Contour, Shape & Color Detection using OpenCV-Python

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CONTOUR, SHAPE, AND COLOR DETECTION USING OPEN CV – PYTHON

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Abstract - In the following work, we will be detecting contours, shapes and colors of various geometrical figures in the sample given binary images using Python 2.7, Open Source Computer Vision Library (OpenCV) and Numpy. The very fundamental functions are used for processing the images, that involves loading them, and detecting various shapes and colors inside the given sample images.

Indexterms - Image Processing, Computer Vision, Python, Open CV.

I. INTRODUCTION TO COMPUTER VISION

With the advancement of Artificial Intelligence [2], Computer vision [3] came into the picture in late 1960s. Its whole purpose was to increase the intellect of the artificial mechanism available by installing the cameras into them and describe whatever they saw just like humans' visual system. Thus, Computer vision should be able to detect actual daily-life 3D objects through 2D pictures. Every picture tells us a story, something present now or what has been going on at a particular time.

II. INTRODUCTION TO OPEN CV

OpenCV is Open Computer Vision Library [4]. It was initially launched in 1999 by Intel. With more updates, it has been modified since then to aim for the real-time computer vision. This library has been written under programming languages like C and C+. It can be easily run on operating systems Windows and Linux. This library can be easily interface with programing languages like Python, MATLAB, Ruby and others as well. Along with Numpy [6] and Python image processing (shape & color detection) can be performed at ease.

III.STEPS INVOLVED IN SHAPE & COLOR DETECTION IN PYTHON 2.7

Let's begin with a given sample image in either .jpg or .png format and apply object detection in it.

3.1Install Python-OpenCV
To implement this project, the following packages of Python 2.7 have to be downloaded and installed: Python 2.7.x, NumPy and Matplotlib. According to the default location, Python will be installed to C drive. Open Python IDLE, import all the packages and start working.

3.2. Read an Image
First, a sample image in which processing is to be applied is to be read. It's done using a pre-defined Python function: CV2.imread(). The sample image should be available in current folder or the full location of the image is to be mentioned as an argument. For reading an image, we can use functions like imread_color, imread_grayscale, imread_unchanged. Etc.

3.3 Traits Description
Knowingtraits
Contour detection (Okay, Shapes are good features? But how do we find them)
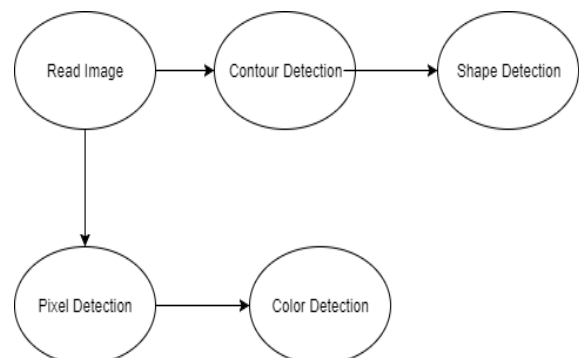Shape detection
Color detection (Study pixels to find out colors).

Fig.1 Flowchart for Shape & Color Detection

IV.PYTHON VS OTHER PROGRAMMING LANGUAGES FOR COMPUTER VISION

Object detection [5] is a domain-specific variation of the machine learning prediction problem.
OpenCV is itself made in C and C++. But it can be easily implemented with various programming languages and environments like Python, MATLAB, Java, R. etc.
Advantages for using Python as fundamental language for Object Detection are:
- Open Source. [7]
- User friendly Data structures. [7]
- Productivity & Speed. [7]
- Simple and elegant Object-oriented programming.

- Third Party Modules present. [7]
- Extensive Support Libraries.[7]
- More choices in graphics packages and toolsets.

V. VARIOUS SHAPE & COLOR DETECTION IMPLEMENTED IN PYTHON

- We find length of various objects in the sample images. We apply elementary geometry, if length comes out to be:

1. '5' we assign it to: Pentagon
2. '4' we assign it: Square
3. '3' we assign it: Triangle
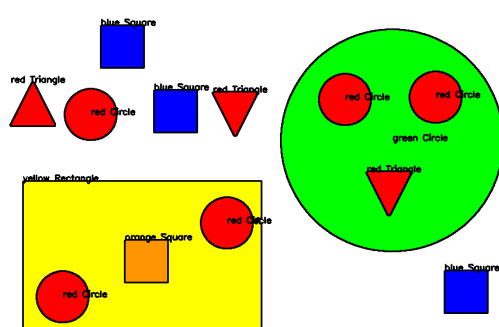4. Else we assign it Circle

Fig.2 An Output of a Sample Image

VI. APPLICATIONS AND FUTURE SCOPE

Computer vision has still not attained a level wherein it can be directly put into use to solve life problems, as it is still in its developmental phase.

With passing years and rigorous pace at which research is being done, Computer Vision or to be precise, Object detection will be completely omnipresent. Computer Vision is a sub-part on Machine Learning.

Some common and widely used application of object detection are:

6.1 Face Recognition
Have you ever thought how iPhone X recognizes your face when you unlock it? Not only it detects, it remembers the face too for next time for the phone to be unlocked. This is one of the simple applications of face recognition that we can see in our daily life.

6.2 Accounting Number of Objects
Computer Vision is also used for counting purpose.For example, when you upload a photo on Facebook, it tells/counts the number of people in that photograph.

6.3 Automobile Spotting
When an object to be detected is a vehicle, it's automobile spotting. There is live tracking on moving Traffic. It is already used on highways and traffic lights for detection of car plate who violates traffic rules.

6.4 Biometric Detection
Biometric consists of everyone's fingerprint, retina scan, iris pattern, heartbeat. Etc. Any of this natural unique quality can be used to lock or open various computer systems.

6.5 Medical Diagnosis
The theory of Object Recognition [1] is also used in medical field where it's used to detect diseases like Tumors or Cancer.

6.6 Optical character recognition (OCR)
The documents are scanned and typed, handwritten or printed characters are recognized using object detection [1].

6.7 Supervision
This concept is mainly used in installed CCTV cameras. The aim is to detect various objects, vehicles, persons for security and safety purposes, using object detection. [1]

6.8 Machine Man Communication
Common gestures used by humans on daily basis can be recorded and used to communicate with Machines.

VII. CHALLENGES

The main purpose is to detect various shapes and colors in a given sample image. The most challenging part in this task was to determine shape and color when two figures overlapped. Small figures inside the big figures was quite challenging. First, we detected small contours, its shapes and then the bigger contour and its shape. We then moved to detect its colors.

CONCLUSION

Computer vision can be used to solve the most intriguing problems with utmost sophistication. All the basics regarding the detection technique along with different ways to achieve it have been profoundly discussed. During the course of programming, we can use both Python and MATLAB for Computer Vision, but we prefer Python because it takes less simulation time than MATLAB. Someone having prior coding experience finds it easy to implement. Contours, shapes & colors were detected in the given sample images successfully.

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