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OBJECT DETECTION SYSTEM

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ABSTRACT:

Accurate Object Detection was always a big deal and an important part of the Information Technology era.

Precise object identification has always been crucial and significant in the context of information technology. With the introduction of Deep Learning and Machine Learning technologies, Object Detection became much more accurate and efficient. These innovations made a significant contribution to the development of computer vision systems. The goal of this research is to achieve high accuracy by integrating state-of-the-art object detecting techniques.

Tensor flow, a deep learning tool, and OpenCV, a programming function library primarily focused on real-time computer vision, are being used in this research. A few other libraries were also employed to aid with object detection, ultimately improving the system's accuracy and dependability. We used a variety of common, readily available market goods to train the network. The goal of this project is to use quick and precise detection to shorten the billing time in super markets.

Keywords: OpenCV, TensorFlow, Image AI, Deep Learning; learning, machine detection, convolutional neural network, Yolo.

I. INTRODUCTION :

In order to fully comprehend, we should not only concentrate on categorizing different images, but also make a concerted effort to estimate the concepts and locations of items in each image. Generally speaking, face, skeleton, and pedestrian detection are included in this task, which is referred to as object detection. A retail store seeking additional digital ways to grow their business is the subject of this study.

We reduced the number of employees working at the billing counters and implemented a more methodical checkout procedure.
In order to do this, we developed a system that uses a camera to automatically detect products. Product detection needs to take into account the product's size, kind, and cost automatically in order to create a bill of materials at the point of sale.. For instance, when toothpaste is put in front of the camera, it will identify the object and determine its pricing based on the weight and size of the toothpaste.
The bill of materials is where each scanned product's data are then displayed for payment. A whole new technological era is emerging as we stand at the pinnacle of a great tectonic change. As a result, it is crucial that we concentrate on the impact that various technologies have both today and in the future on enterprises. These days, a lot of the world's largest IT companies are heavily investing in learning and creating technologies like AI, ML, and IoT (internet of things in an industrial context). These technologies are exploding across verticals and have already started to bring about a fundamental transformation in the way brands conduct business.
To investigate the use of AI and ML in offering unique solutions, in order to assist in fulfilling the varied and constantly evolving demands of their clientele. What we actually need to recognize and comprehend is that labour intensive, repetitive, and large-scale work will be assigned to robots, which will reduce errors and free up time for repeated, monotonous tasks. According to Indian business experts, by 2030, the process of creating a product plan is expected to be outsourced to robots, along with administrative duties like diary management and meeting scheduling. But there are other domains where human intervention is always required, such as tactical reasoning and emotional fragmentation.
The goal of machine learning is to create generic algorithms that can make interesting predictions about a collection of data without requiring the writing of problem-specific specialized code. Rather than writing the code by hand, the generic algorithm can be fed data, and it will generate reasoning on its own. Through the use of artificial intelligence (AI), machine learning gives systems the capacity to autonomously learn from their experiences and get better at them without the need for complex programming. The creation of computer programs that can access data and utilize it to learn for themselves is the focus of machine learning.
In order to find patterns in data and use the examples we provide to guide future decisions, the learning process starts with observations or data, such as examples, firsthand experience, or instruction.. It can group data into several categories. Without changing a single piece of code, emails may be

divided into spam and non-spam categories using the same classification method that was used to identify handwritten digits. The method remains the same, but it generates distinct categorization reasoning because it is fed a variety of training data.

Machine learning algorithm are of different types

A. Supervised Machine Learning Algorithms

Machine learning techniques like supervised learning are widely applied in a variety of industries, including marketing, finance, and healthcare. In order to produce predictions or judgments based on the data inputs, the algorithm is trained on label data in this type of machine learning. A mapping between the input and output data is learned by the algorithm through supervised learning. A label dataset with pairs of input and output data is used to learn this mapping. In order to produce precise predictions on fresh, unseen data, the algorithm looks for patterns in the relationship between the input and output data.

B. Unsupervised Machine Leaning Algorithms

We studied supervised machine learning, which uses label data to train models while training data is being watched over. However, there may be numerous instances where we must identify hidden patterns in the provided information because we do not have label data. Therefore, unsupervised learning approaches are required to solve these kinds of problems in machine learning. Unlike supervised learning, where we know the input data but no matching output data, unsupervised learning cannot be immediately applied to a regression or classification task. Finding a dataset's underlying structure, classifying the data based on similarities, and representing the dataset in a compressed manner are the objectives of unsupervised learning.

C. Reinforcement Machine Learning Algorithms

One subfield of machine learning is reinforcement learning. It involves acting appropriately to maximize reward in a certain circumstance. It is utilized by a variety of software and devices to determine the optimal course of action or behavior for a given circumstance. Reinforcement learning and supervised learning are different in that in supervised learning, the model is trained with the correct answer already present in the training data, while in reinforcement learning, the model is trained without an answer and is guided by the reinforcement agent's decision on how to complete the task at hand. Without a training dataset, it will inevitably pick up knowledge from its experiences.

C. Deep Learning Algorithms

A neural network with three or more layers is, by definition, a deep neural network, or DNN. Most DNNs actually have a lot more layers in practice. To identify and categorize occurrences, detect patterns and relationships, assess possibilities, and make predictions and judgments, DNNs are trained on vast volumes of data. A deep neural network has many layers that help improve and optimize the predictions and judgments made by a single-layer neural network, resulting in predictions and decisions that are more accurate.

Numerous services and apps that increase automation and carry out physical and analytical operations without the need for human participation are powered by deep learning. It powers both commonly used goods and services like voice-activated TV remotes, digital assistants, and credit card fraud detection as well as recent innovations like generative AI and self-driving automobiles.

Neural networks, which are nothing more than a collection of decision-making networks that have been trained to perform a certain function, are the foundation upon which deep learning algorithms are dynamically built. Subsequently, every one of them goes through basic layered representations before proceeding to the subsequent layer. Nonetheless, the majority of machine learning is designed to function pretty well with datasets including hundreds of features or columns. The main reason machine learning fails to classify a data collection as structured or unstructured is that it cannot identify a basic 800x1000 RGB image. Such depths become very impractical for a standard machine learning algorithm to manage. This is the domain of deep learning.

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.
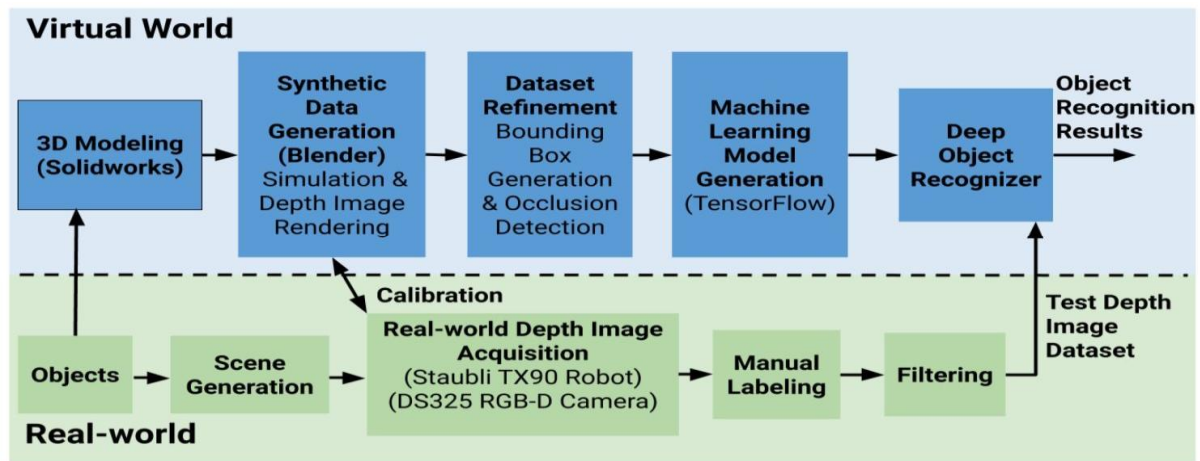
Block Diagram of Object Detection Using Deep learning

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 a language that has an equal parts power and simplicity. The reason Guido van Rossum, the language's founder, chose the name "Monty Python's Flying Circus" for the BBC series was because he detested snakes, which kill animals by squeezing them mercilessly with their lengthy bodies. Python has a very simple syntax and is very easy to learn.

The freedom to distribute copies of the program is another distinctive aspect of Python. After then, you are allowed to examine, modify, and use portions of the code in brand-new, open-source projects. Writing code never requires worrying about tiny details, such as managing the RAM that our application consumes. Because Python is open-source software, it has been ported to many different platforms.
Your Python programs won't need to be modified in order to run on any of these platforms. Python is an interpreted language rather than one that is compiled. Both object-oriented and procedure-oriented programming languages are supported by the Python programming language. Functions and procedures, which are essentially reusable program components, form the foundation of its structure.

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. An application that gives programmers and developers the fundamental tools they need to create and test software is known as an integrated development environment. Python is a general-purpose, high-level, interpreted, dynamic programming language that is quite popular. Python is a widely used but outdated language. When developing huge systems, text editors are insufficient as the finest integrated development environment (IDE) is needed for integrating modules and libraries. Python Jupyter was first developed in 2014 as a Python derivative. C. Nearly every cutting-edge deep learning method available today has a Python implementation in Image AI. This implies that you can create a model, train it with Python, save it on the internet, and import it into your JavaScript. AI models can be created and executed in a static HTML document using TensorFlow.js. AI can be used without even establishing a database or server. The user's browser must support JavaScript in order for you to train and use client-side machine learning models. F. Building video links using cameras is a common usage for them, allowing computers to function as videophones or videoconference stations. Additional applications include security, computer vision, video streaming, and social video recording.

C. Image AI

The Python package Image AI allows developers to construct systems and apps with self-contained deep learning and computer vision capabilities with just a few lines of code. Remarkably, image AI requires comparatively little coding. In Image AI, almost every cutting-edge deep learning method is implemented in Python. Image AI uses a number of offline APIs that may be accessible without an internet connection, such as object and video detection and a number of object tracking APIs. Image AI uses a pre-trained model that can be readily customized. The Object Detection class of the Image AI library contains functions to perform object detection on any image or sequence of images using pre-trained models. With Image AI, 80 different sorts of common, easily available items may be recognized and detected.

D. OpenCV (Open Source Computer Vision Library)

An open-source software library for computer vision and machine learning is called OpenCV, short for Open Source Computer Vision Library. It was initially created by Intel and is currently maintained by the OpenCV Foundation, a community of developers. A vast open-source library for image processing, machine learning, and computer vision is called Opencv. It now has a significant impact on real-time functioning, which is critical to modern systems. It may be used to process photos and movies in order to recognize faces, objects, and even human handwriting. Python can process the OpenCV array structure for analysis when it is integrated with different libraries, such NumPy. We use vector space and apply mathematical operations to these features in order to identify an image pattern and its different features.

OpenCV was released in version 1.0. OpenCV is free for both commercial and academic use because it is distributed under a BSD license. It supports Windows, Linux, Mac OS X, iOS, and Android and provides interfaces in C++, C, Python, and Java. During the design process of opencv, real-time applications for computational efficiency were the primary goal. Optimal C/C++ is used in everything to take advantage of multi-core processing.

E. TensorFlow

A free and open-source software library for artificial intelligence and machine learning is called TensorFlow. Although it may be applied to many different tasks, deep neural network training and inference are its primary focus.

AI can be used without even establishing a database or server. The user's browser must support JavaScript in order for you to train and use client-side machine learning models.

TensorFlow is compatible with a large number of programming languages, such as Python, JavaScript, C++, and Java, which makes it useful for a wide range of applications across numerous industries.

Stateful dataflow graphs are used to express calculations in TensorFlow. TensorFlow gets its name from the operations that these neural networks carry out on multidimensional arrays of data, also known as tensors.[17] Just five of the 1,500 GitHub repositories mentioning TensorFlow, according to Jeff Dean during the Google I/O Conference in June 2016, were from Google.

Google released TensorFlow.js version 1.0 for JavaScript machine learning in March 2018.

Google released TensorFlow 2.0 in January of 2019 [20]. September 2019 saw the formal release of the product.

Google unveiled TensorFlow Graphics, a deep learning tool for computer graphics, in May 2019.

F. WebCam

A webcam is a type of video camera used for recording or live streaming onto a computer or network. Their main applications are in security, social media, live streaming, and video telephony. Webcams are typically connected to a device via USB or wireless protocols, and they can be included as peripherals or built-in computer hardware.

Webcams have been used since 1993 on the Internet, and in 1994 the first widely available commercial model was released. The majority of webcam footage that was transmitted to websites in the early days of the Internet was static. Instant messaging software began to support webcams in the late 1990s and early 2000s, which led to a rise in their use in video conferences. Later on, laptop hardware makers began to include webcams.

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 pretrained 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 Image AI library.

D. Step 4

Now that one has imported image AI 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

Through this study, we have shown how object detection woks with the help of machine learning. 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. . We were able to improve our object detection accuracy.

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