LAB-02: Introduction to Python and OpenCV WRT Image processing

Objective:

The objective of this lab is to introduce the student with OpenCV especially with respect to image processing.

Theory:

Open Source **C**omputer **V**ision Library (**OpenCV**) is an open source software library written in C++ for machine learning and computer vision applications. It is licensed under BSD licenses which make it suitable for use both in the industry and academia.

Why OpenCV?

OpenCV is comprehensive collection of more than 2500 machine learning and computer vision algorithms that can be used from something as simple detecting faces in images to project augmented reality overlaid with scenery.

Another area in which OpenCV excels is its superior support for multiple interfaces and all the major operating systems as compared to other solutions. OpenCV supports Windows, Linux, OS X and Android and provides interfaces for C, C++, Python, Java and MATLAB.

OpenCV is used extensively from tech giants such as Google, Microsoft, Intel, IBM etc. to start-ups like Applied Minds, VideoSurf and Zeitera.

Some of the applications that can be accomplished easily with OpenCV are: identifying objects, tracking camera movements, stitching images together, finding similar images in a database using an image, face detection and tracking moving objects in a video feed etc.

Some Useful Commands:

1. To create a 2D array of zeros using NumPy: my_array = **numpy.zeros ((row, columns))**
2. To create a 2D array of ones using NumPy: my_array = **numpy.ones ((row, columns))**
3. To check the size of a 2D array: size = **numpy.shape(my_array)**
4. Reading an image using OpenCV: my_image = **cv2.imread(“test_image.jpg”,0)**

The second argument determines whether the image is read as a grayscale image or a colored image. **0** is used for reading an image as grayscale and while **1** is used for reading in color. If no argument is passed then the image is read as is.

5. Displaying an image using OpenCV: **cv2.imshow ("Title of the window", my_image**). Two more commands that need to be used while displaying an image are: **cv2.waitKey(x) cv2.destroyAllWindows().** The waitKey() function waits for a key being pressed for x number of milliseconds. If **0** is passed to waitKey() as an argument, it will wait indefinitely for a key press. **cv2.destroyAllWindows()** closes are the open image windows.
6. Writing an image to disk: **cv2.imwrite("image_name.jpg", my_image)**
7. Resizing an image: **cv2.resize(my_image, (new_height,new_width))**

Lab Tasks:

Lab Task 1:

Read any image that you want using the right command and display it.

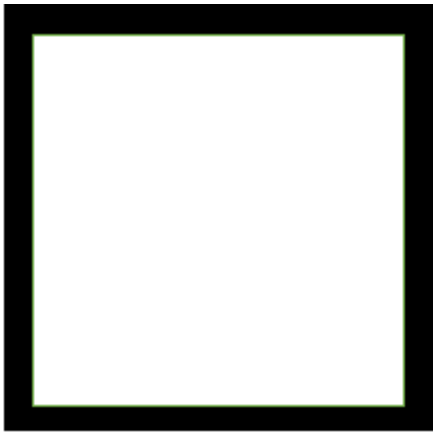
Lab Task 2:

a) Now mirror the image that you have read at center i.e. the lower half of the image should be the copy of the upper half. (**HINT:** You can use nested loops). Write the image to the disk using the right command.

b) Now completely flip the image so that the image is upside down as shown below:

Lab Task 3:

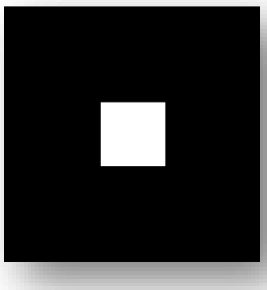
Create an *r x c* matrix of ones and pad 10 pixels wide border of zeros across each side of it, such that its order will become (4+500+4) x (4+500+4) = 508x508 as shown below:

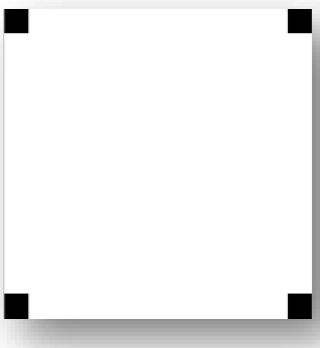


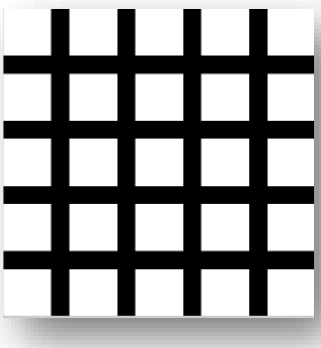
Create a generic function so that the values (500 and 4) can be passed by the user.

Lab Task 4:

Write 3 different Python functions that can create the images given below. Code them in such so that the size of the image itself and the boxes and lines can be changed.





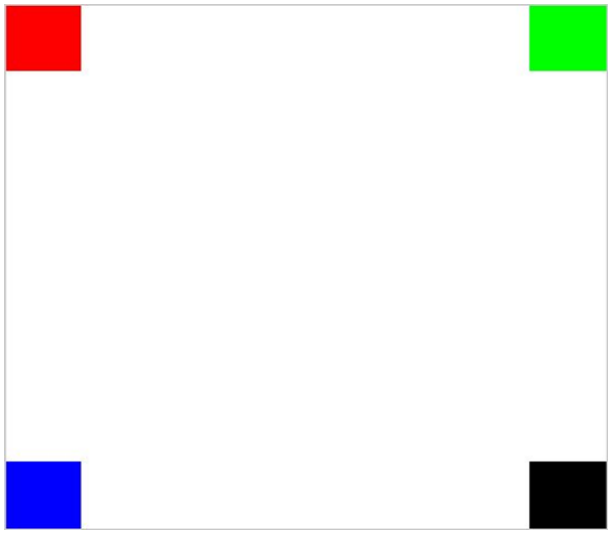


Lab Task 5:

Read an image and resize it to 512x512 using the appropriate function. Then down sample the image by 4 so that the final size of the image is 128x128. Display and save the image to the disk.

Lab Task 6:

Write a function to create a white image of 500x500 (or any other size entered by the user) and then create 4 boxes of Red, Green, Blue and Black respectively on each corner of the image as shown below. The size of the colored boxes should be $1/8^{th}$ the size of the image. (**HINT:** the arrays of ones and zeros can be in more than 2 dimensions)



Conclusion:

This lab gives a basic introductory session on the use of OpenCV for image processing, types of images and creating colored, grayscale and binary images.