

OBJECT DETECTION USING MACHINE LEARNING

Amita Chauhan

Department of Information Technology
Meerut Institute of Engineering and Technology, Meerut, INDIA
amita.chauhan.it.2016@miet.ac.in

Meenakshi Verma

Department of Information Technology
Meerut Institute of Engineering and Technology, Meerut, INDIA
meenakshi.verma.it.2016@miet.ac.in

Simran Gupta

Department of Information Technology
Meerut Institute of Engineering and Technology, Meerut, INDIA
simran.gupta.it.2016@miet.ac.in

Varsha Srivastava

Department of Information Technology
Meerut Institute of Engineering and Technology, Meerut, INDIA
varsha.srivastava.it.2016@miet.ac.in

Ajay Kumar

Department of Information Technology
Meerut Institute of Engineering and Technology, Meerut, INDIA
ajay.kumar@miet.ac.in



Manuscript History

Number: IRJCS/RS/Vol.07/Issue04/APCS10083

Received: 03, April 2020

Final Correction: 17, April 2020

Final Accepted: 25, April 2020

Published: April 2020

Citation: Amita, Meenakshi, Simran, Varsha & Ajay (2020). Object Detection Using Machine Learning. International Research Journal of Computer Science (IRJCS), Volume VII, 41-45. doi://10.26562/IRJCS.2020.APIS10084

Editor: Dr.A.Arul L.S, Chief Editor, IRJCS, AM Publications, India

Copyright: ©2020 This is an open access article distributed under the terms of the Creative Commons Attribution License, Which Permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

Abstract: Accurate Object Detection was always a big deal and an important part of the Information Technology era. After the arrival of Machine Learning and Deep Learning technologies, the efficiency and accuracy for Object Detection increased significantly. These technologies greatly assisted in the evolution of the computer vision systems. This project focuses to integrate state-of-the-art technique for object detection with the aim of the achieving high accuracy. In this project we are using a deep learning part which is Tensorflow and OpenCV, which is a library of programming functions mainly aimed at real-time computer vision. There are few other libraries used which helped in object detection to make the system more accurate and reliable in the long run. We trained the network on various objects which are ordinary and easily available in the market. This projects aim to reduce the billing time in super markets with fast and accurate detection.

Keywords: OpenCV; TensorFlow; Image AI; Deep Learning; learning; machine detection; object based;

I. INTRODUCTION

To have complete understanding, we ought to not only focus on classifying various images, but also try to meticulously estimate the concepts and positions of objects contained in each image. This task is considered as Object Detection and this generally consists of pedestrian detection, face detection and skeleton detection. In this project there is a retail store looking for more digitalized way of expanding their business. We used a more systematic way of checkout system and reduce their human work force at billing counters. In this we devised a system that allows automatic detection of product using camera. The detection of product must be with respect to the size of the product, type of product and automatically take the cost of product to make a bill of materials at checkout. This has to be done in real-time without sending the data to cloud for processing as some of these stores can be in remote areas with the intermittent connectivity so that customers do not have to wait due to latency issues for connectivity. Just for an example if toothpaste is placed in front of the camera,

It will detect the product, according to the size and weight of toothpaste it will understand what the price of the product is. The details of each product scanned are then presented at the bill of materials for payment. We are at the apex of a massive tectonic shift and a brand new technological era is coming into existence upon us. Therefore, it is of great significance for us to focus on the influence that numerous technologies have on businesses now and in the future. Today, many tech giants across this planet are highly investing in learning developing technologies such as Artificial Intelligence, Machine Learning and Internet of Things including IIoT (IoT in industrial setting). These technologies have already initiated to bring a revolutionary change in the way brands do business and are growing in leaps and bounds across verticals. This is incorporated with the fact that the amount of data being produced is exceptional, an approximate 20 billion connected devices by the year 2020, and we will be looking at one trillion associated devices and things by 2050.

Amalgamate all this data being produced, with the progresses being made in the reckon power, AI and ML, will lead to next wave innovation. In fact, the day is not far when businesses, will tackle AI to do data-driven “thinking tasks” for them, notably reducing the time they spend testing new inventions and in altercating and scoping options. It has become crucial for every business to explore AI and ML in providing distinguishing solutions, to help meet the diversified and ever-changing needs of their customers. What exactly we need to understand and perceive is that tasks that are tedious, voluminous and repetitive in nature will be deployed to machines, consequently reducing flaws, saving time on mundane recurrent jobs. In fact, product plan as a task is most likely to be outsourced to machines by 2030 as per Indian business masters followed by administration tasks such as scheduling meetings and diary management. However, tactical thinking and emotional fragment are areas where we will always need human intercession.

Machine Learning is the intention that there are generic algorithms that can predict something interesting about a set of data without any need to write custom code specific to the problem. Instead of penning down the code, one can feed data to the generic algorithm and it builds its own logic based on the data. Machine learning is an application of Artificial Intelligence (AI) that provides systems the capability to automatically learn and improve from experience without being vividly programmed. Machine Learning emphasises on the development of computer programs that can access data and use it learn for themselves. The procedure of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The chief aim is to allow the computers learn automatically without human intervention or assistance an adjust actions correspondingly.

For example, one kind of algorithm is a classification algorithm. It can put data into dissimilar groups. The same classification algorithm used to agonize handwritten numbers could also be used to classify emails into spam and not spam without altering a line of code. It's the same algorithm but it's fed diversified training data so it comes up with different classification logic. Machine learning algorithms are often categorized as supervised or unsupervised.

A. Supervised Machine Learning Algorithms

These algorithms can be applied on what has been learned and perceived in the past to new data using categorized examples to predict future events. Beginning from the analysis of a known training dataset, the learning algorithm generates a resulted function to make predictions about the output values. The system has potential to provide targets for any new input after adequate training. The learning algorithm can also compare its output with the true, intended output and search errors in order to rectify the model consequently.

B. Unsupervised Machine Learning Algorithms

These algorithms are used when the information used to train is neither classified nor labelled. Unsupervised learning studies how systems can result a function to elaborate a hidden structure from unlabelled data. The system doesn't feature out the right output, but it explores the data and can draw inferences from datasets to describe hidden structures from unclassified data.

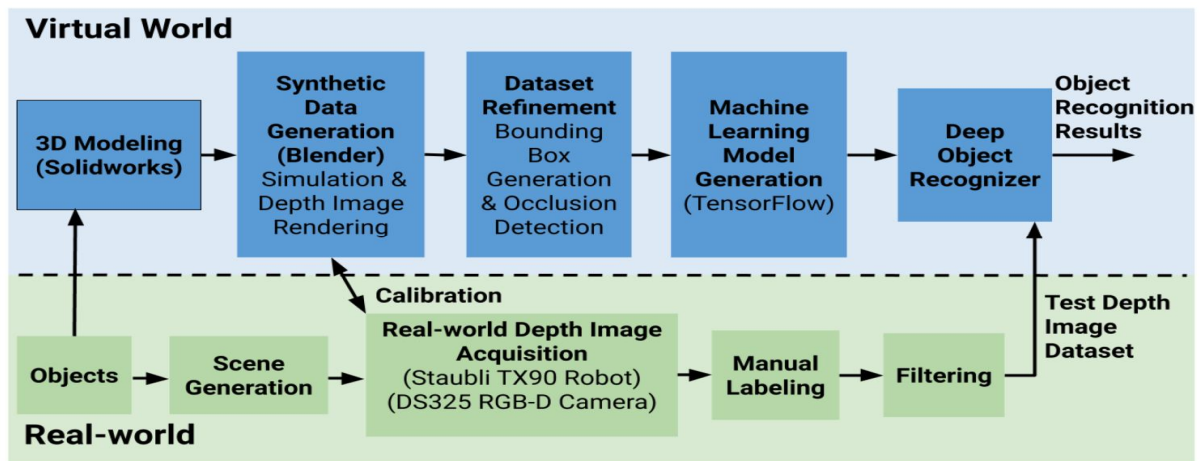
C. Reinforcement Machine Learning Algorithms

This is a learning method that interconnects with its environment by generating actions and discovers flaws or rewards. Trial and error search and retarded reward are the most pertinent characteristics of reinforcement learning. This method allows machines and software agents to automatically determine the supreme behaviour within specific factors in order to maximize its performance. Simple reward response is required for the agent to learn which action is supreme; this is known as the reinforcement signal.

Deep learning is an artificial intelligence function that emulates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a sub range of machine learning in artificial intelligence (AI) that has networks capable of grasping unsupervised from data that is unstructured or unclassified. Also known as deep neural learning or deep neural network.

Deep learning has evolved hand-in-hand with the digital era, which has brought about an eruption of data in all forms and from every possible area of the world. This data, known simply as Big Data, is drawn from sources like social media, internet search engines, e-commerce platforms, and online cinemas and many more. This huge amount of data is readily accessible and can be distributed through applications like cloud computing. However, the data which usually is unstructured is so vast that it could take decades for humans to apprehend it and extract relevant documentation. Companies realize the remarkable potential that can infer from unravelling this wealth of data and are increasingly adapting to AI systems for automated support.

Object Detection Object Detection is the process of finding real- world instances like car, cycle, TV, birds and humans in still images or videos. It allows for the recognition, localization and detection of multiple objects within an image which helps us with a much better understanding of an image. It is commonly used in applications such as image retrieval, security and advanced driver assistance systems. Here we are using Object Detection using tensor flow which is a deep learning library.



Block Diagram of Object Detection Using Deep learning

II. OTHER TECHNOLOGIES

Numerous other technologies are used in this project. Python programming language is used for coding and Python IDE is used for writing the code and numerous other technologies that we will talk about.

A. Python

Python is one of those languages which is simple and powerful at the same time. One can get surprised to find that how easy it is to focus on the solution to the problem rather than the syntax and structure of the language in which programming is to be done. Guido van Rossum, the creator of the python language, named the language after the BBC show "Monty Python's Flying Circus". He doesn't particularly liked snakes that kill animals for food by winding their long bodies around them and squeeze them ruthlessly.

Python is extremely easy to get along with. Python has extraordinary simple syntax. One more speciality of python is, you can freely distribute copies of this software then read it's code, make changes to it, and use pieces of it in new free programs. Whenever we are writing code, no need to worry about the low-level details such as managing the memory used by our program.

Due to its open-source nature, Python has been ported to many platforms. All your python programs can work on any of these platforms without requiring ant changes at all. Python is an interpreted language and not a compiled language. Python supports procedure-oriented programming as well as object-oriented languages, the program is built around functions and procedures which are nothing but reusable parts of programs. In object-oriented languages, the program is built around objects which wrap data and functionality. Python has a very powerful but simplistic way of doing OOP.

It has embeddable property; one can embed Python within your C/C++ programs to give scripting capabilities for your program's users. The Python Standard Library is huge indeed. It can help in performing various actions involving regular expressions, documentation generation, web browsers, databases, threading, unit testing, email, GUI, cryptography and other system-dependent stuff.

B. Python IDE

An integrated development environment is an application which provides programmers and developers with basic tools to write and test software. Python is a widely used high-level, general-purpose, interpreted, dynamic programming language. Python is dilapidated and extensively popular language. Text editors are not sufficient for building large systems which require integrating modules and libraries and best IDE is required. Python Jupyter started as a derivative of IPython in 2014 to support scientific computing and interactive data science across all programming languages.

C. ImageAI

ImageAI is a python library built to entitle developers to build applications and systems with self-contained deep learning and Computer Vision abilities using a few lines of code. ImageAI makes use of comparatively small codes. ImageAI contains a python execution of almost all of the state-of-the-art deep learning algorithms. ImageAI makes use of numerous APIs that work offline – it has object detection, video detection and various object tracking APIs that can be called without internet connection. ImageAI makes use of a pre-trained model and can easily be modified. The Object Detection class of the ImageAI library includes functions to perform object detection on any image or set of images, using pre-trained models. With ImageAI, one can detect and identify 80 different kinds of common and easily available objects.

D. OpenCV (Open Source Computer Vision Library)

It is an open source computer vision and machine learning software library. OpenCV was built to prepare a common infrastructure for computer vision applications and to accelerate the use of machine cognizance in the commercial and daily use products. OpenCV makes it easy for businesses to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes an extensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms are used to detect and recognize faces, identify objects, track camera movements, tracking moving objects, classify human actions in videos, produce 3D point clouds from stereo cameras, extract 3D models of objects, follow eye movements, find similar images from an entire scene, stitch images together to produce a high resolution image of an entire scene, remove red eyes from images taken using flash, recognize scenery and institute markers to overlay it with augmented reality and many more other applications. The library is used comprehensively in companies, research groups and by governmental bodies.

E. TensorFlow

This is the most famous and popular Deep Learning library in the world which is addressed as Google's TensorFlow. Google product uses machine learning in almost all of its products to optimize the search engine, translation, image captioning or recommendations. TensorFlow architecture works in three parts: Pre-processing the data, Build the model and Train and estimate the model. It is called TensorFlow because it takes input as a multi-dimensional array, also known as tensors. You can build a sort of flowchart of operations (called a graph) that you desire to perform on that input. The input goes in at one end and then it flows through this system of multiple operations and comes out the other end as a result. This is why It is named as TensorFlow because the tensor goes in it flows through a list of operations and then it comes out the other side. TensorFlow.js is a javascript library for training and deploying machine learning in the browser and in Node.js. It is a companion library to TensorFlow, a popular ML library for python. It is hardware – accelerated because it uses WebGL (a JavaScript graphics API), so it has surprisingly good performance. TensorFlow.js also allows you to load models you have trained in the Python version of TensorFlow. That means you can write a model and train it using Python, then save it to a location available on the web and load it in your JS. In TensorFlow.js, you can create and run AI models in a static HTML document. You can use AI without setting up a server or even a database. As long as the user's browser supports JavaScript you can train and use ML models, all client-side.

F. WebCam

A webcam is a video camera that streams or feeds an image or video in real time to or through a computer to a computer network, just like the internet. Webcams are actually small cameras that sit on a bench, attach to a user's monitor or are built into the hardware. The popular use of webcams is the construction of video links, permitting computers to act as videophones or videoconference stations. Other uses like computer vision, video broadcasting, security and for recording social videos.

G. Windows 10

Windows 10 is a series of operating systems produced by Microsoft and released as part of its Windows NT Family of operating systems. It is the successor to Windows 8.1, launched nearly two years ago and was released to manufacturing on July 15, 2015 and broadly released for retail sale on July 29, 2015.

III. APPROACH

A. Step 1

Our first task is to create the necessary folders. Folders like Object Detection as root folder; Models as stores pre-trained model; Input as stores image file on which we desire to perform object detection; Output as stores image file with detected objects

B. Step 2

Open your preferred IDE for penning down the python code and create a new file, detector.py.

C. Step 3

Import Object Detection class from the ImageAI library.

D. Step 4

Now that one has imported imageAI library and the Object Detection class, the next most important task is to create an instance of the class Object Detection.

E. Step 5

Now specify the path from our input image, output image and model.

F. Step 6

After instantiating the Object Detection class one can now call for various functions from the class. The class contains the functions to call pre-trained models.

G. Step 7

Next you will call the function, which accepts a string which contains the path to the pre-trained model.

H. Step 8

This steps calls the function load Model() from the detector instance. It loads the model from the path specified using some class method.

I. Step 9

To detect objects in the image, we need to call the detect Object from Image function using the detector object that we created.

J. Step 10

The dictionary items can be accessed by traversing through each item in the dictionary.
Now complete the object detection code.

III. CONCLUSIONS

It is safe to conclude that one can automate the billing system like we scan the images of our products and using ML Model we compute the prices for all your products and total cost in considerably less time than before and that too without creating a fuss at the billing counter. By using this we need not to worry about the barcode and looking at the price of the product which is usually written in the corner and that too minutely.

ACKNOWLEDGEMENT

The authors would like to thank our faculty guide, Mr. Ajay Kumar, Assistant Professor at Department of IT at Meerut Institute of Engineering and Technology, Meerut for facilitating the development of the paper, making available resources and also for final deployment.

REFERENCES

1. Tom M. Mitchell – Machine Learning, Mc Graw Hill Education (India Private Limited), 2013.
2. Ethem Alpaydin – Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2014.
3. Stephen Marsland – Machine Learning : An algorithmic perspective, CRC Press 2009.
4. Bishop C, Pattern Recognition and Machine Learning, Berlin Springer- Verlag.
5. Cosma Rohilla Shalizi, Advanced Data Analysis from an elementary point of view, 2015.
6. Ian Goodfellow, Yoshua Bengio, Aaron courville, Deep Learning MIT, Press.
7. Rittinghouse, John W, and James F ransome, - Cloud Computing: Implementation, Management and Security, CRC Press 2017.
8. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A practical Approach, Tata Mc Graw Hill, 2009