COMPUTER VISION

project

TEAM
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Object Detection with Open CV Python

Abstract-The paper has covered topics ranging from how artificial intelligence and machine learning algorithms help in object detection to how OpenCV is such a useful tool for beginners who wish to learn how real time object identification and tracking can be done. It also shows the flexibility of a tracking system to a moving camera, ideal for automotive safety applications. Image identification makes use of techniques like detection of an object, its recognition, and segmentation. The use of artificial intelligence and machine learning enhances the rate of processing the data and maintaining the standard of the outcome. Example, by using artificial intelligence, we can very easily complete difficult tasks.

Introduction A few years ago, the creation of the software and hardware image processing systems was limited to the development of the user interface, which most of the programmers of each firm were engaged in. The situation has been significantly changed with the advent of the Windows operating system when the majority of the developers switched to solving the problems of image processing itself. However, this has not yet led to the cardinal progress in solving typical tasks of recognizing faces, car numbers, road signs, analyzing remote and medical images, etc. Each of these "eternal" problems is solved by trial and error, by the efforts of numerous groups of engineers and scientists. As modern technical solutions turn out to be excessively expensive, the task of automating the creation of the software tools for solving intellectual problems is formulated and intensively solved abroad. In the field of image processing, the required tool kit should be supporting the analysis and recognition of images of previously unknown content and ensure the effective development of applications by ordinary programmers. Just as the Windows toolkit supports the creation of interfaces for solving various applied problems.

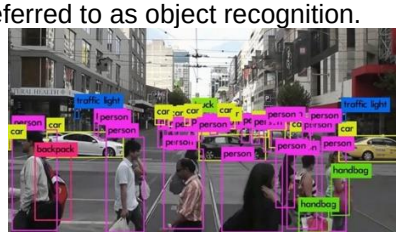
Object recognition is to describe a collection of related computer vision tasks that involve activities like identifying objects in digital photographs. Image classification involves activities such as predicting the class of one object in an image. Object localization is referring to identifying the location of one or more objects in an image and drawing an abounding box around their extent. Object detection does the work of combines these two tasks and localizes and classifies one or more objects in an image. When a user or practitioner refers to the term “object recognition “, they often mean “Object detection “. It may be challenging for beginners to distinguish between different related computer vision tasks. So, we can distinguish between these three computer vision tasks with this example: Image Classification: This is done by Predict the type or class of an object in an image. Input: An image which consists of a single object, such as a photograph. Output: A class label (e.g., one or more integers that are mapped to class labels).

Object Localization: This is done through, Locate the presence of objects in an image and indicate their location with a bounding box. Input: An image which consists of one or more objects, such as a photograph. Output: One or more bounding boxes (e.g., defined by a point, width, and height).

Object Detection: This is done through, Locate the presence of objects with a bounding box and types or classes of the located objects in an image. Input: An image which consists of one or more objects, such as a photograph. Output: One or more bounding boxes (e.g., defined by a point, width, and height), and a class label for each bounding box. One of the further extensions to this breakdown of computer vision tasks is object segmentation, also called “object instance segmentation” or “semantic segmentation,” where instances of recognized objects are indicated by highlighting the specific pixels of the object instead of a coarse bounding box.

From this breakdown, we can understand that object recognition refers to a suite of challenging computer vision tasks.

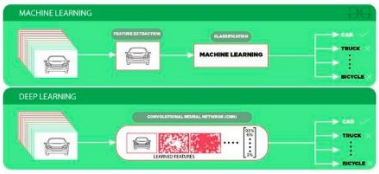
For example, image classification is simply straight forward, but the differences between objects localization and object detection can be confusing, especially when all three tasks may be just as equally referred to as object recognition.



Having understood the working methodology, it is time to talk about what makes object detection so important.

Object detection forms a ground for other important AI vision techniques like image classification, image retrieval, or object co-segmentation that drives meaningful information out of real-life objects. Developers and engineers are using these techniques to build futuristic machines that will deliver groceries and medicines to our doorsteps!

An object detection algorithm can help automatically detect cattle movements, traffic signals, and road lanes for self-driving vehicles to reach their destinations. This, in turn, eliminates the need for drivers for logistic errands.

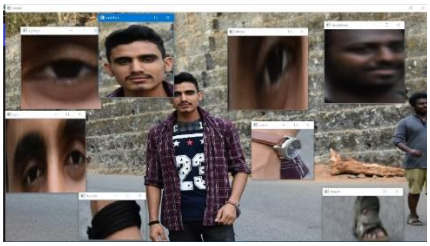


Not only that, but object detection can also run-on mobile networks by pruning the layers of a deep neural network. It is already being used in security scanners or metal detectors at airports to detect unwanted and illegal objects.

Apart from this, businesses use object detection for people counting, number plate recognition, speech recognition, and evidence detection. However, sometimes, a slight lack of accuracy hampers its efficiency to detect minute objects. A lack of cent percent accuracy makes it less preferable for some critical domains like mining and the military.

OpenCV is the huge open-source library for computer vision, machine learning, and image processing and now it plays a key role in real-time operation which is especially important in today's Method-systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it is integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

The first OpenCV version was 1.0. OpenCV is released under a BSD license and hence it is free for both **academic** and **commercial** use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS, and Android. When OpenCV was designed the main focus was real-time applications for computational efficiency. All things are written in optimized C/C++ to take advantage of multi-core processing.
Look at the following images



From the above original image, lots of pieces of information that are present in the original image can be obtained. As in the above image there are two faces available and the person(I) in the images wearing a bracelet, watch, etc. so by the help of OpenCV we can get all these types of information from the original image.
It is the basic introduction to OpenCV we can continue the Applications and all the things in our upcoming articles.
Applications of OpenCV: There are lots of applications which are solved using OpenCV, some of them are listed below

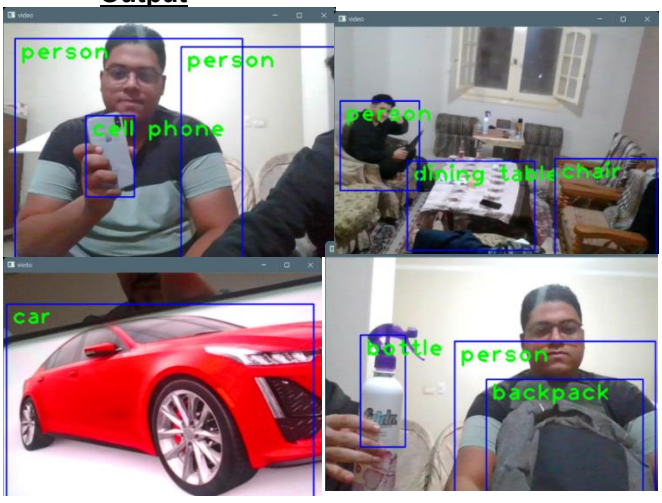
- face recognition
- Automated inspection and surveillance

- number of people – count (foot traffic in a mall, etc.)
- Vehicle counting on highways along with their speeds
- Interactive art installations
- Anomaly (defect) detection in the manufacturing process (the odd defective products)
- Street view image stitching
- Video/image search and retrieval
- Robot and driver-less car navigation and control
- object recognition
- Medical image analysis
- Movies – 3D structure from motion
- TV Channels advertisement recognition

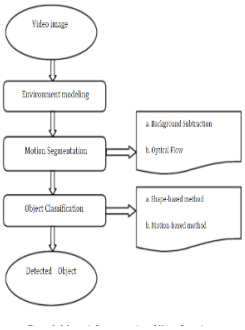
OpenCV Functionality

- Image/video I/O, processing, display (core, imgproc, highgui)
- Object/feature detection (obj detect, features2d, nonfee)
- Geometry-based monocular or stereo computer vision (calib3d, stitching, video stab)
- Computational photography (photo, video, supers)
- Machine learning & clustering (ml, Flann)
- CUDA acceleration (gnu

Output



flowchart



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conclusion

Detecting an object accurately in a surveillance video is one of the major research areas in computer vision due to its wide range of applications. It is incredibly challenging one, to process the image obtained from a surveillance video due to the following reasons low resolution, illumination variation, dynamic objects in the background, slight changes in the background like waving of leaves. We have presented an overview of recent developments in object detection methods. The detection process occurs in background modeling, object detection, and object classification.