Real-time Object Recognition
Using Image Processing & Deep Learning

Abstract:

Object recognition is the technique of identifying the specific object present in digital images. It is one of the most important applications of Image Processing and Deep Learning.Object recognition has immense applications in the field of monitoring and surveillance, medical analysis, robot localization and navigation etc.

Introduction:

Our Objective is to use image processing techniques and deep learning techniques to recognize objects.Every object class has its own special features that helps in classifying them into a specific class- for example all circles are round. Object class detection uses these special features of that object inorder to identify and separate them into their class.

Object detection is mainly involves these two tasks

1. Draws a bounding box around each object of interest in the image
2. Assigns them a class label.

When humans look at a photograph or watch a video, we can readily spot people, objects, scenes, and visual details. The goal is to teach a computer to do the same as humans do.

Survey:

The brief survey of how object recognition works is as follows:

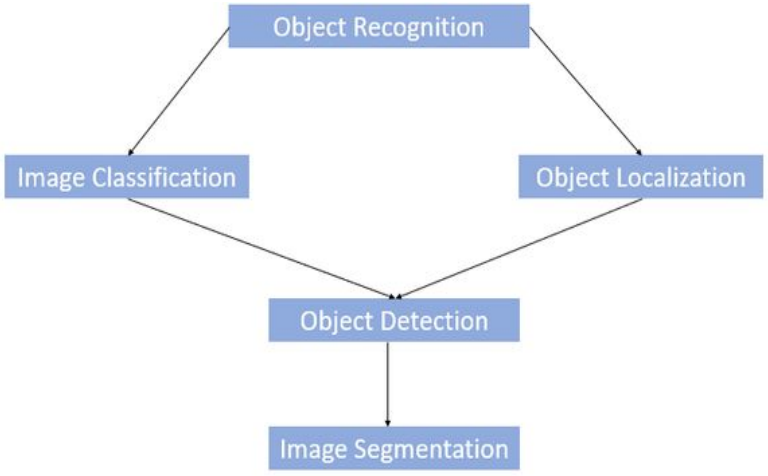

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Image Classification:

In Image classification, it takes an image as an input and outputs the classification label of that image with some metric (probability, loss, accuracy, etc). For Example: An image of a cat can be classified as a class label “cat” or an image of Dog can be classified as a class label “dog” with some probability.

Object Localization:

This algorithm locates the presence of an object in the image and represents it with a bounding box. It takes an image as input and outputs the location of the bounding box in the form of (position, height, and width).

Object Detection:

Object Detection algorithms act as a combination of image classification and object localization. It takes an image as input and produces one or more bounding boxes with the class label attached to each bounding box. These algorithms are capable enough to deal with multi-class classification and localization as well as to deal with the objects with multiple occurrences.

Conclusion:

a)Challenges:

- In object detection, the bounding boxes are always rectangular. So, it does not help with determining the shape of objects if the object contains the curvature part.
- Object detection cannot accurately estimate some measurements such as the area of an object, perimeter of an object from image.

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b)Applications:

This object recognition techniques can be utilized in many fields such as:

1. **Driverless Cars:** Object Recognition is used for detecting road signs, other vehicles, etc.
2. **Medical Image Processing:** Object Recognition and Image Processing techniques can help detect disease more accurately. For Example, Google AI for breast cancer detection detects more accurately than doctors.
3. **Surveillance and Security:** such as Face Recognition, Object Tracking, Activity Recognition, etc.

References:

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- [1311.2524] Rich feature hierarchies for accurate object detection and semantic segmentation
- https://in.mathworks.com/solutions/image-video-processing/object-recognition.html
- http://cs231n.stanford.edu/slides/2018/cs231n_2018_lecture11.pdf

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