**Department of Electrical Engineering**

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| **Faculty Member:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Dated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
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| **Course/Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Semester: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
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**CS-477 Computer Vision**

**Lab#3: Introduction to OpenCV**

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|  |  | **PLO4-CLO4** | **PLO5-CLO5** | **PLO8-CLO6** | **PLO9-CLO7** |
| **Name** | **Reg. No** | **Investigation**  **(5 marks)** | **Modern Tool Usage**  **(5 marks)** | **Ethics**  **(5 marks)** | **Individual and Team Work**  **(5 marks)** |
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**Lab#3: Introduction to OpenCV**

**Objectives:** The following are the main objectives of this lab:

* Load, save and display image data using Python
* Access and modify pixels as well as ROIs in images
* Place lines, rectangles, circles and text in images
* Resize image at various scales
* Rotate image at various angles

**Lab Instructions**

* This lab activity comprises of following parts: Lab Exercises, and Post-Lab Viva/Quiz session.
* The lab report shall be uploaded on LMS.
* Only those tasks that are completed during the allocated lab time will be credited to the students. Students are however encouraged to practice on their own in spare time for enhancing their skills.

**Lab Report Instructions**

All questions should be answered precisely to get maximum credit. Lab report must ensure following items:

* Lab objectives
* Python codes
* Results (graphs/tables) duly commented and discussed
* Conclusion

## Introduction

This laboratory exercise will introduce OpenCV which is a popular and widely used library for image processing and computer vision applications. A large number of algorithms used in robotics employ aspects of vision such as in feature extraction, image stitching, stereovision, visual servoing and structure from motion etc. Before starting computer vision, it is important to familiarize with the basics of image processing which is the subject of this lab.

## Objectives

* Load, save and display image data using Python
* Access and modify pixels as well as ROIs in images
* Place lines, rectangles, circles and text in images
* Resize image at various scales
* Rotate image at various angles

## Lab Conduct

* Respect faculty and peers through speech and actions
* The lab faculty will be available to assist the students. In case some aspect of the lab experiment is not understood, the students are advised to seek help from the faculty.
* In the tasks, there are commented lines such as #YOUR CODE STARTS HERE# where you have to provide the code. You must put the code between the #START and #END parts of these commented lines. Do NOT remove the commented lines.
* Use the tab key to provide the indentation in python.

**Theory**

OpenCV is a library that focuses on image processing and computer vision. An image is an array of colored square called pixels. Each pixel has a certain location in the array and color values in BGR format. By referring to the array indices, the individual pixels or a range of pixels can be accessed and modified. OpenCV provides many functions for resizing, rotating, and placing objects in images. Rotation involves computing a 2-D rotation matrix which is applied for the transformation of the image.

In the lab, you will be provided with a number of image files which you must use in the tasks.

**Lab Task 1 – Load and Display Images [1]**

Write a python script in which you will load 3 images from disk. Then, display the images in different windows at the same time. You will need to provide the code and a single screenshot which shows all 3 windows.

*### TASK 1 CODE STARTS HERE ###*

*### TASK 1 CODE ENDS HERE ###*

*### TASK 1 SCREENSHOT STARTS HERE ###*

*### TASK 1 SCREENSHOT ENDS HERE ###*

**Lab Task 2 – Cropping [1]**

Write code to load the walle.jpg file. Using the slice operation, crop out the four quadrants of the image and display them in separate windows. The code must be generic enough to take the image size into account. For submission, provide the code and a single screenshot showing all 4 windows.

*### TASK 2 CODE STARTS HERE ###*

*### TASK 2 CODE ENDS HERE ###*

*### TASK 2 SCREENSHOT STARTS HERE ###*

*### TASK 2 SCREENSHOT ENDS HERE ###*

**Lab Task 3 – Modifying Pixel Colors [2]**

Write code to load the walle.jpg file and place alternating green and white horizontal lines in the image. Do **NOT** use the line function (cv2.line). You need to this by changing the pixel colors. Each line must be 1-pixel thick. The lines are also spaced apart by 1-pixel wide gap. Thus, the image will have one green line, then one line of image pixels, then one white line, then another line of image pixels and so on. Provide the code and screenshot for the submission.

*### TASK 3 CODE STARTS HERE ###*

*### TASK 3 CODE ENDS HERE ###*

*### TASK 3 SCREENSHOT STARTS HERE ###*

*### TASK 3 SCREENSHOT ENDS HERE ###*

**Lab Task 4 – Placing Shapes and Text [1]**

Load any one of the provided images and place a line, rectangle, circle and text using the inbuilt functions in OpenCV. Each of the placed object must have a different color. The text must contain the name of at least one member of your group. Provide the code and screenshot of the image.

*### TASK 4 CODE STARTS HERE ###*

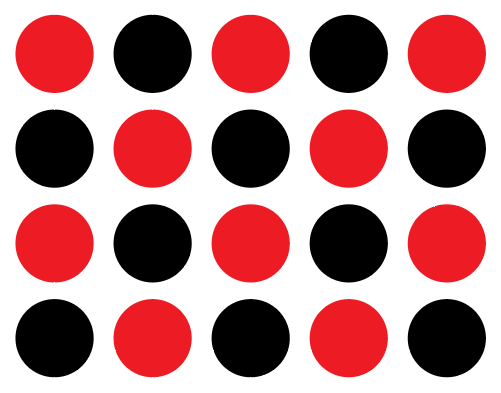
*### TASK 4 CODE ENDS HERE ###*

*### TASK 4 SCREENSHOT STARTS HERE ###*

*### TASK 4 SCREENSHOT ENDS HERE ###*

**Lab Task 5 – Further Placing Shapes [2]**

In this task, you will place solid circles of alternating colors similar to those shown in the figure.



To make the circle solid, the thickness argument should be set to -1 in the cv2.circle function. The above shown pattern must be placed on one of the provided images. It is up to you to choose the radius of the circles as well as their colors. At least, 2 colors must be used. Provide the code and screenshot of the final result.

*### TASK 5 CODE STARTS HERE ###*

*### TASK 5 CODE ENDS HERE ###*

*### TASK 5 SCREENSHOT STARTS HERE ###*

*### TASK 5 SCREENSHOT ENDS HERE ###*

**Lab Task 6 – Resizing Images [1]**

Load any one of the provided images and use the resize function to make copies of the image at different sizes. Display at least 3 different sizes in separate windows and take the screenshot. Provide the code and screenshot for the submission.

*### TASK 6 CODE STARTS HERE ###*

*### TASK 6 CODE ENDS HERE ###*

*### TASK 6 SCREENSHOT STARTS HERE ###*

*### TASK 6 SCREENSHOT ENDS HERE ###*

**Lab Task 7 – Rotating Images [2]**

Load any one of the provided images and use the rotate function to rotate the image at angles of 30, 60 and 90 degrees. For each rotated image, you need to manually adjust the scale factor (in get2DRotationMatrix function) so that the entire image is shown in the window. The rotated image’s border/corner must touch the window’s border. Show all 3 windows in the screenshot. Provide the code and screenshot for the submission.

*### TASK 7 CODE STARTS HERE ###*

*### TASK 7 CODE ENDS HERE ###*

*### TASK 7 SCREENSHOT STARTS HERE ###*

*### TASK 7 SCREENSHOT ENDS HERE ###*