International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 11 | Nov 2019 www.irjet.net p-ISSN: 2395-0072

Object Detection in an Image using Deep Learning

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Abstract**—***The object detection supported deep learning is a vital application in deep learning technology, that is characterised by its robust capability of feature learning and have illusation compared with the object detection methods. The paper first makes an introduction of the methods in object detection, and expounds the methods of deep learning in object detection. Then it introduces the emergence of the object detection methods based on deep learning and elaborates the most typical methods nowadays in the object detection via deep learning. In the statement of the methods, the paper focuses on the framework design and the working principle of the models and analyses the model performance in the real-time and the accuracy of detection. Eventually, it discusses the challenges in the object detection based on deep learning and offers some solutions for reference*

Keywords— *object detection; deep learning; convolutional neural network, performance analysis*

I. INTRODUCTION

Object detection is one of the classical problems of computer vision and is often described as a difficult task. What makes object detection a definite downside is that it involves each locating and classifying regions of a picture. The locating part is not needed in, for example, whole image classification.[3]. To detect an object, we need to have some idea where the object might be and how the image is segmented. Object detection has already been the significant research direction and the focus in the computer vision , which can be applied in the driverless car, robotics, video surveillance and pedestrian detection.[2]

Object detection is developing from the single object recognition to the multi-object recognition.. Every object category has its own special option that helps in classifying the category, for example, all circles are round. Object class detection uses this special feature. Methods for object detection general fall into either machine based approaches or deep learning based approaches. Deep learning techniques that are able to do end – to – end object detectionwithout specifically defining features, and are typically based on convolutional neural networks.[1]

The task of object detection that has tremendous application in our lifestyle. The goal of object detection is recognise multiple objects during a single image, not only to return the confidence of the class for each object, but also predict the corresponding bounding boxes.

It but takes considerable time and energy to really classify the content of a given image region associate degreed each time and process capacities that an agent will pay on classification are limited.[4]

Humans use a process called visual attention to quickly decide which locations of an image need to be processed in detail and which can be ignored. This allows U.S.A to subsume the massive quantity of visual data and to use the capacities of our sensory system efficiency.

Fig: Detection of Object

II. LITERATURE SURVEY

➢ Why Deep Learning is essential

To detect the object in an image deep learning is must , because without the use of deep learning it is not possible to detect object in an image. Deep Learning conjointly called deep structured learning or ranked learning. It is part of broader familyof machine learning methods based on learning representations, as apposed to task specific algorithms.[5]

Image object analysis is one of the most prominent fields in deep learning. Deep learning has attracted plenty of attention as a result of it's notably smart at style of learning that has the potential to be terribly helpful for globe applications.[7]

Deep models don't need special hand engineered features and can be designed as the classifier and regression device. Therefore, the deep learning technology is of great prospect in the object detection.[3].

Deep learning has attracted a great deal attention as a result of it's notably sensible at a sort of learning that has the potential to be terribly helpful for real-world applications.

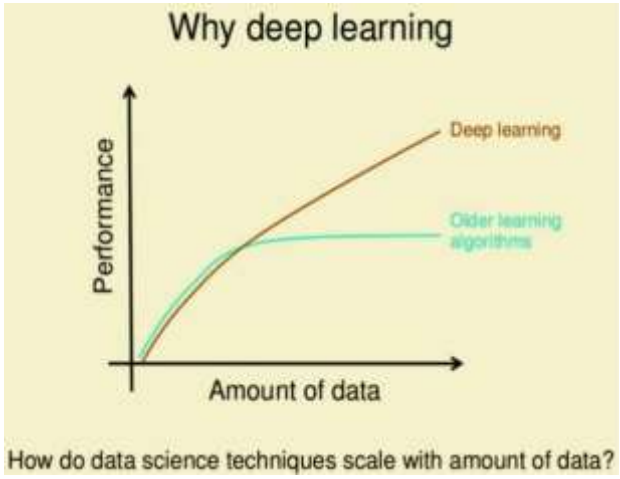

Fig: Performance of Deep Learning

➢ Related Work

First makes an associate degree introduction of the classical ways in object detection, and expounds the relation and distinction between the classical ways and the deep learning methods in object detection. Then it introduces the emergence of the object detection methods based on deep learning and elaborates the most typical methods [1].

Deals with the sphere of laptop vision, chiefly for the appliance of deep learning in object detection task. On the one hand, there's an easy outline of the datasets and deep learning algorithms usually utilized in laptop vision. On the other hand, a new dataset is built according to those commonly used datasets, and choose one of the network.[6]

The problem mentioned during this article is object detection victimization deep neural network particularly convolution neural networks. Object detection was previously done using only conventional deep convolution neural network where as using regional based convolution network increases the accuracy and also decreases the time required to complete the program [3].

In this paper they are going step more and address the matter of object detection victimization DNNs, that's not solely classifying however conjointly exactly localizing objects of varied classes [4]. They represent a simple and powerful formulation of object detection as regression problem to object box masks.

➢ Review of object detection

Object detection is an application to detect the object from the specified scenes by a certain measure or method. Before the emergence of deep learning technology, the methods of object detection are primarily accomplished by establishing the mathematical models based on some prior knowledge [5].

There are several methods of object detection. One of the most popular methods for object detection is the one developed by Viola and Gones which is based on Haar feature and uses a sliding window approach [1]. It is implemented on OpenCV , although most people use it to detect faces , it can be trained and used for any kind of objects.

GPU approach – accelerated frameworks offer flexibility to design and train custom deep neural networks and provide interfaces to commonly used programming languages such as Python and C , C++.

CPU Based Approach:

The high performance CPU node typically support large memory and storage capacities and robust network connectivity. They are more general purpose than GPUs but fail to match them in raw compute capabilities [3].

A CPU is very powerful and it is the reason why computers manages to do any task, they tend to be more flexible than GPUS and they include a larger instruction set , they run at higher clock speeds, they are responsible of IO operations of all computer components and they are responsible for the integration with virtual memory in the operating, system which is something a GPU can't do [2] .CPUs perform their tasks sequentially i.e. they can do one issue at a time .

Why CPU approach is more preferable ?

- CPUs have larger instruction set than GPUs making GPUs less flexible.
- The main weakness of GPUs as compared to CPUs is memory capacity on GPUs are lower than CPUs.
- CPU can fetch those memory packages in the RAM faster than the GPU which has much higher latency
- CPUs provide some help to GPUs , CPUs helps to feed GPU with enough data and read/write files from/to RAM/HDD during training.

➢ Neural Network

Neural Networks are the computer system modelled on the human brain and nervous system. An Artificial neural network is an interconnected group of node akin to the vast network of neuron in a brain.

Artificial neural networks or connectionist systems square measure computing system mistily impressed by the biological neural networks, that represent animal brains.

The neural network itself isn't an rule, however rather a framework for several completely different machine algorithms to figure along and method complicated information inputs . Such systems learn to perform tasks by considering examples, usually while not being programmed with any task specific rules.

For example in image recognition they may learn to spot pictures that are manually labeled as "Cat" or "No Cat" and mistreatment the result to spot Cats in other images.

They do this any prior knowledge about Cats, for example, that they have fur, tails, whiskers and Cat – like faces. Instead they mechanically generates distinguishing characteristics from the educational material that they method.

III. METHODOLOGY

- Flow:

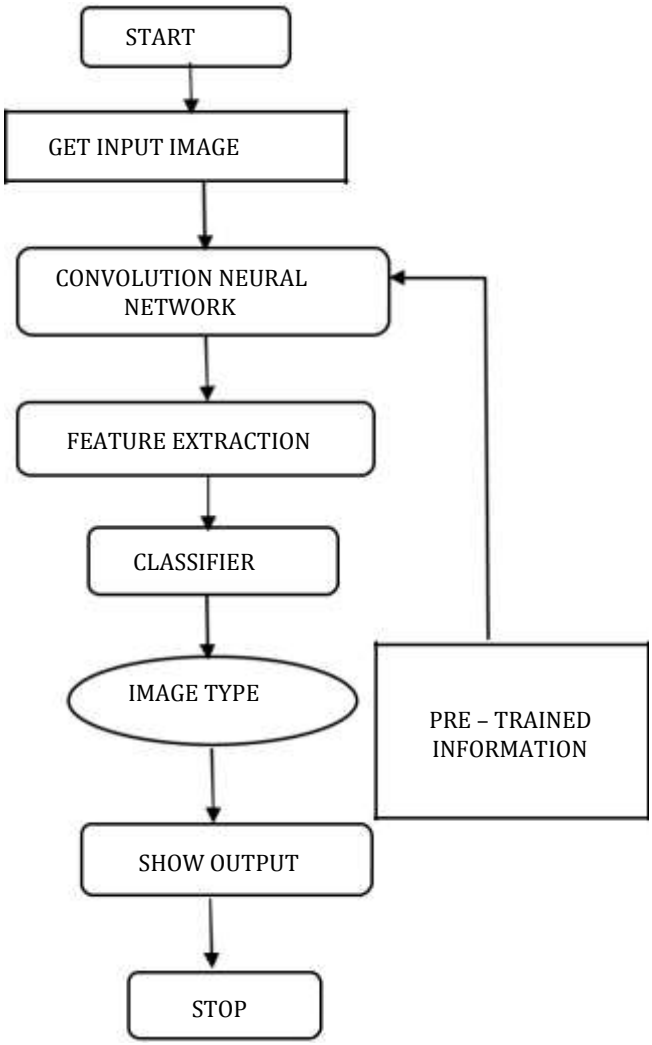

Fig: Flow of Implementation

- Convolutional Neural Network

The simplest deep learning approach , and a widely used one ,for detecting objects in images Convolutional Neural Networks or CNNs. Convolutional neural networks (CNNs) has been widely used in visual recognition [1] due to its high capability in correctly classifying images. CNNs become the foremost preferred alternative for determination image classification challenges.

Besides image classification, researchers have extend the appliance of CNNs to several totally different tasks in visual recognition like localization[2], segmentation [3], equally object detection [5].

CNNs, support vector machines (SVM) and bounding box regression along to supply a high performance in object detection. People switch to focus on CNNs since [1] shows a significant improvement of classification accuracy by employing a deep CNNs.

Unlike classification, the detection task conjointly needs United States of America to localize the item by specifying a bounding edge box.

A set of convolutional filters can be combined to form a convolutional layer of a neural network [7].The matrix values of the filters are treated as neuron parameters and trained using machine learning. In this paper we are going to use the sting boxes as our proposal generation algorithmic program. The basic plan of edge boxes is that this algorithmic program generates a foothold map with a structured edge detector wherever every picture element contains a magnitude and orientation data of the string.

1. Convolution Layer

It is the first layer to extract feature from an input image. The convolution of an image from different filters can perform operations such as edge detection ,blur and sharpen by applying filters. A set of convolutional filters can be combined to form a convolutional layer of a neural network [7].

Convolution layer preserve relationship between pixels by ;earning image feature using small squares of input data. It is mathematical operation that takes two input s inputs such as image matrix and filters or kernal.

2. ReLU

It is a Rectified Linear Unit. After every convolution layer, it's convention to use a nonlinear layer (or activation layer) instantly later on. The purpose of this layer is to introduce nonlinearity to a system that basically has just been computing linear operations during the convolution layers [2].
ReLU layers work far better because the network is able to train a lot faster (because of the computational efficiency) without making a significant difference to the accuracy.

3. Pooling

After some ReLU layers, programmers could favour to apply
a **pooling layer**. To make the network more manageable for classification, it is useful to decrease the activation map size in the deep end of the network. Generally the deep layers of the network require less information about exact spatial locations of features, but require more filter matrixes to recognize multiple high-level patterns [22, p. 342].

By reducing the peak and breadth of the information volume, we can increase the depth of the data volume and keep the computation time at a reasonable level. There square measure 2 ways that of reducing the information volume size. One way is to incorporate a pooling layer when a convolutional layer [22, pp. 339Max-pooling{simply|merely">merely outputs the utmost price among an obiong neighbourhood of the activation map [22, pp. 339{342]. Another way of reducing the data volume size is adjusting the stride parameter of the convolution operation.

4. Fully connected Layer

A absolutely connected neural network consists of a series of fully connected layers. Each output dimension depends on each input dimension. The fully connected layer works is that it looks at the output of the previous layer and determines which feature must corelate to a particular task [5]. Basically fully connected layer looks at what high layer feature most strongly corelate to a particular class and has particular weights so that when you compute products between the weights and therefore the previous layer, you get the right possibilities for the various categories.

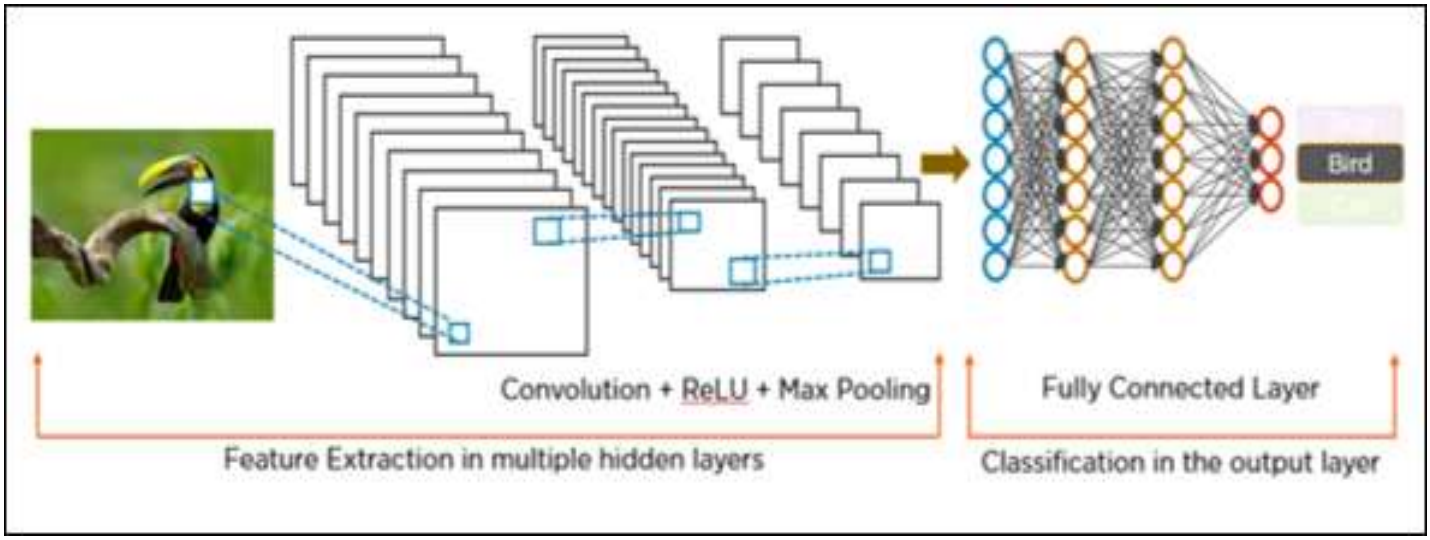

Fig: Layer of convolutional neural network

IV. CONCLUSIONS

In this paper, we offer a replacement model for object detection supported CNN. we have learned hands on experience in working with CNN to solve the detection problem . It elaborates on the common object detection model based on deep learning. We have proposed CNN methods which could be applied to the recognition, object detection and segmentation. Then a main object detecting model which eliminates unnecessary elements with CNN.

CNNs are an efficient method of applying neural networks to image processing, real time processing of high definition images.

We introduced convolutional neural network by discussing the different types of layers used in implementations ; the convolution layer, the ReLU layer, the pooling layer and the fully connected layer.

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