19AIE205 Python for Machine Learning

Project Report – 2020

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Real-time object detection

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Real-Time Object Detection

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1.Problem Definition / Abstract

Object detection is a computer vision technique that lets us identify and locate objects in images or videos. Object detection can be used to count objects in a scene and determine and track their precise locations, all while accurately labelling them.

For example, an image that contains two cats and a person. Object detection allows us to at once classify the types of things found while also locating instances of them within the image. Object detection is inextricably linked to other similar computer vision techniques like image recognition and image segmentation, in that it helps us understand and analyze scenes in images or video.

Object detection is becoming a great field of application and research in Computer Vision. It is widely used in computer vision tasks such as image annotation, activity recognition, face detection, face recognition, video object co-segmentation. It is also used in tracking objects, tracking the movement of a cricket bat, or tracking a person in a video.

In my project, I will be doing the object detection of images by using OpenCV and Python,by applying the most popular YOLO(You Look Only Once) algorithm.OpenCV is the computer vision framework that is used to support the YOLOv3 algorithm.

The YOLOv3 i will be using is more powerful than basic YOLO and YOLOv2 and faster than previous algorithms like R-CNN .

2. Datasets

Here I am using a pre-trained model known as Darknet architecture(OpenCV-python framework) for classifying 80 different classes

Datasets we will be using:

1. yolo.cfg - Configuration file
2. yolo.weights - pre-trained weights
3. coco.names - 80 classes names
4. Image files -input image

All the dataset was downloaded from:
https://github.com/pjreddie/darknet/tree/master/data
https://github.com/cvjena/darknet/blob/master/cfg/yolo.cfg
https://pjreddie.com/darknet/yolo/

3. Prepare Data

Since we'll be using a pre-trained model, we'd have to download certain files. The "weights" file, the "configuration" file, and the "coco-names" file. The models are trained on the MS COCO dataset which has 80 classes of objects present in it.

The original image from which we want to detect objects cannot be given directly into the algorithm. So we need to do some conversion from this image. This conversion is called blob conversion which is basically extracting features from the image.It helps us to reshape our image while also normalizing them and re-ordering the colour channels in proper order.

We are loading the Yolov3 weights and configuration file with the help of the dnn module of OpenCV. The coco.names file contains the names of the different objects that our model has been trained to identify. We store them in a list called classes

The data image provided will have different sizes which may not look perfect while printing the output image, so we will reduce the height and width of our image to a scale of 40% and 30%.

Still the resulting image after changing the size , won't be enough for the algorithm to work with it . We need to do a few conversions of the image. This is called blob conversion which is basically extracting features from image.This function performs scaling, mean subtraction and channel swap which is optional. We will use blobFromImage that accepts image,model and output layers as parameters.The resulting image is being given to the algorithm.We can try on different images on our algorithm to produce the object detected image .

4. Python packages

Numpy

NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object and tools for working with these arrays.
It is the fundamental package for scientific computing with Python.
It contains various features including these important ones:
NumPy can also be used as an efficient multi-dimensional container of generic data.
Arbitrary data-types can be defined using Numpy which allows NumPy to seamlessly and speedily integrate with a wide variety of databases.

OpenCV-Python

Is a huge open-source library for computer vision, machine learning, and image processing. OpenCV supports a wide variety of programming languages like Python, C++, Java, etc. It can process images and videos to identify objects, faces, or even the handwriting of a human. When it is integrated with various libraries, such as Numpy which is a highly optimized library for numerical operations, then the number of weapons increases in your Arsenal i.e whatever operations one can do in Numpy can be combined with OpenCV.

5. Explain the algorithm used.

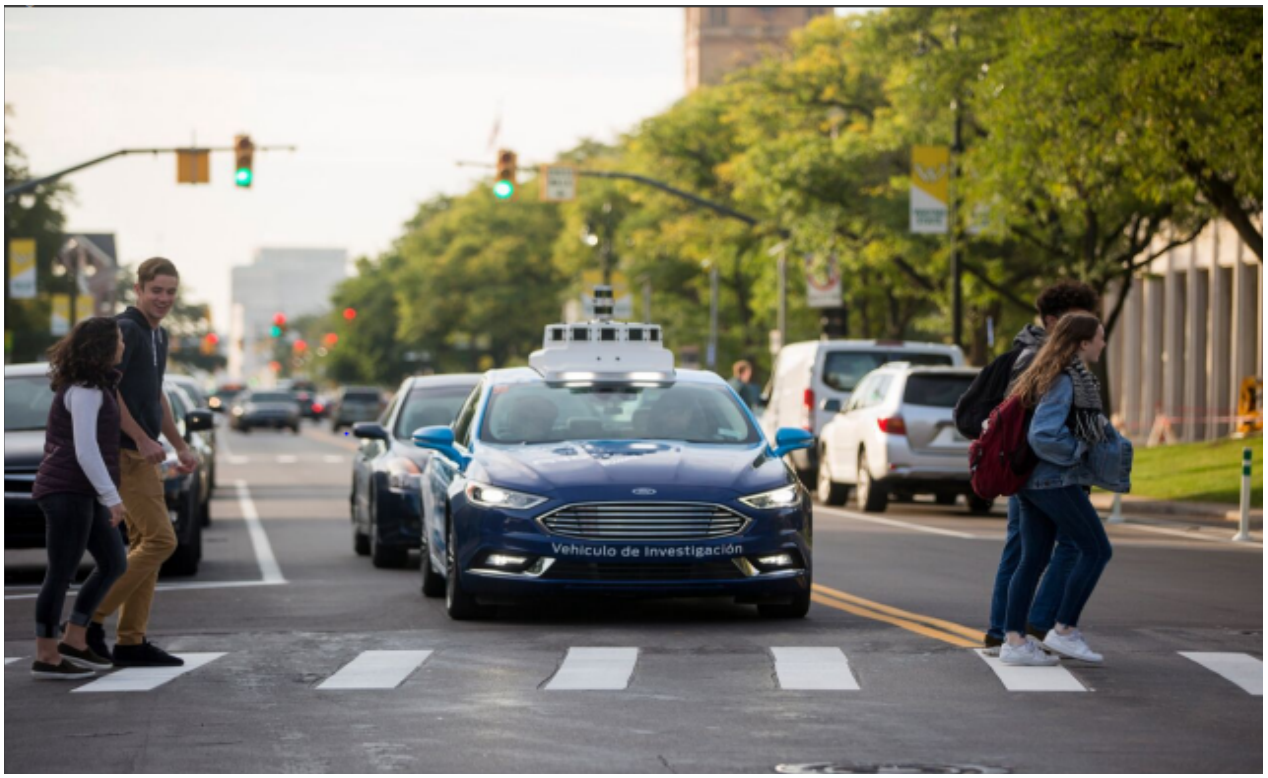
There are a few different algorithms for object detection and they can be split into two groups:
Algorithms based on classification. They are implemented in two ways. First, they select regions of interest in an image.
Second, they classify these regions using convolutional neural networks. This solution can be slow because we have to run predictions for every selected region.
Algorithms based on regression: Instead of selecting interesting parts of an image, we predict classes and bounding boxes for the whole image in one run of the algorithm. This can include YOLO (You Only Look Once) algorithms and SSD (Single Shot Multibox Detector).
In my project, I will be using YOLO algorithm for real-time object detection in images

Algorithm: YOLO(You only look once)

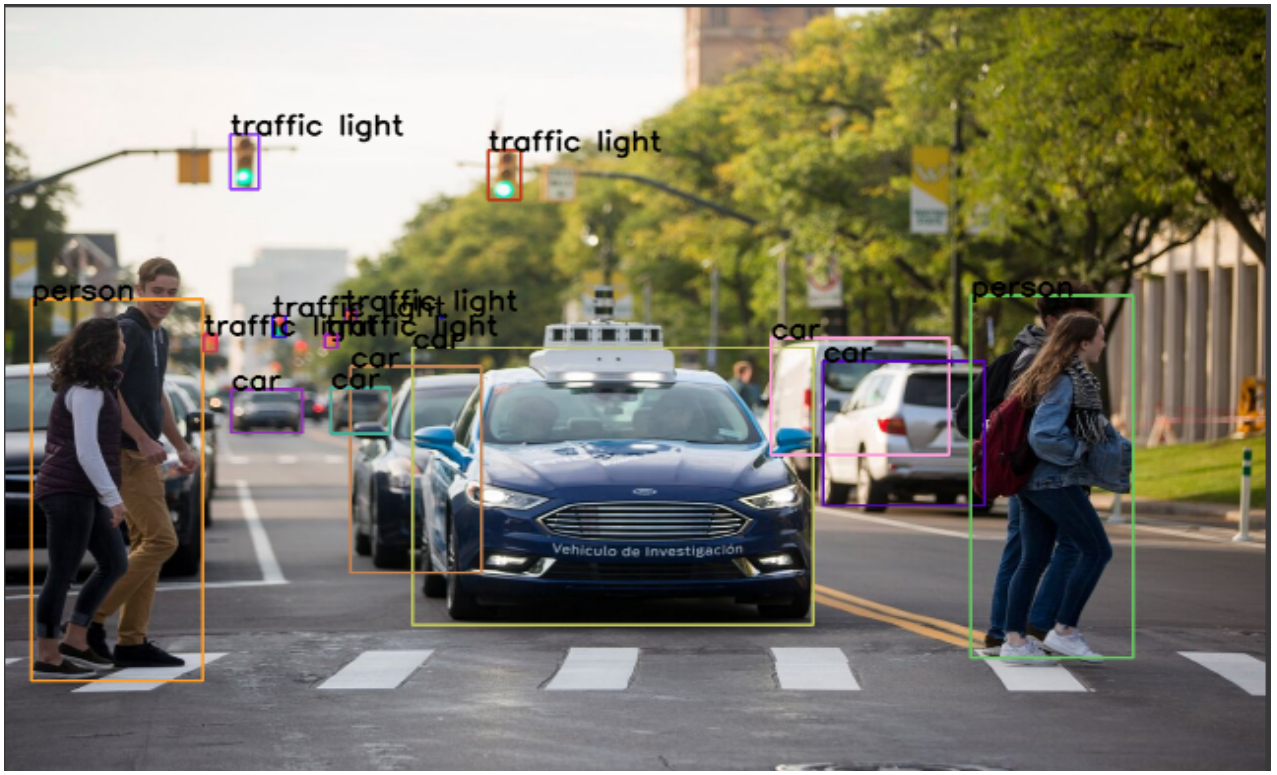
YOLO is a convolutional neural network (CNN) for doing object detection in real-time. The algorithm applies a single neural network to the full image, and then divides the image into regions and predicts bounding boxes and probabilities for each region. These bounding boxes are weighted by the predicted probabilities. The model recognizes 80 different objects in images.
It is super fast and nearly as accurate as Single Shot MultiBox (SSD)

6. Experimental result obtained.

The input image given in the program is :



Output:



7. Conclusion.

Object detection can be used in numerous territories of image processing,Few applications are:-

Object recognition: It can also be used for tracking the objects, for instance tracking a ball during a match in the football world cup,counting people during crowded situations

Face detector :.Face detection and Face Recognition is widely used in computer vision tasks. This is a simple application of object detection that we see in our daily life.Like , phone detecting our face , social media detecting etc.

Facial expression detector: Facial expression analysis plays a key role in analyzing emotions and human behaviors.

Self driving cars: The autonomous driving is In order for a car to decide what to do in next step whether accelerate, apply brakes or turn, it needs to know where all the objects are around the car and what those objects are That requires object detection and we would essentially train the car to detect known set of objects such as cars, pedestrians, traffic lights, road signs, bicycles,motorcycles, etc

Optical character recognition: or optical character reader:It is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, or from subtitle text superimposed on an image, we are extracting characters from the image or video.

There are many more applications in real life , for object detections like, picture retrieval, security, observation, computerized vehicle systems and machine investigation.

YOLO performed pretty well as compared to the other detectors of that time in terms of speed and accuracy. It is not the most accurate algorithm when it comes to object detection but certainly, it makes that up with its impressive speed and thus is a good balance between speed

and accuracy.The potential outcomes are inestimable with regards to future use cases for object detection.

8. Reference.

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