**Practical No: 5**

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## Aim: Write a program to apply various enhancements on images using image derivatives by implementing Gradient and Laplacian operations.

## Gradient: The following code block shows how to compute the gradient with the convolution kernels shown previously, with the gray-scale chess image as input. It also plots how the image pixel values and x\_component of the gradient vector changes with the y coordinates for the very first row in the image(x=0):

**Program Code: A**

import numpy as np

from scipy import signal, misc, ndimage

from skimage import filters, feature, img\_as\_float

from skimage.io import imread

from skimage.color import rgb2gray

from PIL import Image, ImageFilter

import matplotlib.pylab as pylab

def plot\_image(image, title):

pylab.imshow(image), pylab.title(title, size=20), pylab.axis('off')

ker\_x = [[-1, 1]]

ker\_y = [[-1], [1]]

im = rgb2gray(imread('../images/chess.png'))

im\_x = signal.convolve2d(im, ker\_x, mode='same')

im\_y = signal.convolve2d(im, ker\_y, mode='same')

im\_mag = np.sqrt(im\_x\*\*2 + im\_y\*\*2)

im\_dir = np.arctan(im\_y/im\_x)

pylab.gray()

pylab.figure(figsize=(30,20))

pylab.subplot(231), plot\_image(im, 'original'), pylab.subplot(232),

plot\_image(im\_x, 'grad\_x')

pylab.subplot(233), plot\_image(im\_y, 'grad\_y'), pylab.subplot(234),

plot\_image(im\_mag, '||grad||')

pylab.subplot(235), plot\_image(im\_dir, r'$\theta$'), pylab.subplot(236)

pylab.plot(range(im.shape[1]), im[0,:], 'b-', label=r'$f(x,y)|\_{x=0}$', linewidth=5)

pylab.plot(range(im.shape[1]), im\_x[0,:], 'r-', label=r'$grad\_x (f(x,y))|\_{x=0}$')

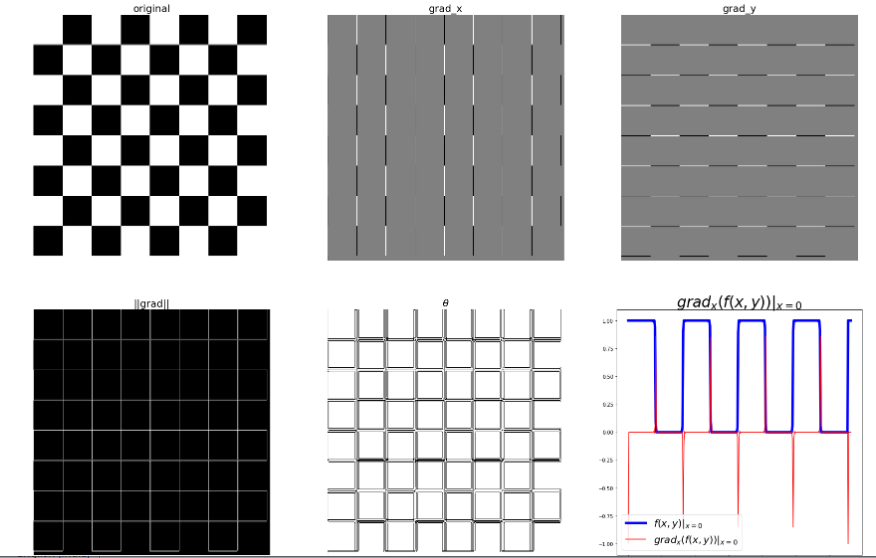
pylab.title(r'$grad\_x (f(x,y))|\_{x=0}$', size=30)

pylab.legend(prop={'size': 20}

pylab.show()

**output:**

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**Program Code B: Laplacian operations.**

ker\_laplacian **=** [[0,**-**1,0],[**-**1, 4, **-**1],[0,**-**1,0]]

im **=** rgb2gray(imread('../images/chess.png'))

im1 **=** np**.**clip(signal**.**convolve2d(im, ker\_laplacian, mode**=**'same'),0,1)

pylab**.**gray()

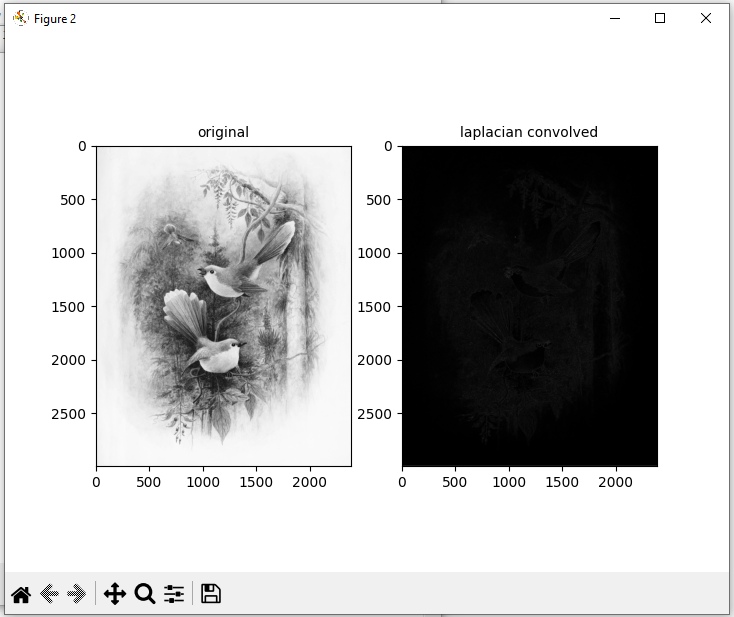
pylab**.**figure(figsize**=**(20,10))

pylab**.**subplot(121), plot\_image(im, 'original')

pylab**.**subplot(122), plot\_image(im1, 'laplacian convolved')

pylab**.**show()

**output:**

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