Assignment 01

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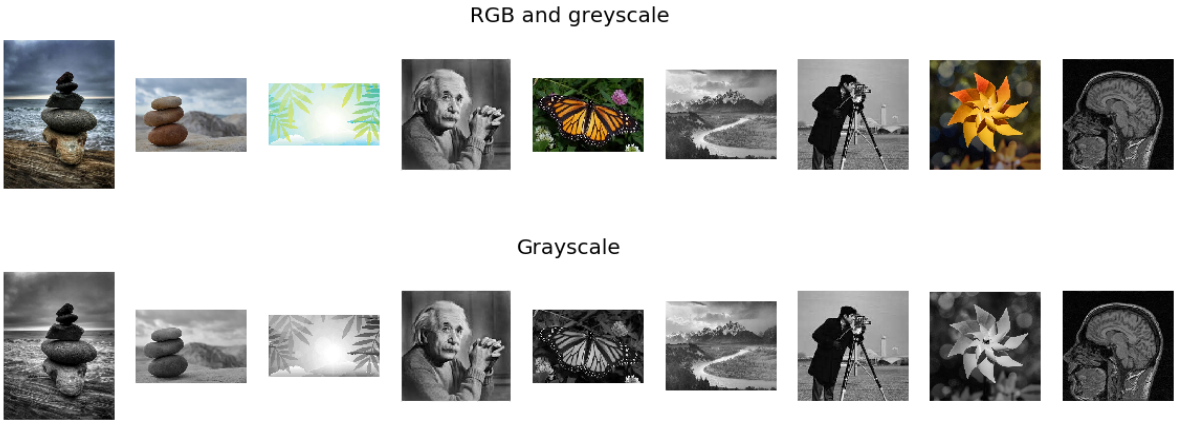
In [1]:
```
import cv2
import glob
import matplotlib.pyplot as plt
import numpy as np
from rgbExclusion import rgbExclusion
%matplotlib inline
```

2.1

Load the set of images and display them as Grayscale and rgb images. You are required to show these images ”inline” rather than creating a new window for every other image.

In [2]:
```
images = [cv2.cvtColor(cv2.imread(file), cv2.COLOR_BGR2RGB) for file in glob.glob(".\images\*.*")]

fig = plt.figure(figsize=[20,3])
num = len(images)
for i in range(num):
    a=fig.add_subplot(1,num,i+1)
    image = images[i]
    plt.imshow(image, cmap='gray')
    plt.axis('off')
    fig.suptitle('RGB and greyscale', fontsize=20)

fig = plt.figure(figsize=[20,3])
for i in range(num):
    a=fig.add_subplot(1,num,i+1)
    gray_img = cv2.cvtColor(images[i], cv2.COLOR_RGB2GRAY)
    plt.imshow(gray_img, cmap='gray')
    plt.axis('off')
    fig.suptitle('Grayscale', fontsize=20)
```



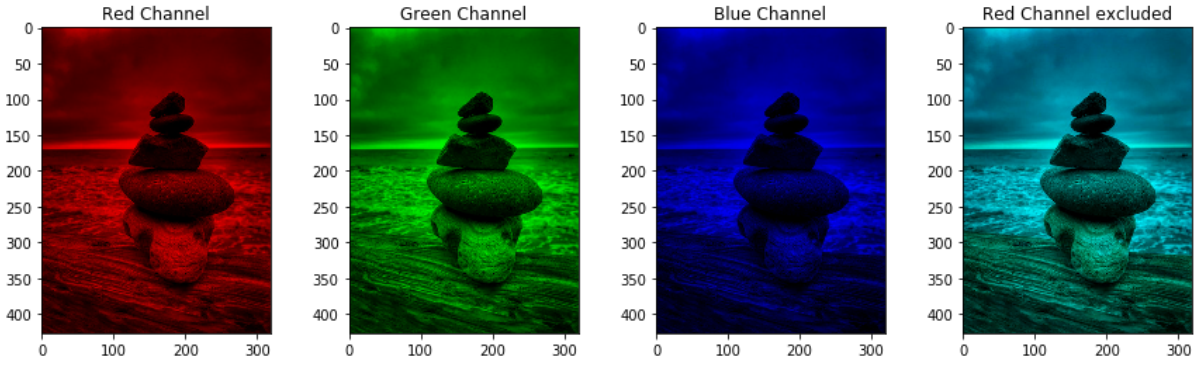
2.2

Implement the function rgbExclusion() in the helper script, in which the input image is decomposed into the three channels: R, G and B and return the image excluding the specified channel. Display the results in notebook.

In [3]:
```
def rgbExclusion(image, channel):
    red_img = np.array(np.zeros(image.shape), dtype='i')
    green_img = np.array(np.zeros(image.shape), dtype='i')
    blue_img = np.array(np.zeros(image.shape), dtype='i')
    #separating channels
    red_channel = image[:,:,0]
    green_channel = image[:,:,1]
    blue_channel = image[:,:,2]
    red_img[:,:,0] = red_channel
    green_img[:,:,1] = green_channel
    blue_img[:,:,2] = blue_channel
    #creating a copy so input image doesnt change
    excluded_img = image.copy()
    #excluding specified channel
    if (channel == 'red'):
        excluded_img[:,:,0] = np.zeros([image.shape[0], image.shape[1]])
    elif (channel == 'green'):
        excluded_img[:,:,1] = np.zeros([image.shape[0], image.shape[1]])
    elif (channel == 'blue'):
        excluded_img[:,:,2] = np.zeros([image.shape[0], image.shape[1]])
    return  red_img, green_img, blue_img, excluded_img
```

In [4]:
```
red_channel, green_channel, blue_channel, excluded_img = rgbExclusion(images[0], channel='red')

fig = plt.figure(figsize=[15,4])
fig.add_subplot(1,4,1)
plt.imshow(red_channel)
plt.title('Red Channel')
fig.add_subplot(1,4,2)
plt.imshow(green_channel)
plt.title('Green Channel')
fig.add_subplot(1,4,3)
plt.imshow(blue_channel)
plt.title('Blue Channel')
fig.add_subplot(1,4,4)
plt.imshow(excluded_img)
plt.title('Red Channel excluded')
```

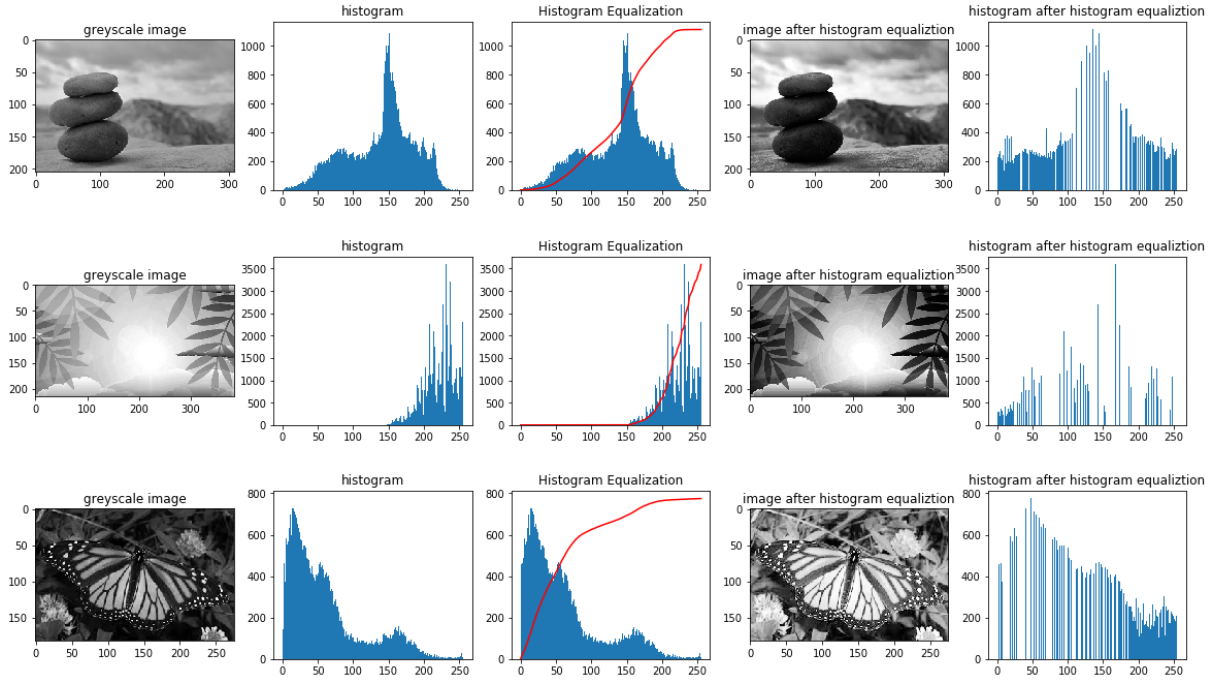
Out[4]:
```
Text(0.5, 1.0, 'Red Channel excluded')
```



2.3

Take at-least 3 images from given set and plot histograms before and after applying histogram equalization. Show these image inline format i.e. grayscale image –> display histogram –> apply histogram equalization–> display the equalized image and its histogram.

In [5]:
```
for i in [1, 2, 4]:
    fig = plt.figure(figsize=[20,3])
    #converting into greyscale image
    gray_img = cv2.cvtColor(images[i], cv2.COLOR_RGB2GRAY)
    #plotting greyscale image
    fig.add_subplot(1,5,1)
    plt.imshow(gray_img, cmap='gray')
    plt.title('greyscale image')
    #plotting greyscale image Histogram
    fig.add_subplot(1,5,2)
    hist = plt.hist(gray_img.ravel(),bins=256,range=(0,255))
    plt.title('histogram')
    #cdf
    fig.add_subplot(1,5,3)
    cdf = hist[0].cumsum()
    cdf_normalized = cdf * float(hist[0].max()) / cdf.max()
    hist = plt.hist(gray_img.ravel(),bins=256,range=(0,255))
    plt.plot(cdf_normalized, color = 'r')
    plt.title('Histogram Equalization')
    #plotting greyscale image after histogram equalization
    fig.add_subplot(1,5,4)
    equ = cv2.equalizeHist(gray_img)
    plt.imshow(equ, cmap='gray')
    plt.title('image after histogram equaliztion')
    #plotting Histogram of greyscale image after histogram equalization
    fig.add_subplot(1,5,5)
    hist = plt.hist(equ.ravel(),bins=256,range=(0,255))
    plt.title('histogram after histogram equaliztion')
```

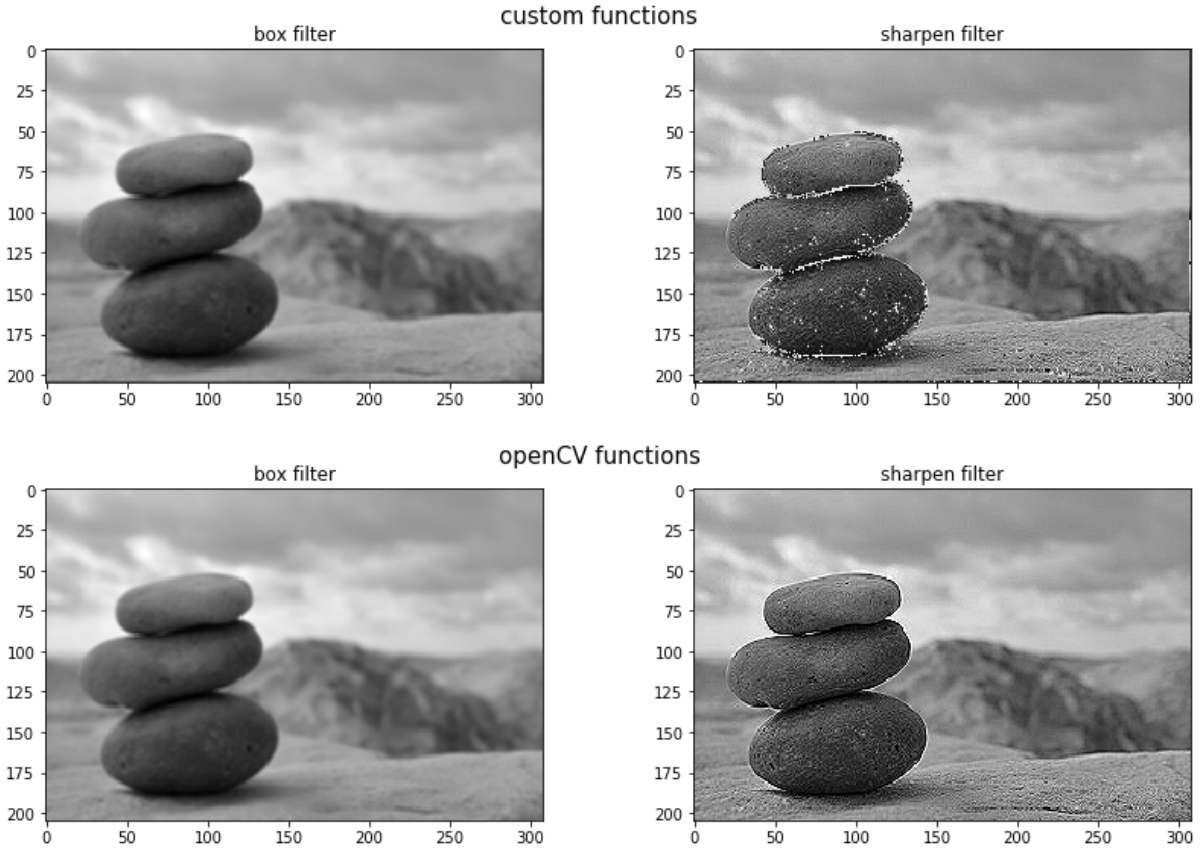


2.4

You are required to implement the convolution operation from scratch. This function which takes an image and a kernel and returns the convolution of them. Compare the results of your implemented function with the ones available (built-in) in python packages. You are required to convolve images for sharpening and blurring effects

In [6]:
```
def conv(image, kernel):
    kernel = np.flipud(np.fliplr(kernel))
    kernel_size = len(kernel)
    output = np.zeros_like(image)
    # zero padding
    image_padded = np.zeros((image.shape[0] + kernel_size-1, image.shape[1] + kernel_size-1))
    image_padded[int(np.floor(kernel_size/2)):-int(np.floor(kernel_size/2)), int(np.floor(kernel_s
ize/2)):-int(np.floor(kernel_size/2))] = image
    # convolotion pixel by pixel iteration
    for x in range(image.shape[1]):
        for y in range(image.shape[0]):
            # multplication and summation
            output[y, x]=(kernel * image_padded[y: y+kernel_size, x: x+kernel_size]).sum()
    return output

kernel_sharpen = np.array([[0, -1, 0], [-1, 5, -1], [0, -1, 0]])
kernel_box = np.array([[1, 1, 1], [1, 1, 1], [1, 1, 1]])/9
gray_img = cv2.cvtColor(images[1], cv2.COLOR_RGB2GRAY)
fig = plt.figure(figsize=[14,4])
plt.subplot(1,2,1)
img = conv(gray_img, kernel_box)
plt.imshow(img, cmap='gray')
plt.title('box filter')
plt.subplot(1,2,2)
img = conv(gray_img, kernel_sharpen)
plt.imshow(img, cmap='gray')
plt.title('sharpen filter')
fig.suptitle('custom functions', fontsize=15)

fig = plt.figure(figsize=[14,4])
plt.subplot(1,2,1)
#using cv2 filters
img = cv2.filter2D(gray_img, -1, kernel_box)
plt.imshow(img, cmap='gray')
plt.title('box filter')
plt.subplot(1,2,2)
img = cv2.filter2D(gray_img, -1, kernel_sharpen)
plt.imshow(img, cmap='gray')
plt.title('sharpen filter')
fig.suptitle('openCV functions', fontsize=15)
```

Out[6]: Text(0.5, 0.98, 'openCV functions')

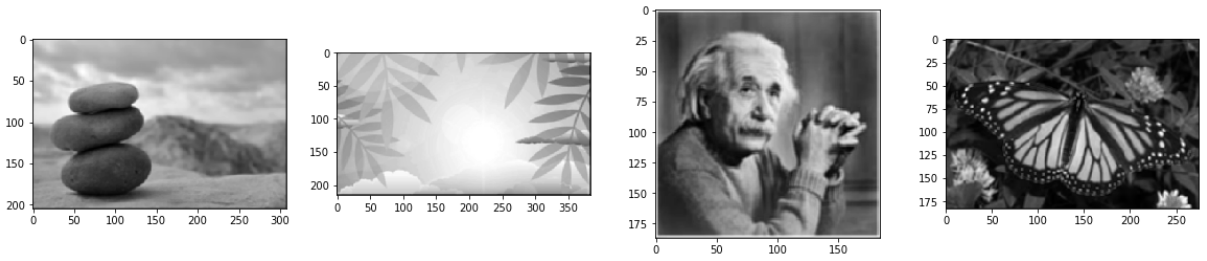


2.5

Load a couple of images from the given set.

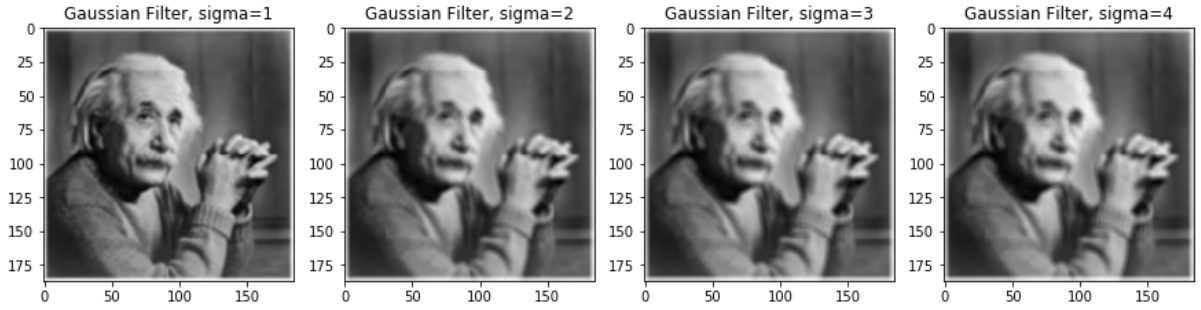
1. Apply box filter using convolution, and display the resultant image

In [7]:
```
kernel_box = np.array([[1, 1, 1], [1, 1, 1], [1, 1, 1]])/9
fig = plt.figure(figsize=[20,4])
for i in [1, 2, 3, 4]:
    gray_img = cv2.cvtColor(images[i], cv2.COLOR_RGB2GRAY)
    img = conv(gray_img, kernel_box)
    plt.subplot(1,4,i)
    plt.imshow(img, cmap='gray')
```



1. Apply Gaussian filter to the image, with varying sigma values.

In [8]:
```
fig = plt.figure(figsize=[15,4])
gray_img = cv2.cvtColor(images[3], cv2.COLOR_RGB2GRAY)
for i in [1,2,3,4]:
    img = cv2.GaussianBlur(gray_img, (5,5),sigmaX=i)
    plt.subplot(1,4,i)
    plt.imshow(img, cmap='gray')
    plt.title("Gaussian Filter, sigma=%i" %i)
```



1. Add Gausian Noise and Salt and Pepper Noise to them.
2. Apply Gaussian Filter and Median Filters

In [9]:
```
"""
fig = plt.figure()
fig.add_subplot(1, 3, 1)
gray_img = cv2.cvtColor(images[7], cv2.COLOR_RGB2GRAY)
plt.imshow(gray_img,cmap='gray')
plt.title("Original Image")

fig.add_subplot(1, 3, 3)
filtered_img = cv2.GaussianBlur(img, (5,5),sigmaX=2)
plt.imshow(filtered_img,cmap='gray')
plt.title("Gaussian Filter, sigma=2")
"""
```

Out[9]:
```
'\nfig = plt.figure()\nfig.add_subplot(1, 3, 1)\ngray_img = cv2.cvtColor(images[7], cv2.COLOR_RGB2
GRAY)\nplt.imshow(gray_img,cmap=\'gray\')\nplt.title("Original Image")\n\nfig.add_subplot(1, 3, 3)
\nfiltered_img = cv2.GaussianBlur(img, (5,5),sigmaX=2)\nplt.imshow(filtered_img,cmap=\'gray\')\npl
t.title("Gaussian Filter, sigma=2")\n'
```

2.6

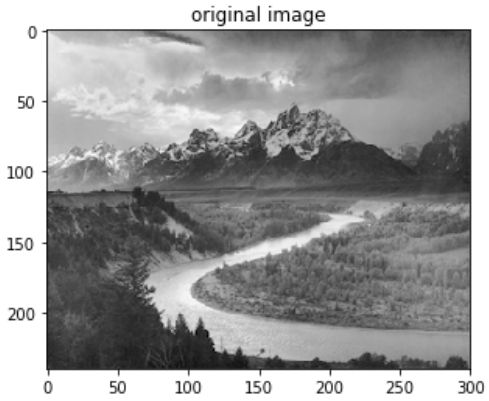
Load a few images from the given set.

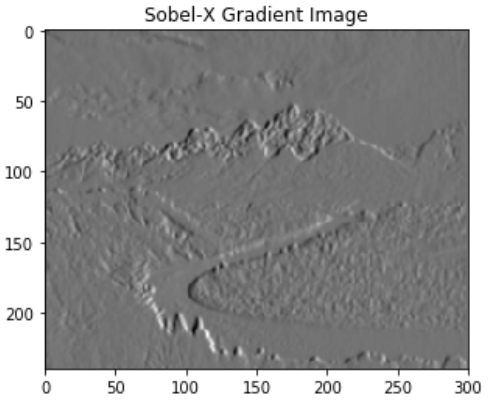
1. Apply Sobel operator, computer gradient magnitude and display the results (original image, gradient images and gradient magnitude image).

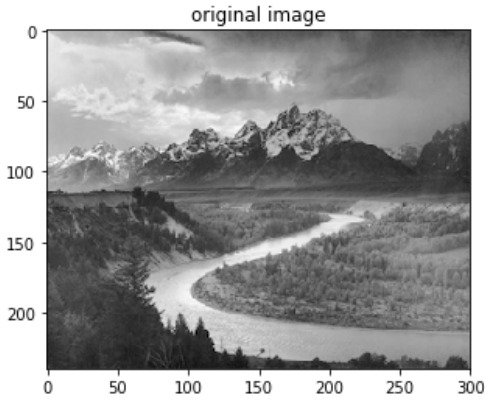
In [10]:

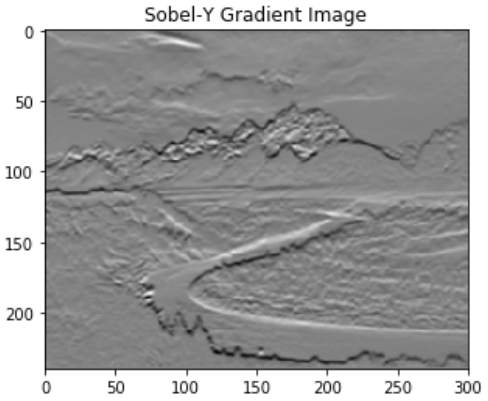
```
gray_img = cv2.cvtColor(images[5], cv2.COLOR_RGB2GRAY)
fig = plt.figure(figsize=[15,4])
plt.subplot(1,2,1)
plt.imshow(gray_img, cmap='gray')
plt.title('original image')
plt.subplot(1,2,2)
SobelX = cv2.Sobel(gray_img,cv2.CV_64F,1,0,ksize=5)
plt.imshow(SobelX, cmap='gray')
plt.title('Sobel-X Gradient Image')

fig = plt.figure(figsize=[15,4])
plt.subplot(1,2,1)
plt.imshow(gray_img, cmap='gray')
plt.title('original image')
plt.subplot(1,2,2)
SobelY = cv2.Sobel(gray_img,cv2.CV_64F,0,1,ksize=5)
plt.imshow(SobelY, cmap='gray')
plt.title('Sobel-Y Gradient Image')

fig = plt.figure(figsize=[15,4])
plt.subplot(1,2,1)
plt.imshow(gray_img, cmap='gray')
plt.title('original image')
plt.subplot(1,2,2)
sobel=np.hypot(SobelX,SobelY)
plt.imshow(sobel,cmap='gray')
plt.title('Sobel Gradient Magnitude Image)')
```

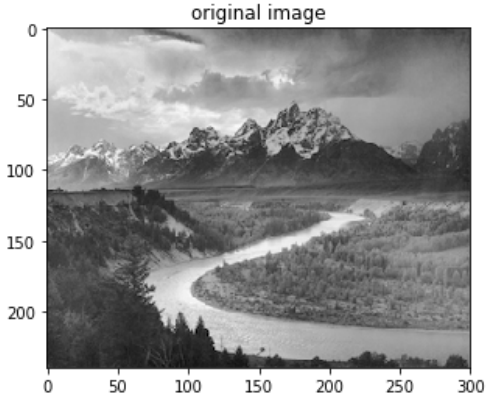
Out[10]: Text(0.5, 1.0, 'Sobel Gradient Magnitude Image)')

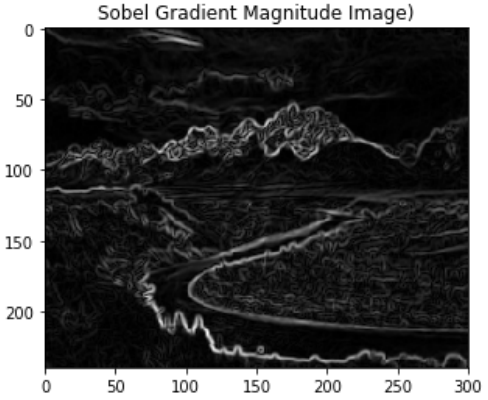






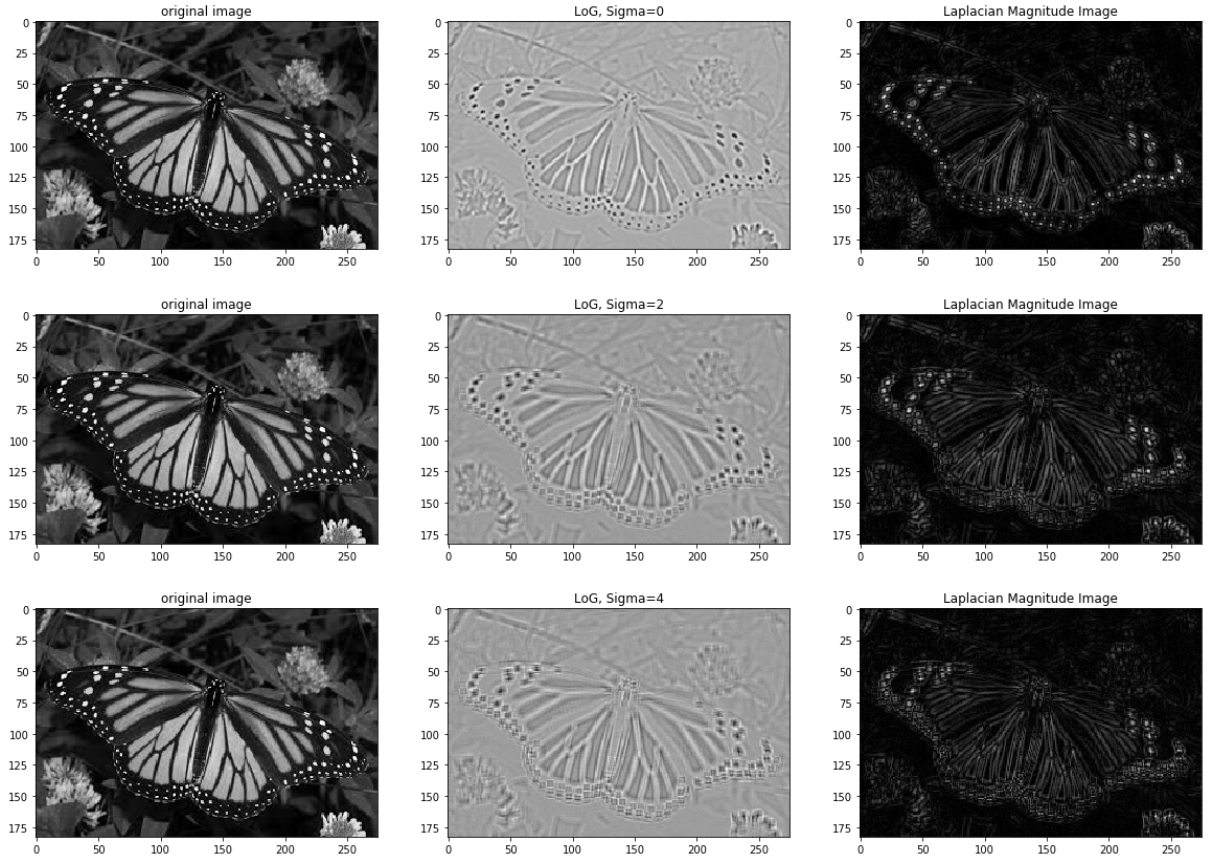






1. Apply Laplacian of Gaussian, computer laplacian magnitude and display the results (original image, filtered images and laplacian magnitude image). Try different filter kernel coeffcients.

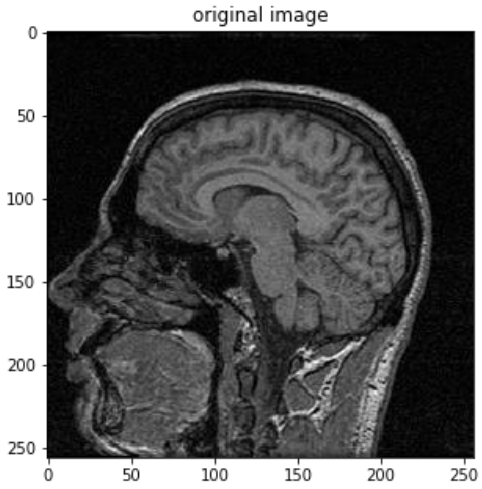
In [11]:
```
for i in [0,2,4]:
    fig = plt.figure(figsize=[20,4])
    #origional greyscale image
    plt.subplot(1,3,1)
    gray_img = cv2.cvtColor(images[4], cv2.COLOR_RGB2GRAY)
    plt.imshow(gray_img, cmap='gray')
    plt.title('original image')
    #applying gaussian kernel
    plt.subplot(1,3,2)
    gaussian_img = cv2.GaussianBlur(gray_img, (5,5),sigmaX=i)
    #taking leplacian after gaussian filtering
    Laplacian_img = cv2.Laplacian(gaussian_img,cv2.CV_64F)
    plt.imshow(Laplacian_img, cmap='gray')
    plt.title('LoG, Sigma=%i' %i)
    plt.subplot(1,3,3)
    Laplacian_mag = np.uint8(np.absolute(Laplacian_img))
    plt.imshow(Laplacian_mag,cmap='gray')
    plt.title('Laplacian Magnitude Image')
```

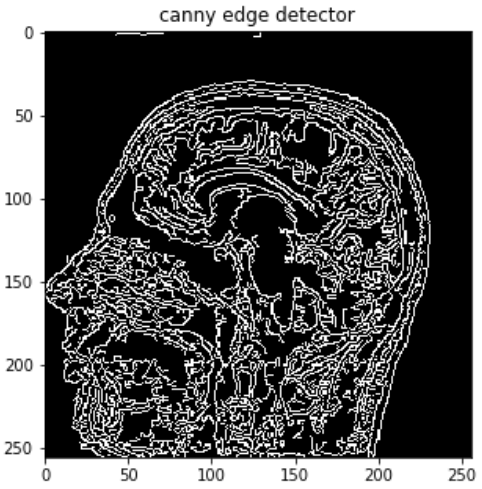


1. Apply Canny Edge Detector and display the results.

In [12]:
```
fig = plt.figure(figsize=[15,5])
plt.subplot(1,2,1)
gray_img = cv2.cvtColor(images[8], cv2.COLOR_RGB2GRAY)
plt.imshow(gray_img, cmap='gray')
plt.title('original image')
plt.subplot(1,2,2)
canny_img = cv2.Canny(gray_img, 80, 200)
plt.imshow(canny_img, cmap='gray')
plt.title('canny edge detector')
```

Out[12]:
```
Text(0.5, 1.0, 'canny edge detector')
```





2.7

Implement Canny Edge detector from scratch or use built-in function from python packages, and apply it on a real time video/stream.

In [13]:
```
cap = cv2.VideoCapture(0)
while True:
    #capturing frames from camera
    ret, frame = cap.read()
    frame = cv2.GaussianBlur(frame, (5, 5), 1)
    frame = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    edge = cv2.Canny(frame, 30, 100)
    cv2.imshow('Canny Edge', edge)
    #press q to exit
    if cv2.waitKey(20) == ord('q'):
        break
```

In [ ]:
```
```