Lab No 1: **Date:**

Introduction to OpenCV using Python

Objectives:

In this lab, student will be able to

1. Understand the execution environment of PyCharm
2. Learn basic concepts of OpenCV with Python
3. Learn and use the basic functions of OpenCV

I. Introduction to OpenCV

OpenCV is an open-source software library for computer vision and machine learning. The OpenCV full form is Open-Source Computer Vision Library. It was created to provide a shared infrastructure for applications for computer vision and to speed up the use of machine perception in consumer products. OpenCV, as a BSD-licensed software, makes it simple for companies to use and change the code. There are some predefined packages and libraries that make our life simple and OpenCV is one of them.

The term Computer Vision (CV) is used and heard very often in artificial intelligence (AI) and deep learning (DL) applications. The term essentially means giving a computer the ability to see the world as we humans do.

Computer Vision is a field of study which enables computers to replicate the human visual system. As already mentioned above, it's a subset of artificial intelligence which collects information from digital images or videos and processes them to define the attributes. The entire process involves image acquiring, screening, analysing, identifying and extracting information. This extensive processing helps computers to understand any visual content and act on it accordingly.

II. OpenCV Installation

To install OpenCV, one must have Python and PIP, preinstalled on their system. To check if your system already contains Python, go through the following instructions: Open the Command line(search for cmd in the Run dialog(+ R). Now run the following command:

python --version

If Python is already installed, it will generate a message with the Python version available.

PIP is a package management system used to install and manage software packages/libraries written in Python. These files are stored in a large "on-line repository" termed as Python Package Index (PyPI). To check if PIP is already installed on your system, just go to the command line and execute the following command:

pip -v

The PIP can be downloaded and installed using the command line by going through the following steps:

Method: Using cURL in Python

Curl is a UNIX command that is used to send the PUT, GET, and POST requests to a URL. This tool is utilized for downloading files, testing REST APIs, etc.

Step 1: Open the cmd terminal

Step 2: In python, a curl is a tool for transferring data requests to and from a server. Use the following command to request:

curl https://bootstrap.pypa.io/get-pip.py -o get-pip.py

python get-pip.py

Verification of the installation process

One can easily verify if the pip has been installed correctly by performing a version check on the same. Just go to the command line and execute the following command:

pip -v or pip --version

III. Simple Image and video reading/writing program:

Reading, displaying, and writing images are basic to image processing and computer vision. Even when cropping, resizing, rotating, or applying different filters to process images, you'll need to first read in the images. So it's important that you master these basic operations. Use the following link to read more information.

https://learnopencv.com/read-display-and-write-an-image-using-opencv/

Solved Exercise:

```
# import the cv2 library
import cv2

# The function cv2.imread() is used to read an image.
img_grayscale = cv2.imread('D:\CLASS MATERIAL\MY CODE\data\kid.jpg', 0)

# The function cv2.imshow() is used to display an image in a window.
cv2.imshow('graycsale image', img_grayscale)

# waitKey() waits for a key press to close the window and 0 specifies indefinite loop
cv2.waitKey(0)

# cv2.destroyAllWindows() simply destroys all the windows we created.
cv2.destroyAllWindows()

# The function cv2.imwrite() is used to write an image.
cv2.imwrite('d:\grayscale.jpg', img_grayscale)
```

```
import numpy as np
import cv2

cap = cv2.VideoCapture(0)
fourcc = cv2.VideoWriter_fourcc(*'XVID')
out = cv2.VideoWriter('d:\output.avi',fourcc, 20.0, (640,480))

while(True):
    ret, frame = cap.read()
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    out.write(frame)
    cv2.imshow('frame',gray)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break

cap.release()
out.release()
cv2.destroyAllWindows()
```

Lab Exercises:

1. Write a simple program to read, display, and write an image.
2. Write a simple program to read and display a video file.
3. Write a simple program to Extracting the RGB values of a pixel.
4. Write a simple program to draw rectangle.
5. Write a simple program to Resizing the Image.
6. Write a simple program to Rotating the Image.