Welcome to Assignment 1 on course CV_CSL442_S21

Instructions:

1. Use Python 3.x, jupyter notebook to run this notebook.

2. Write your code only in between the lines 'YOUR CODE STARTS HERE' and 'YOUR CODE ENDS HERE' you sould not change anything else code cells, if you do, the answers you are supposed to get at the end of this assignment might be wrong.

3. Read documentation of each function carefully.

4. Out of 7 questions we consider best 5 for the evaluation purpose.

5. Copying assignment solutions from others is strongly discouraged and will be considered as violation of academic code of conduct.

6. Early submitted assignment solutions will be considered for evaluation, so students please check your solutions carefully before submission.

7. Required two items for submission:

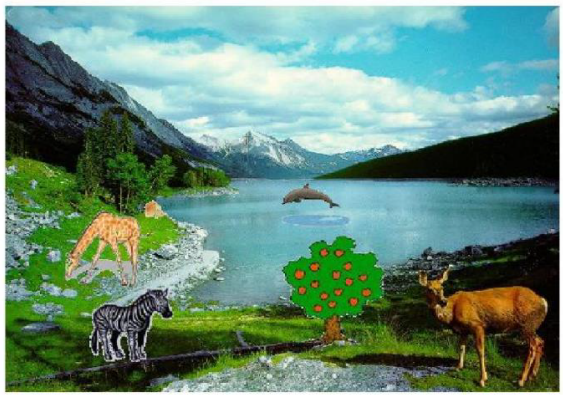
```
1. Solutions jupyter notebook file.
2. Link to the recorded video of your program explanation and output
demo. Try to keep the video duration minimum (preferably 10-15min).
```

8. All the submissions should be submitted only in teams. Assignmnet due date is 15.2.2021 before 5:00PM. Late submission is accepted till 16.2.2021 before 5:00PM with 2 marks penalty from the accquired marks.

*****-:All the best:-*****

1Q. Using basic image operations combine the scene and object images to get the composite image as shown below.



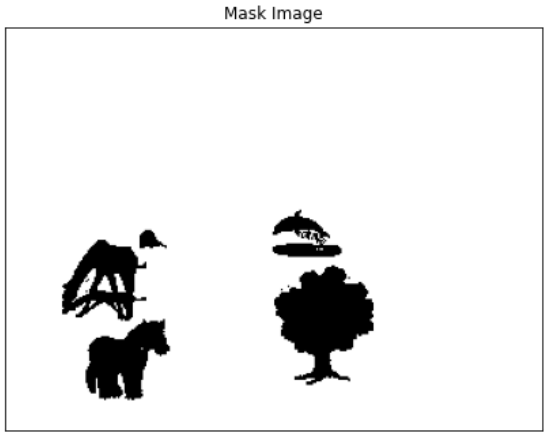



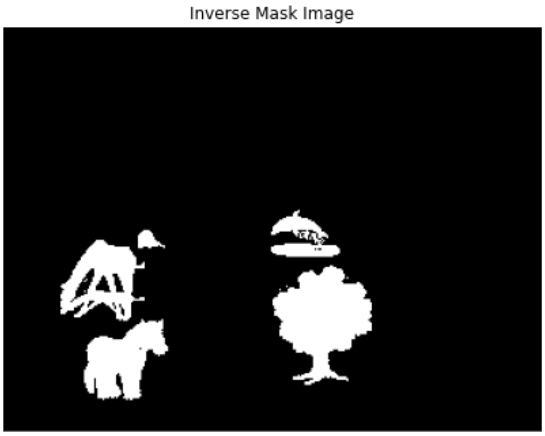
In [1]:

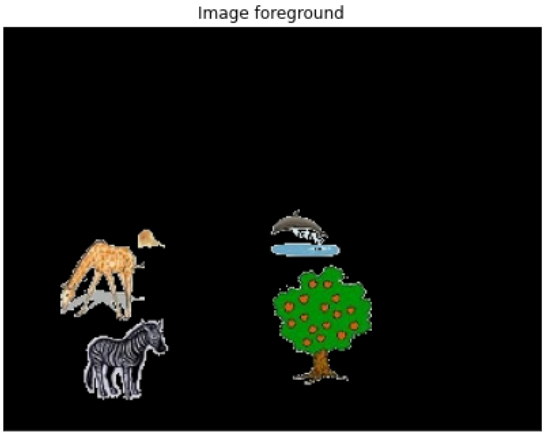
```
import cv2
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline


img1 = cv2.imread("..\\img61.jpg")
img2 = cv2.imread("..\\Sample_Image.jpg")

#YOUR CODE STARTS HERE



#YOUR CODE ENDS HERE

mask=cv2.cvtColor(mask,cv2.COLOR_BGR2RGB)
mask_inv=cv2.cvtColor(mask_inv,cv2.COLOR_BGR2RGB)
img_background=cv2.cvtColor(img_background,cv2.COLOR_BGR2RGB)
img_foreground=cv2.cvtColor(img_foreground,cv2.COLOR_BGR2RGB)
res_img=cv2.cvtColor(res_img,cv2.COLOR_BGR2RGB)

plt.figure(figsize=(16,12))
plt.subplot(2,2,1)
plt.imshow(mask)
plt.title('Mask Image')
plt.xticks([])
plt.yticks([])
plt.subplot(2,2,2)
plt.imshow(mask_inv)
plt.title('Inverse Mask Image')
plt.xticks([])
plt.yticks([])
plt.subplot(2,2,3)
plt.imshow(img_background)
plt.title('Image background')
plt.xticks([])
```

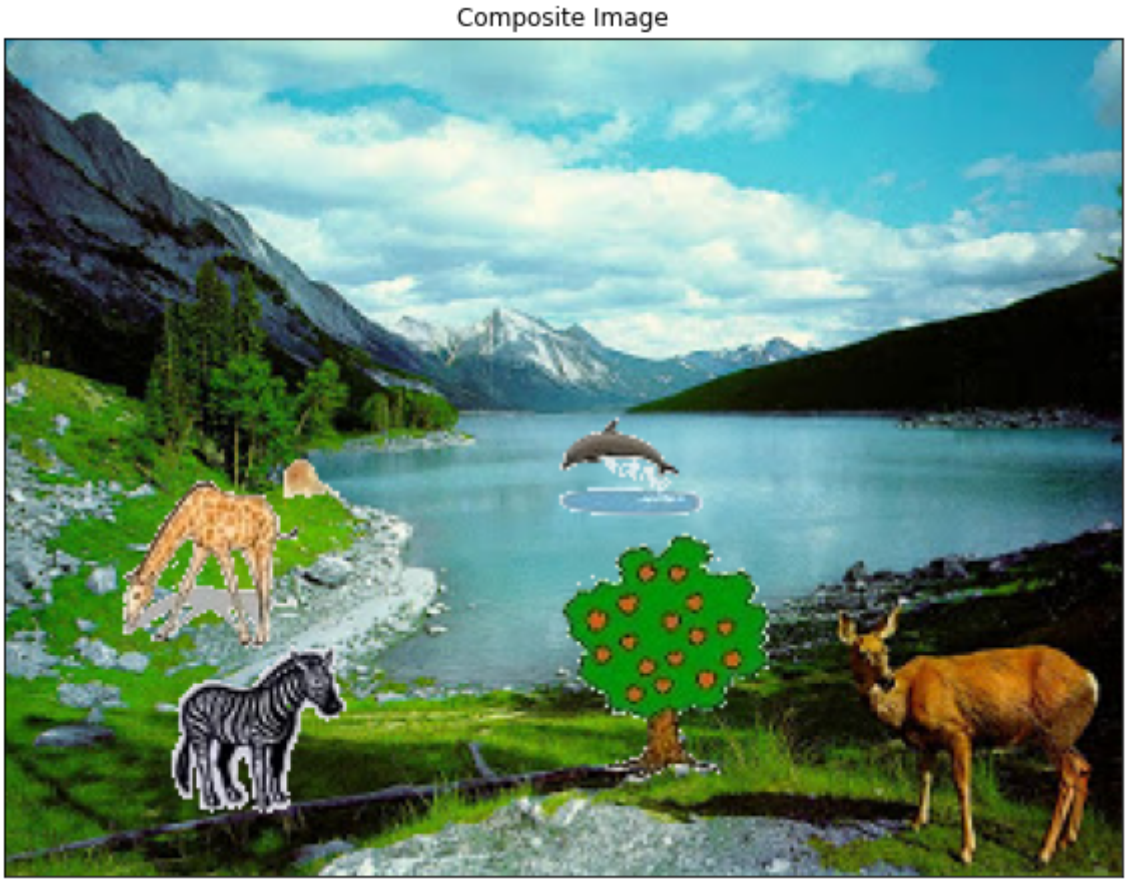
```
plt.yticks([])
plt.subplot(2,2,4)
plt.imshow(img_foreground)
plt.title('Image foreground')
plt.xticks([])
plt.yticks([])
plt.figure(figsize=(10,8))
plt.subplot(1,1,1)
plt.imshow(res_img)
plt.title('Composite Image')
plt.xticks([])
plt.yticks([])
```

Out[1]: ([], [])







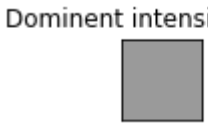


2Q. Implement a function domIntensity(im, k), which takes an image im and an integer k and returns a list of k most dominant intensities of that image. Experiment your code on any 3 images to validate the program output.

In [14]:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline

def domIntensity(im, k):
    #YOUR CODE STARTS HERE




    #YOUR CODE ENDS HERE
    return sorted_intensities[:k]

def displayIntensityPalette(im, dom_list):
    plt.figure()
    if len(im.shape) == 2:
        plt.imshow(im, cmap = "gray")
    else:
        plt.imshow(im)
    plt.xticks([])
    plt.yticks([])
    plt.title("Given input image")
    k = len(dom_list)
    # Most dominant intensity
    top_im = np.array([[list(dom_list[0])]])
    plt.figure(figsize = (0.75,0.75), frameon=False)
    plt.imshow(top_im)
    plt.title('Dominent intensity shade')
    plt.xticks([])
```

```
    plt.yticks([])
    # k most dominant intensity palette
    plt.figure(figsize = ((0.75*k),0.75), frameon=False)
    dom_inty_im = np.array([[list(dom_list[i]) for i in range(k)]])
    plt.imshow(dom_inty_im)
    plt.xticks([])
    plt.yticks([])
    plt.title("Top 10 intensity Palette ")

im = cv2.imread("E:\\VNIT Stuff\\CV_W21\\IVP_W21_OpenCV_with_Python_practice Program
dom_list = domIntensity(im,10)
displayIntensityPalette(im, dom_list)
```



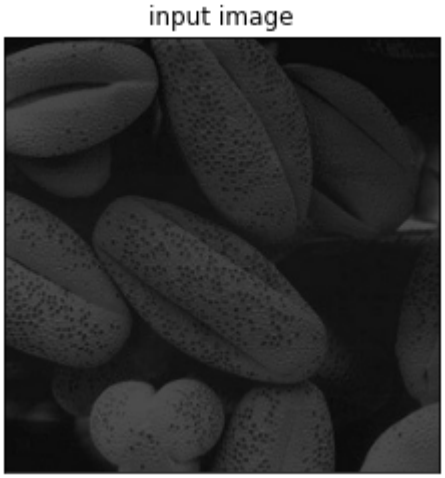
3Q. Write a function histogramEqualization(image) to stretch the image contrast. Using this function enhance the images histogram1.jpg, histogram2.jpg and histogram3.jpg and compare it with inbuilt function results. Record the observations.

In [26]:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt
import math
%matplotlib inline

def plotHistogram(im):
    #YOUR CODE STARTS HERE



    #YOUR CODE ENDS HERE
    return imgHist

def histogramEqualization(im):
    #YOUR CODE STARTS HERE



    #YOUR CODE ENDS HERE
```

```
    return im_new

he = cv2.imread('..\\histogram3.jpg',0)
he1=cv2.cvtColor(he,cv2.COLOR_BGR2RGB)

plt.figure(figsize=(16,12))
plt.figure()
plt.title("input image")
plt.imshow(he1)
plt.xticks([])
plt.yticks([])

# Implemented
eq_img= histogramEqualization(he)
hist=plotHistogram(eq_img)
eq_img=cv2.cvtColor(eq_img,cv2.COLOR_BGR2RGB)
plt.figure(figsize=(16,12))
plt.figure()
plt.title("Handcoded histogram equalization result")
plt.imshow(eq_img)
plt.xticks([])
plt.yticks([])

#inbuilt
inbuilt_hist_img=cv2.equalizeHist(he)
inbuilt_hist = cv2.calcHist([eq_img], [0], None, [256], [0, 256])

plt.figure()
plt.title("Inbuilt Equalized image")
plt.imshow(inbuilt_hist_img, cmap = "gray")
plt.xticks([])
plt.yticks([])

plt.figure()
plt.title("Handcoded Equalized image histogram")
plt.bar(range(256),hist)
plt.show()
plt.figure()
plt.title("Inbuilt Equalized image histogram")
plt.plot(inbuilt_hist)
plt.show()
```

```
<Figure size 1152x864 with 0 Axes>
```

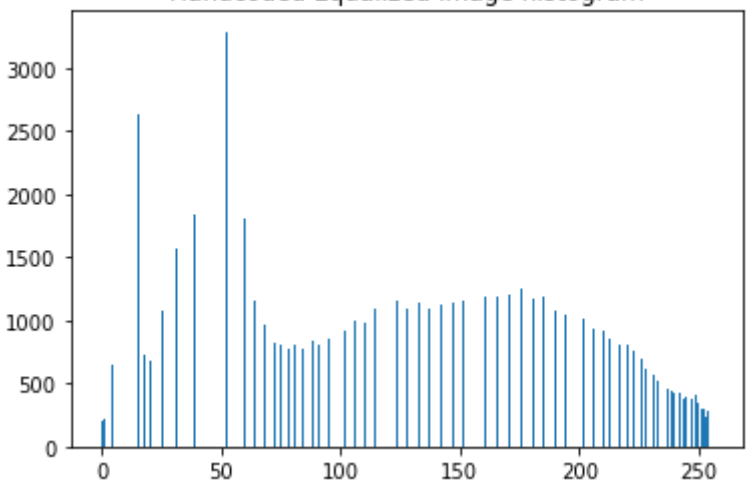



```
<Figure size 1152x864 with 0 Axes>
```

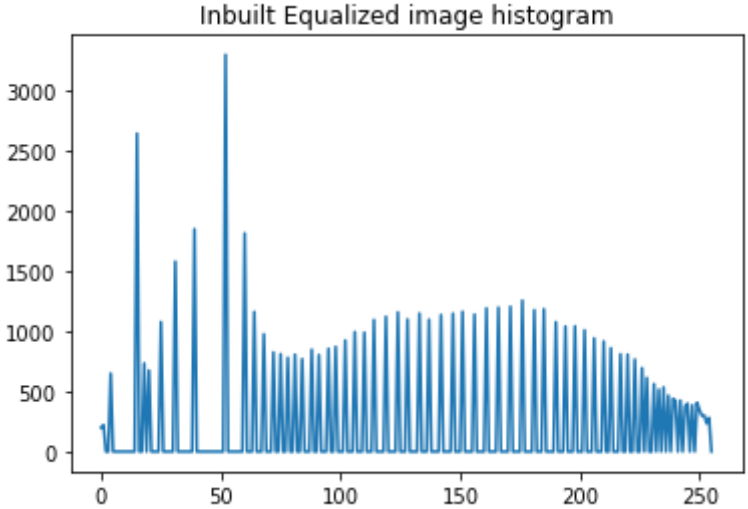
Handcoded histogram equalization result

Inbuilt Equalized image

Handcoded Equalized image histogram



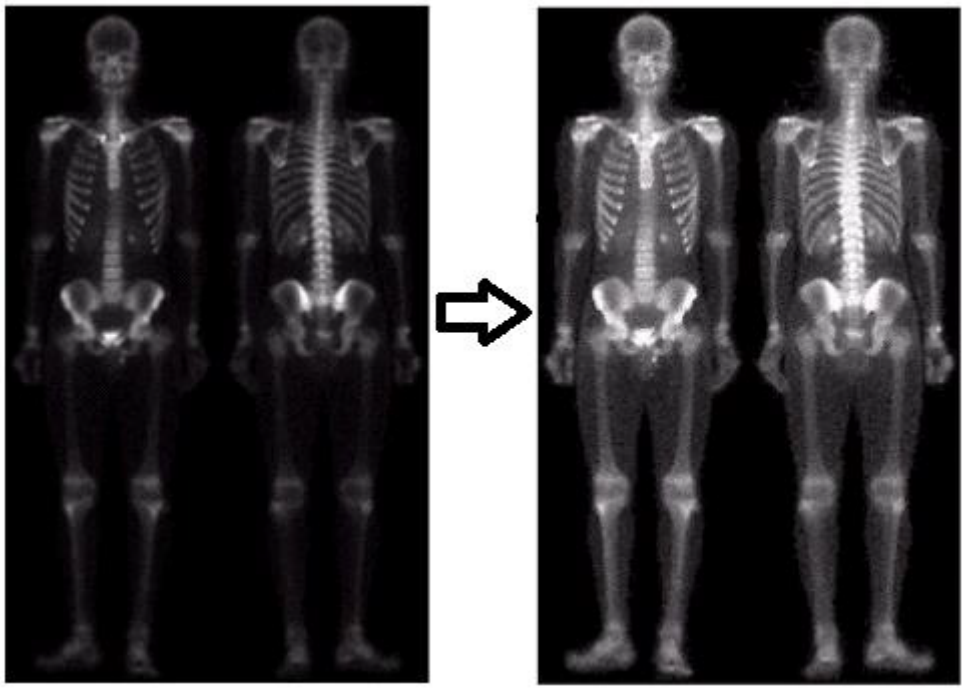
Inbuilt Equalized image histogram



4Q.Images of outdoor scenes are often degraded by haze (due to fog, dust, etc). Light is attenuated by its passage through the atmosphere, and additional unwanted scattered light is added. We want to enhance the images to remove the effect of the haze. Look at input histograms of images “haze1.tif” and “haze2.tif”. Let’s assume that the pixels in the degraded image that have the lowest values (in each color band) actually should be pure black, and the pixels that have the highest values (in each color band) are actually should be pure white. A simple de-hazing algorithm is to take a color image, and for each band (red, green, blue), stretch its values to occupy the full range (0 to 255), such that 1% of data at the extreme ends is saturated at the low and high values (see Matlab’s “imadjust”). Then put the bands back together into an RGB image. Implement this algorithm and test it on the given images.

In [ ]:
```
import cv2
import numpy as np
import matplotlib.pyplot as plt
import math
%matplotlib inline

# YOUR CODE STARTS HERE




# YOUR CODE ENDS HERE
```

5Q. Try to enhance the ‘skeleton.jpg’ image by performing the sequence of operations given as comments in the program. make note of the observations in each step.



In [ ]:
```
# Question 5: Sequence of steps to enhance the image.

#1. (a).read image of whole body bone scan.
#2. (b) Laplacian of (a).
#3. (c) Sharpened image obtained by adding (a) and (b).
#4. (d) Sobel gradient of image (a).
#5. (e) Sobel image smoothed with a 5 × 5 box filter.
#6. (f) Mask image formed by the product of (b) and (e).
```

```
#7. (g) Sharpened image obtained by the adding images (a) and (f).
#8. (h) Final result obtained by applying a power-law transformation to (g).

#YOUR CODE STARTS HERE




#YOUR CODE ENDS HERE
```

6Q. Write a program to find the largest correlation spot in the given image (hills.jpg) using linear filtering based template matching technique. Draw rectangular bounding box at the detected template (template.png) matched locations.

In [ ]:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt
import math
%matplotlib inline

# Implement Linear Filtering technique on an image using a linear filter #correlatio
def linear_filter(image, filter_): # 'filter' is a keyword in python, so is the unde
    """
    Performs linear filtering on an image.
    Assume image size is W1xW2, filter size is F1xF2.

    Arguments:
    image -- input image possibly with 3 channels(RGB).
    filter_ -- linear filter to apply on image.

    Returns:
    result -- filtered image.
    """
    # DO NOT CHAGE THIS CODE
    image = np.array(image.convert('L')) # converts image to gray scale, so that it
    image_height, image_width = image.shape[0], image.shape[1]

    filter_ = np.array(filter_.convert('L'))
    filter_height, filter_width = filter_.shape[0], filter_.shape[1]

    # result shape will be of size --> (((W1-F1+2P) / S) + 1) x (((W2-F2+2P) / S) +
    # S is stride length, if you don't know about them, don't worry, you will learn
    # we will use simplest setting P=0,S=1. See the next line.

    result_height, result_width = (image_height - filter_height) + 1, (image_width -
    result = np.array([[0 for j in range(result_width)] for i in range(result_height
    # YOUR CODE STARTS HERE




    # YOUR CODE ENDS HERE
    return result



# To test your implementation, run the below code.
image = Image.open('~/hills.jpg')
filter_ = Image.open('~/template.png')
result = linear_filter(image, filter_)
```

```
plt.imshow(result)
plt.title('Filtered Image')
plt.show()
```

7Q. Write functions/subroutines to design spatial filters (sizes of 3X3 and 5X5) - mean, median, Min-Max. For the given noise images. Apply the appropriate filter to enhance the image quality. use images Cameraman_SandP_0.08.jpg, Camerman_G_0.05.jpg. Make observations upon comparing their outputs.

In [34]:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt
import math
%matplotlib inline

#YOUR CODE STARTS HERE




#YOUR CODE ENDS HERE
```