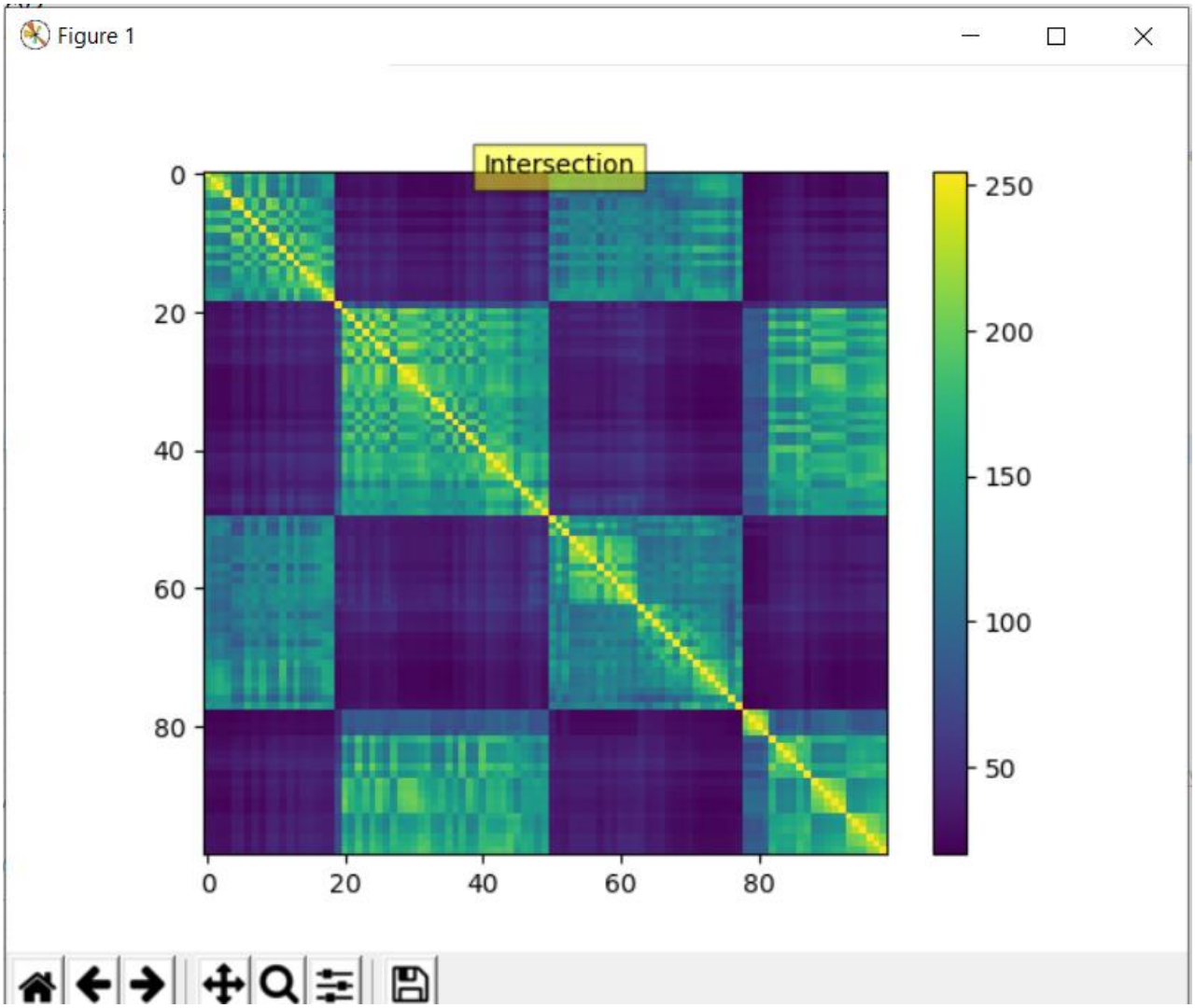
```
chimatrix = np.zeros((99, 99), dtype='float64' )

for i1, h1 in enumerate(histlist):
    for i2, h2 in enumerate(histlist):
        intmatrix[i1][i2] = hintersection(h1, h2)*255
plt.imshow(intmatrix)
plt.colorbar()
plt.text(40,0,"Intersection", bbox=dict(facecolor='yellow', alpha=0.5)) #To display
text on histogram
plt.show()

for i1, h1 in enumerate(histlist):
    for i2, h2 in enumerate(histlist):
        chimatrix[i1][i2] = hchisquared(h1, h2)
chimatrix*=255.0/chimatrix.max()
plt.imshow(chimatrix)
plt.colorbar()
plt.text(40,0,"Chi squared", bbox=dict(facecolor='yellow', alpha=0.5)) #To display
text on histogram
plt.show()
```

Output images:

Histogram:



Intersection:



Chi-squared:

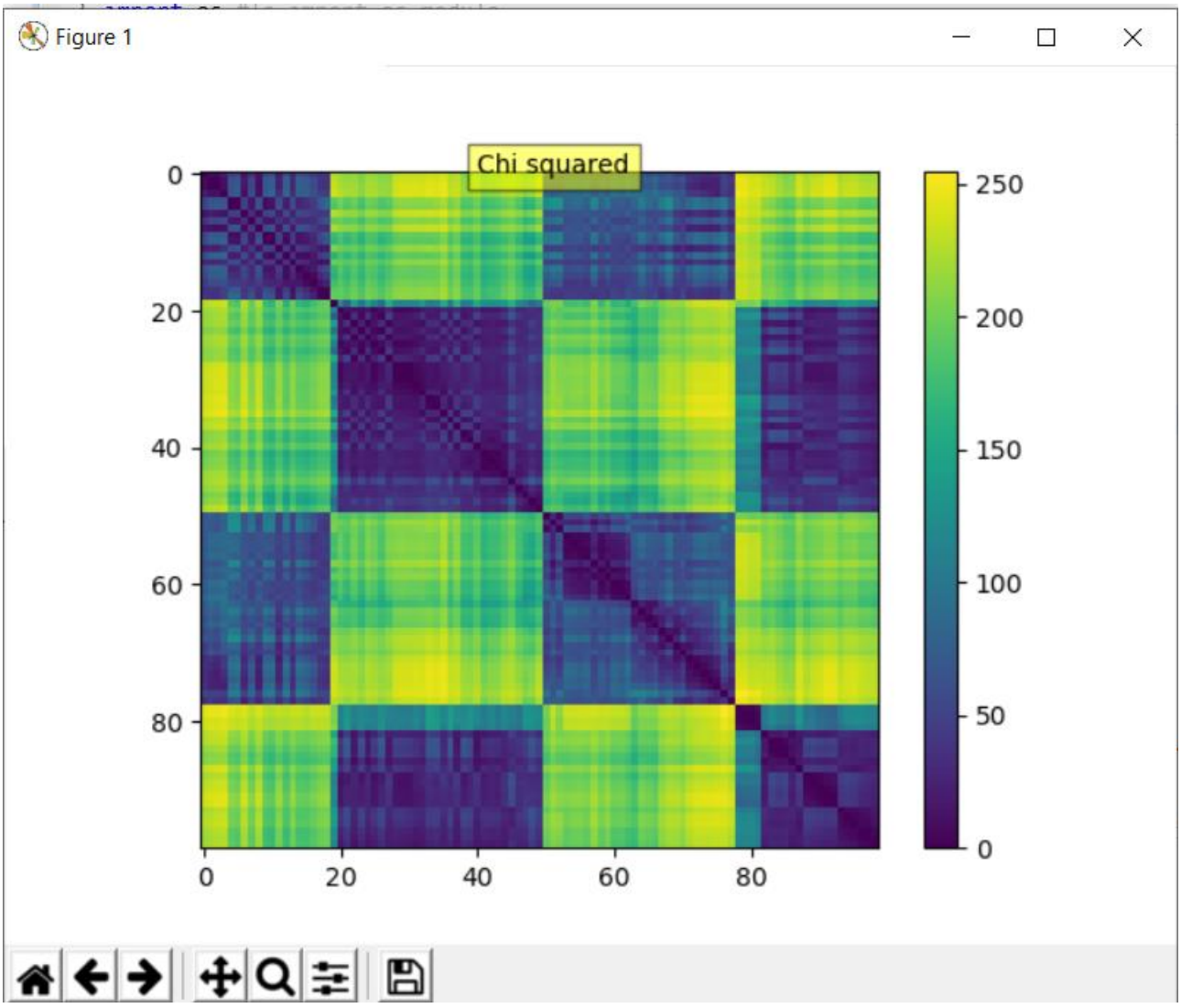


Figure 1
Chi squared
0
20
40
60
80
0
20
40
60
80
250
200
150
100
50
0