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Application of Python-OpenCV to detect contour of shapes and colour of a real image

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Abstract: **OpenCV-Python has found its use in various fields during the course of its development, especially in the shape and colour detection of an actual image. It is more reliable to make a better and faster decision. So, OpenCV and Python are increasingly finding their application in the shape and colour detection of the images. In this following work, we will focus on how to detect the shapes and colour of a binary image by using Python 3.8, OpenCV 4.5, and Numpy 1.19.3 resources. This research is investigated in two steps process. Firstly, the image has been processed to detect the various shapes and colors of an image's specific shape. Secondly, catching the colour of an actual image by using our model.**

Keywords: **OpenCV, Python, Numpy, Computer vision, shape and colour detection.**

1. INTRODUCTION

OpenCV is one of the most popular and well-known open-source software libraries for computer vision and machine learning. It was first developed by intel in 1999 and released in 2000. This library uses optimized C/C++ and has an interface that supports Python, JAVA, MATLAB, etc [3, 5]. This library is comfortable running on the operating system, say, Windows and Linux. OpenCV contains over 2500 optimized algorithms, including an extensive range of classic and cutting-edge computer vision and machine learning methods [3,4,5].

In addition, Python is a friendly programming language but a cost of speed [9]. Thus, doing the code is fast, and the original OpenCV C++ implementation is wrapped by Python-OpenCV [5]. Complex tasks include identifying and recognizing faces and objects, classifying human action in videos, tracking camera movements and moving objects, extracting 2D and 3D features, gesture Recognition, human-computer attractions, and many more [1, 2, 6].

In this paper, we have focused on detecting geometrical contour and colour of shapes and detecting the colour of an image of a traffic signal by using the application of python-OpenCV.

2. STEPS INVOLVED IN SHAPES AND COLOUR DETECTION OF AN IMAGE

2.1 Installation Python-openCV

To install OpenCV in our system, we must have pre-installed Python 3.8, NumPy, and Matplotlib [9, 10]. OpenCV is directly downloaded and installed using pip, and type the following command: *pip install opencv-python*. To develop our model in this study, we have considered Visual Studio code and are ready to import all the libraries.

2.2 Read image file

OpenCV makes it easy to read in various file formats(JPG, PNG, TIFF) using imread [5, 6, 8]. Initially, an image is proposed to import and read the image. To read the image cv2. imread() is used, which is an in-built function. It is noted that the images are loaded from a specific folder. However, this function cannot be read due to a missing file and invalid format.

3. WORKING TRAITS DESCRIPTION:

1. First we have to read the image using imread() function.
2. Contour detection.
3. Shape detection of the geometrical shapes.
4. study pixel of an image to detect the colours.

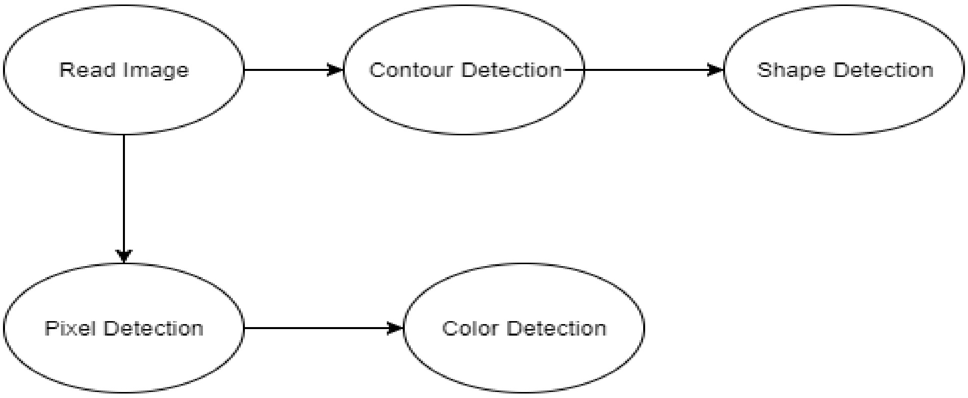

Fig 1: A flow charts for shape and colour detection.

4. ADVANTAGES OF USING PYTHON FOR OPENCV

The advantages of using Python for computer vision are used widely in our society [3, 9]. Computer vision is a cutting-edge and potentially Revolutionary Technology in Computer Science and Technology improvement. It is a subset of machine learning, which is itself a subset of artificial intelligence (AI) [4]. Computer vision allows computers to recognize objects in Digital Images or videos [6]. Implementing OpenCV through Python will enable developers to handle operations involving visualizations. In this case, Python is the most used programming language for CV.

Python is a programming language designed to make it simple for both novice and experienced programmers [9]. It is mostly used as a mature, well-supported programming language for machine learning, which is why many programmers or developers use it for CVs.

5. SHAPE AND COLOUR DETECTION BY PYTHON-OPENCV

In this section, we study Python-OpenCV through how to detect the contour and colour of these geometrical shapes. In the second case, we also examine our model to detect the colour of a traffic light image.

5.1 Shape and colour detection of Geometrical shape

In the first stage, we have made an image with six various geometrical shapes and colours, see Figure 1. By applying Python-OpenCV, we developed our model carefully to detect the contour of the shapes and colour of specific shapes, see Figures 2 and 3. To catch the length of various shapes in our given image (Figure 1), we have run our model as, (i) when it is Rectangular, we assign length equal to '4', (ii) when it is Pentagon, we assign length equal to '5', (iii) when it is Star we assign length equal to '12', (iv) We assign length equal to '6' when it is a Hexagon, (v) when it is Triangular we assign length equal to '3', and (vi) else we assign Circle in our model.

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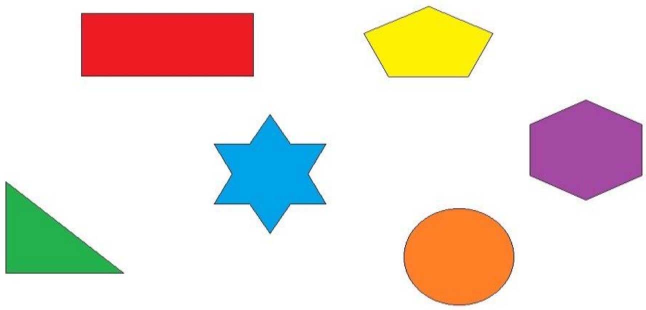


Fig 2: Original image

In Figure 3, we have successfully detected the contour and shapes of these geometrical shapes. The solid black edge of the shapes describes the recognition of contours. The specific shape of our model perfectly defines the names. Now, we will focus on detecting the colour of the shapes, see Figure 4.

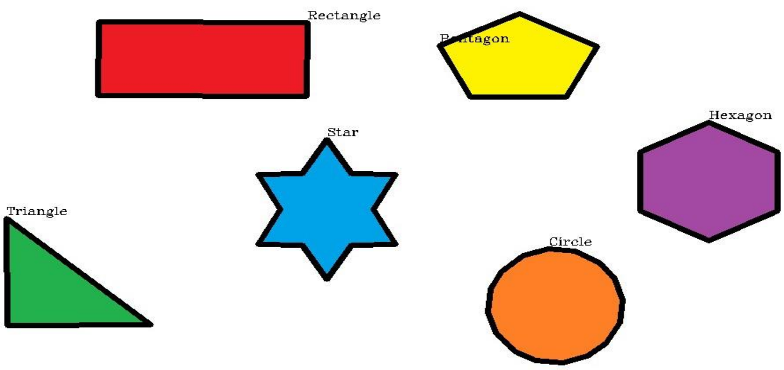
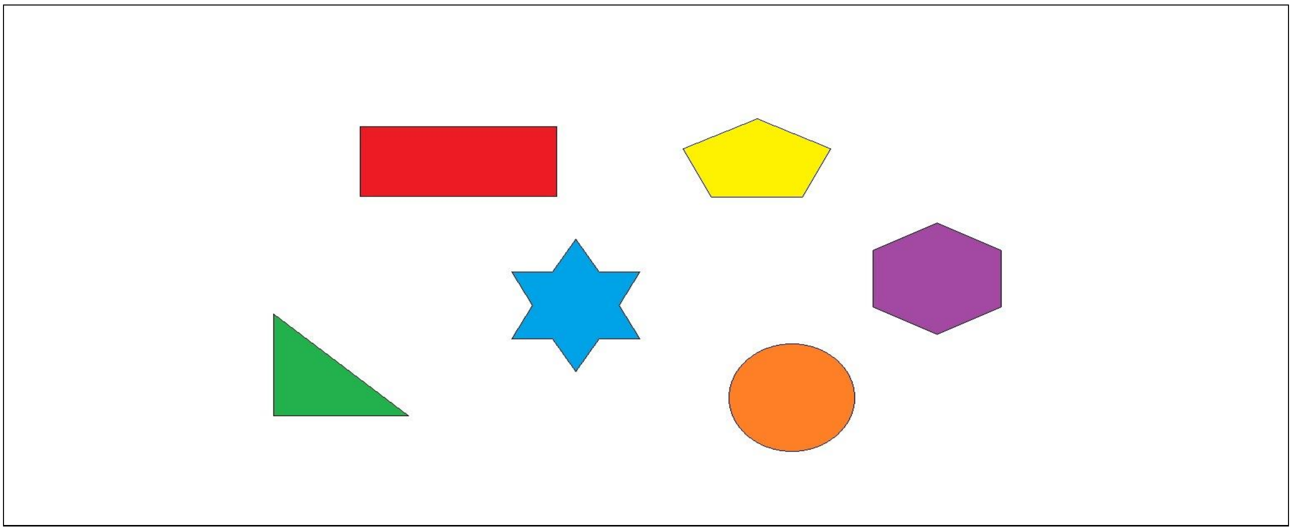


Fig 3: Contour and Shape detection by applying Python-OpenCV

Now, we have considered our given image to detect the colour.

Table 1: Colour detection of geometrical shapes



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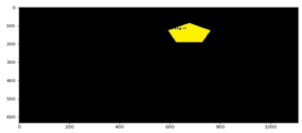
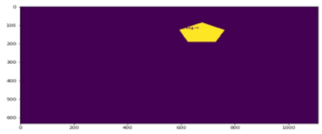
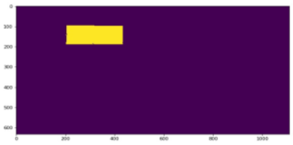
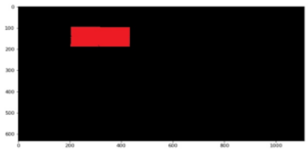
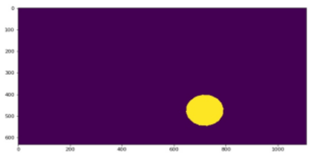
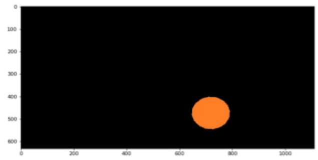
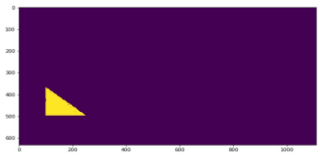
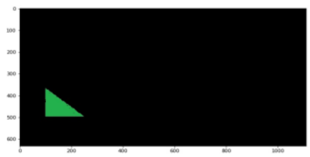
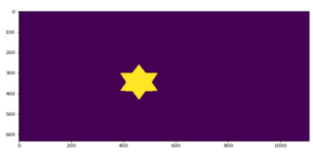
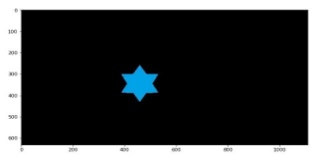
Shape name	Original colour	Mask of the shape	Colour of the shape	Result of the colour
Pentagon	Yellow			Yellow
Rectangle	Red			Red
Circle	Orange			Orange
Triangle	Green			Green
Star	Blue			Blue

5.2 Colour detection of a traffic image

Based on the basic experiment of the geometrical shapes. We have examined the traffic image to recognize the colour by using our Python-OpenCV model, see table 1. In this case, we have considered our developed model with the below image, see Figure 5.

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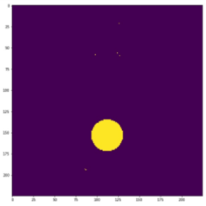
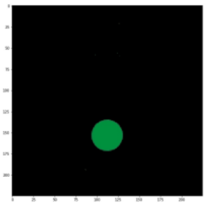
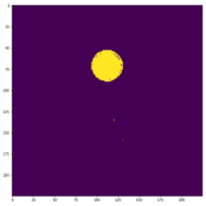
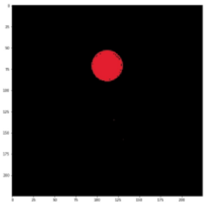
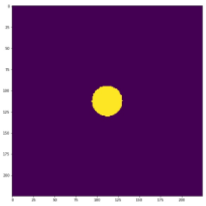
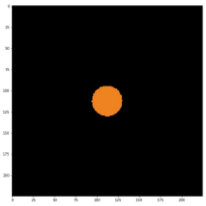
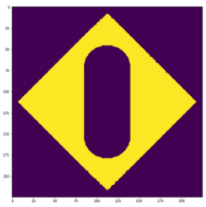
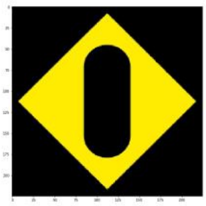
Table 2: Colour detection of a traffic image

Fighur 5. A traffic image

shape	original colour	Mask of image	detected colour	result of the colour
Green circular	Green			Green
Red circular	Red			Red
Orange circular	Orange			Orange
Yellow shape	Yellow			Yellow

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6. FUTURE SCOPE OF COMPUTER VISION

Although computer vision is still in its early stages of research, it has not yet reached the point where it can be directly applied to solving real-world problems. Computer vision technology has been growing exponentially [3, 5, 6]. It has been a subject of matters of cumulative interest and rigorous research for the last decades. It has been a source of widespread fascination and thorough investigation for decades. In recent years, the computer vision and pattern recognition groups have focused a lot of emphasis on object detection in photos and videos [1, 2, 8]. Our study has discussed some common and widely used applications in computer vision.

6.1 Face recognition

Face recognition is a technique for recognizing of verifying an individual identity by utilizing their face [1, 2]. When we click a photo of our friends, the face detection algorithm in the camera can detect and focus the faces and adjust accordingly. It is one of the simple applications of computer vision that we can see in our daily life.

6.2 Health care

Computer vision has a lot of potential in the healthcare division. It has a strong chance to assist in diagnosing diseases, for example, finding cancer cells in a tissue biopsy [6]. In addition, object recognition is also used in the medical field, where it is utilized to detect the diseases such as brain tumors.

6.3 Bio-metric detection

Bio-metric detection techniques are categorized as physiological attributes or behavioral singularities [6, 7]. Physiological bio-metric is the classification of a person based on data received from his or her fingerprints, face, eye iris, and hand geometry. But, behavioral bio-metrics consists of measurements taken from human actions such as voice verification and handwriting signatures.

6.4 Stop and pedestrian sign detection

Traffic and pedestrian sign detection and recognition are essential modules of the driver or pedestrian warning and assistance system [1, 6]. Computer vision models have been used widely to solve these types of problems.

7. CHALLENGES

In this study, the primary purpose is to detect the contour and color of an image's shapes by implementing our model, which is based on Python-OpenCV. The biggest challenges of our model are that it cannot detect the contour of shapes and color when two or more shapes are overlapped, and small shapes between the large figures are also challenging to detect. Another challenging part we have got by experiment is that sometimes it can't detect complex shapes, colors, and contours.

8. CONCLUSION

In this article, we study the detection of shapes and colors of images by using Python-OpenCV. The brief analysis in this paper suggests that the contour, shapes, and colors were detected in the given sample images successfully by our developed model. Although, this study has some limitations or challenges, which will be studied shortly.

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