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Object Detection using Artificial Intelligence and Machine Learning

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ABSTRACT

Computer vision is indeed a branch of artificial intelligence which teaches machines to identify and manage images. Utilizing digital photos or videos with deep neural networks, computers can reliably detect and classify items. Object detection is the technique used to detect the objects in particular images or videos. The YOLO family of techniques, which have very great speed and accuracy, have been used in numerous scenario detection jobs as object detection technology has progressed. Depending on the YOLOv5 model, the suggested model detects the type of cars on the road. This model with different parameters for training and testing. The results shows that the algorithm proposed can easily recognize the type of vehicles which are in public places or in traffic areas.

KEYWORDS: Computer Vision, Object detection, Yolov5

I. INTRODUCTION

The science of computers and software systems that detect and comprehend pictures and environments is known as computer vision. Item detection is essential in image recognition, automated vehicles, and factory equipment, among other applications. It's a computer vision approach for recognising & locating objects of interest in photos and movies. Utilizing Artificial Intelligence algorithms, it forms boundary boxes from around identified items, allowing us all to find or identify the stated thing in the supplied scene [1-5]. It is a virtual reality that works with finding instances of semantic items of a specific class (such as individuals, houses, or cars) in digital photos and videos. It is connected to image processing and computer vision [6]. Facial detection and face recognition are two well-studied object detection areas. It has a wide range of uses in computer vision [7], involving image classification and video editing. Each object model has a distinguishing attribute that aids in categorising the category — for example, all circles are circular. These specific features are used in object class detection [8-9]. When looking for circular, for instance, items at a known location from either a point (i.e. the centre) are searched. Likewise, when looking for squares, look for things with parallel sides and identical side [10-12]. Face recognition uses a similar approach, with eyes, noses, and lips frequently identified, as well as

skin colour and spacing among eyes.There are many object detection algorithms such as RCNN, DenseNet, RetinaNet, YOLO, etc. So, to propose the vehicle detector model, Yolo method is used in order to detect the type of vehicles on traffic area as this algorithm achieves high accuracy and predict better results as compared to other algorithms [13-17].

II. LITERATURE SURVEY

Neural network models are a class of methods for pattern recognition that are roughly patterned after the human mind. Sensation data is viewed as input data gadget interpretation, labelling, or clustering by them. It can recognise faces, distinguish people in photos, and identify facial expressions. Clustering and grouping are two methods for identifying commonalities. Deep learning has the potential to form connections between, say, pixels during a picture and an individual's name with classification. In neural network models, several methods are utilised, such as CNN, RNN, deep learning, and so on. Deep-learning networks are distinguished from hidden neuron machine learning in its thickness, or the number of objective evaluation via which data can pass throughout a patterns detection inter process.

In [18], The researchers recommend a three-stage approach dubbed innovative identification method to increase the evaluation of projects for vehicles of various scales. They use a picture cropping approach to split the system into multiple patches in the first step to prevent vehicle deformation in assessment scale and maintain more data in aerial photographs.In the second stage, they combine the primary image and two patches into a batch and detect vehicles with a Convolutional Neural Network (CNN).

In [19], To resolve the difficulties of poor identification in densely repeating dense item scenes or photos, the authors created an RGB-D object recognition network architecture based on the YOLO v3 architecture.

The article describes a thorough overview of recent improvements in visual anomaly detection using deep learning [20-24] in [25].

The researchers Ali Tourani, Asadollah Shahbahrami, and Sajjad saroori introduced a methodology for alpr Detection (LPD) and Character Recognition (CR) as a unified application in [26], which demonstrated substantial accuracy and strong materials.

I. METHODOLOGY

The methodology used here Yolov5 method. Yolov5 method is one of the technique used to detect and identify the particular object in the given images or videos. The YOLO series of devices has just been released. This was the first object recognition model to integrate object detection forecasting and item categorization into the an unified edge discrete network, and it is now preserved in the Darknet framework. It was the first of the YOLO algorithms to be developed in the PyTorch framework, which makes it much lighter and easier to use [27-29].
YOLO algorithms divide all the given input images into the S * S grid system. Each grid is responsible for object detection. These grids cells predict the boundary boxes for the detected object [30-31].

Figure 1: YOLOv5 grid system

II. IMPLEMENTATION

To develop the vehicle detector model, Google Colab platform is used for training and testing vehicle datasets in order to achieve high accuracy and performance [32]. To detect the kinds of vehicles, the different steps for implementation of the model which are as follows:-
The first step of implementation is data collection. So, approximately 1000 different vehicle images were collected. After data collection, the next step is data annotation. It is the method of labelling different types of images using tools like LabelMe, LabelImg tool. All these 1000 images are then annotated with the help of LabelMe tool and then stored as json format. Once all the images are annotated, these json files are then converted into text format. These data including images, json files, and text files are together called as datasets [33-38].
These datasets are then trained using yolov5 algorithm in order to predict our data. Once the trained model is ready, it can be used for detections of any type of images based on their labelled classes. So, vehicle datasets are then trained, and visualized using tensorboard which shows the graphs and plot representations. Then, datasets are tested on unlabeled data to predict the results with bounding boxes [39-42].

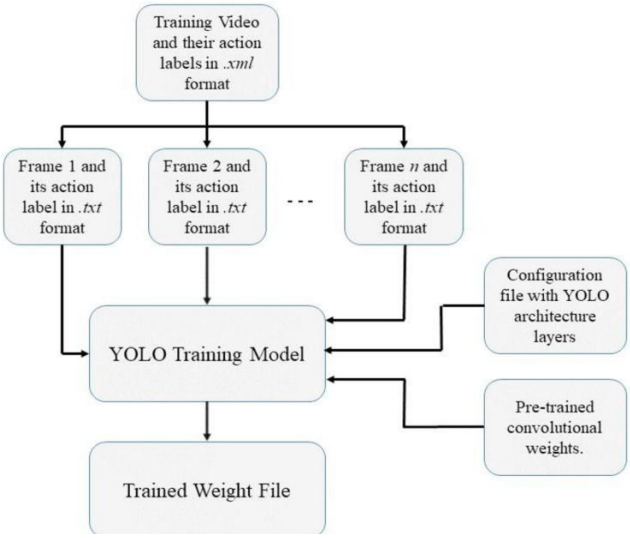

Figure 2: YOLOv5 flow diagram

CONCLUSION

YOLOv5 performs well and should be customized to suit our needs. However, training the model can take a very important GPU power and time. It is recommended to use at least Google Colab with 16GB GPU or preferably a TPU to speed up the method for training the massive dataset. YOLO accesses to the whole image in predicting boundaries. And also it predicts fewer false positives in background areas. Comparing to other classifier algorithms this algorithm is much more efficient and fastest algorithm to use in real time.

YOLOv5 vehicle detector trained and validated all the images of vehicles with the help of bounding boxes. Then, it produced the required results in terms of graphs which show the validation metrics and at last, it detected all inferences on unlabeled vehicles data with high speed and performance. YOLOv5's for its small weight size and good frame rate of chips will pave its way to be first choice for embedded-system based real-time object detection tasks. For future work, this vehicle detector can be used in various real time applications such as in college campus or any public areas such as malls, in order to detect the type of authorized and unauthorized vehicles with the help of CCTV cameras.

Figure 3: Results

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