Development in Automatic Number Plate Detection Model

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Abstract

Today vehicles are a integral part of human life, the number of vehicle owners is growing day by day and this has led to development of state of the art Machine learning models to detect vehicles and number plates, in the past years this technology has surged in development as this technology has multiple applications such as traffic management, Toll automation, security in Government and private establishment, usage in developed cities or smart cities to track the flow of traffic and also in tracking or apprehension of criminals and these are just some applications of this kind of model. The process behind this processing of a image or a frame of video to detect vehicles in real time or video footage or images, we then apply Optical character recognition method to retrieve the text written on the numbee plate and process that data as per the users preference. In this paper we are going to discuss about such a model that we developed in order to detect vehicles specifically the type of vehicle (i.e. Cars, Trucks, Bus etc.) and also detects what type of number plate a certain vehicle carries (i.e. Electric, Commercial, Personal etc.) We are going to use Tensor Flow's EfficientDet_lite_3 model which works on CNN architecture to train our model using techniques such as transfer learning which incorporates training from past models, To develop such a model we need high dimensional data sets to achieve higher accuracy ANPR (Automatic Number Plate Detection) datasets are tedious to curate, requiring an incredible investment of time and staff hours to annotate, ANPR contracts with local and federal governments tend to be highly competitive. Because of that, it's often not the trained model that is valuable, but instead the dataset that a given company has curated. This paper reviews about conventional Machine Learning models available and also recently developed machine learning models and how the development of Automatic number plate detection system models can be further made better by adding new features to get personalized results for the

person training the model. The main objective of this model is to analyze the current models on the market and select the best model for faster and more accurate results.

Keywords: *vehicle management; Machine learning; Predicting; CNN; Efficientdet_Lite_3;*

1. Introduction

One of our main objective is the identification of the vehicle type, the number plate type and the text written on that plate.

India was the sixth largest producer of automobiles globally with an average annual production of about 29 million vehicles in 2017–2018, of which about 4 million were exported.2 India is the largest tractor manufacturer, second largest two-wheeler manufacturer, second largest bus manufacturer, fifth largest heavy truck manufacturer, sixth largest car manufacturer, and eighth largest commercial vehicle manufacturer. The contribution of this sector to GDP has increased from 2.77% in 1992–1993 to about 7.1% now and accounts for about 49% of manufacturing GDP (2015–2016) [1]

Because of this; it is necessary to fall in parallel with technological and scientific developments, traffic accidents are still at the forefront people's daily life both in our country and also all over the world. Compared to air, sea and railway traffic, traffic on highways continues to be a significiant problem in current life [4]

Recent years have witnessed a colossal increase of vehicles on the roads; unfortunately, the infrastructure of roads and traffic systems has not kept pace with this growth, resulting in inefficient traffic management. Owing to this imbalance, traffic jams on roads, congestions, and pollution have shown a marked increase. The management of growing traffic is a major issue across the world. Intelligent Transportation Systems (ITS) have a great potential in offering solutions to such issues by using novel technologies [3]

while trying to find a solution for this problem we stumbled upon CNN architecture . The term Deep Learning or Deep Neural Network refers to Artificial Neural Networks (ANN)

with multi layers. Over the last few decades, it has been considered to be one of the most powerful tools, and has become very popular in the literature as it is able to handle a huge amount of data. The interest in having deeper hidden layers has recently begun to surpass classical methods performance in different fields; especially in pattern recognition [5]

The software industry is now making slow but sure progress towards machine intelligence. For the creation of intelligent robots, machine learning and artificial intelligence are becoming indispensable in every industry. Machine learning, in its most basic form, is a collection of algorithms that analyse data, extract knowledge from it, and use it to make wise judgements. ML algorithms could be commonplace. We've covered each of these models in this section. The algorithms used in traditional or conventional machine learning are complicated. It requires the assistance of humans and domain expertise. [6]

2. Algorithm

2.1. For vehicle, number plate and text detection:

We use a model that has been already pre trained on the by Tensorflow organisation, we chose this model because it is faster than its counter parts and is accurate too. Here below in fig 2.1.1 we have a graph that represents to thath the EfficientDet achieves new state-of-the-art 55.1% COCO AP with much fewer parameters and FLOPs than previous detectors [2].

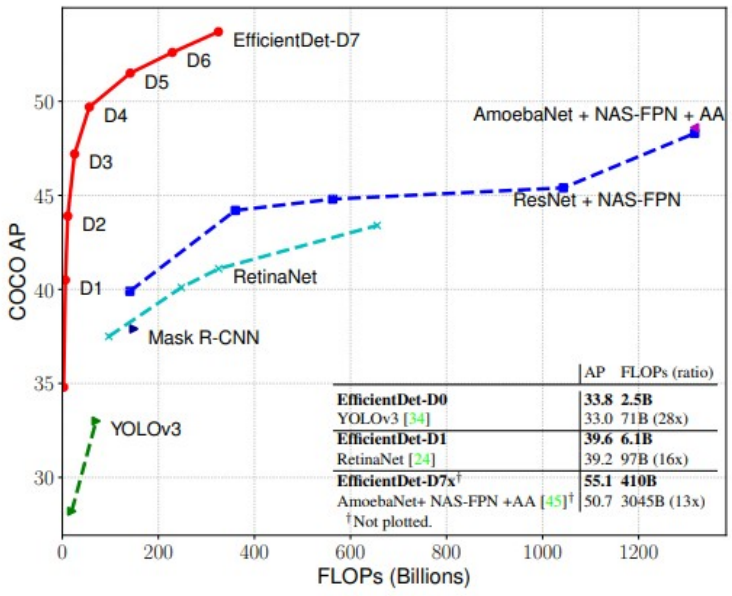

Fig. 1: Model FLOPs vs. COCO accuracy – All numbers are for single-model single-scale. Our EfficientDet achieves new state-of-the-art 55.1% COCO AP with much fewer parameters and FLOPs than previous detectors.

The model can be customized based on the preference of the user, the model is uses CNN architecture to detect objects, initially the model was trained to detect more than 70 ob jects but we can use labels in our code to specifically detect what we need, further more will be discussed in detail in the next units.

When we say CNN it stands for Convolutional Neural network, the CNN architecture consists of mainly three layers they are convolutional, pooling and fully connected layer, the CNN can differentiate images and detect objects based on similarities, they can consider 2D structure of the images, process them and extract the properties that are specific to images. once a vehicle type is identified the image will be passed to a new model to detect numb er plate this model is trained on the backbone of Efficientdet models. This model uses a CNN architecture to detect number plates. we use google vision API to detect text in the numbner plate which also uses CNN for text detection in an image.

3. Materials and Methods and Model

3.1. Dataset Collection

Any machine learning model will require data in order to be developed. In our case, for Vehicle number plate detection we had to collect datasets of we had to collect numerous images of vehicles, the classes we wanted to detect were truck, bus, motorcycle, car, bicycle and we retrained the efficient Det model with said data.

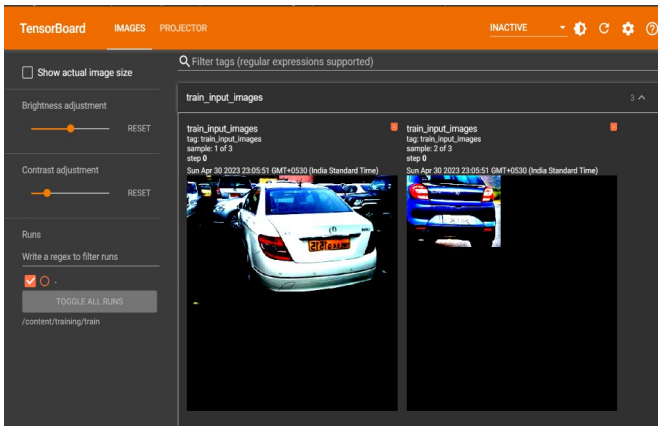

Fig. 2. this is a glimpse of the type of data that was collected as a part of data collection step

3.2. Data Cleaning and Preprocessing

We used various methods for cleaning and pre processing of the data, we resized the images to send to the model for training, we also use image normalization technique we also use image segmentation and image labeling to only target specif regions on the image where the object is present, we also did implement image quality control where we eliminated the images which where un compressable .

3.3. Training and Testing the dataset

The system will be trained using the cleansed data. Teaching the system to implement functionality depending on the supplied data is known as training the system. In this case we are going to train our model with the updated dataset and we are going to pass it to the efficient det model for retraining and cusomizing it.

Model testing in machine learning is the process of assessing a fully trained model's performance on a testing set. The testing set, which consists of a collection of testing samples, should be kept apart from the training and validation sets while yet having the same probability distribution.

3.3.1. For Vehicle and Number plate Detection Model

We loaded all our processed and labeled dataset and divided them by the score as following Training 80%, Validation 10%, Testing 10%. we train them for 10 node hours on the google cloud auto ML platform. We used this platform as it implements transfer learning to the trained model, the output would be in a dictionary format with values such as detected class id number, detection score and detection region. We get a .tflite format file at the end of the training which

we can later implement inb our code using libraries such Tensor Flow or Tensor Flow lite.

4. Results and Discussions

4.1.1. For Vehicle detection

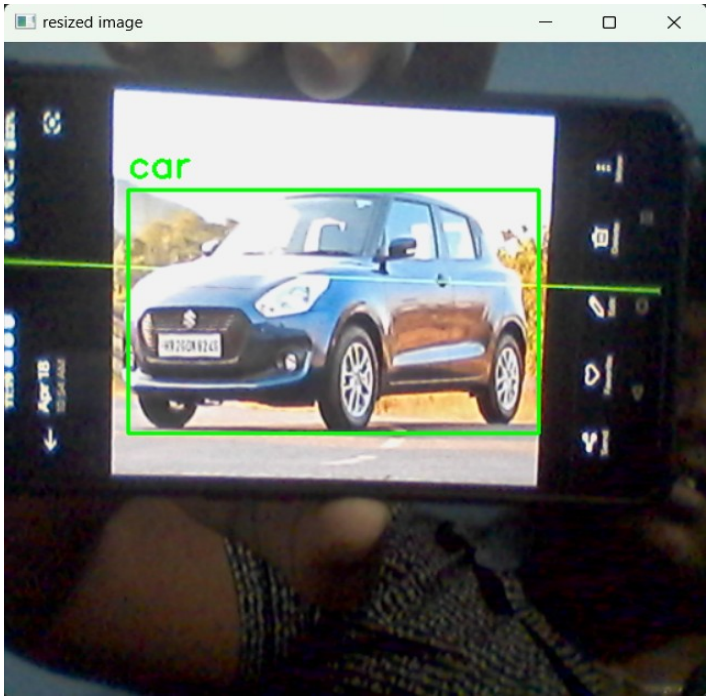

Fig. 3

The model has been trained on 5 classes those are cars, trucks, motorcycle, Buses and By-cycle. We then used the CNN algorithm to train the model based on the images. The frame in the video is passed as an input data using the input_data variable the image is passed as an numpy array of type uint-8, and then the inpu data is passed to the tensors, these tensors are allocated using the .tflite model file that we get through training the model. The figure 3 shows how it detected the car from a mobile screen. We have also found results for trucks busses and motorcycle too, the detection speed is from 100ms to 180ms and it runs the processes real time video at 23 FPS.

4.1.2. For **Detection of number plate and number plate type**

Fig. 4

The output generated in the Fig. 4 is the number plate extracted from the image we passed to the model in Fig. 3, the output is then generated and passed for further processing in the next step that is text recognition.

```
Vehicle Type : car  SCORE: 0.7265625
Detected at : xmin : 96  ymin : 129  xmax : 383  ymax : 312
Got a detection
Numberplate type: White Numberplate  SCORE: 0.80078125
Detected at : xmin : 38  ymin : 14  xmax : 264  ymax : 223
```

Fig. 5

Fig. 5 shows how vehicle data is outputted and it has detected the right image. The image in Fig. 4 is passed to the google vision API to make necessary detection regarding texts in image. And we get the following output as given below in Fig. 6 this whole process takes 250ms to 300ms execute.

Fig 6

```
Got a detection
DETECTED PLATE:  HR260K6246
Printing nplate list  ['HR260K6246']
Returning from check function HR260K6246
returning from detect text function : HR260K6246
Value from val function : True
Vehicle Type : car  Numberplate Type : White Numberplate  Numberplate Text : HR260K6246
```

5. Conclusions

In this paper we have used pre trained models and we have proved that it could be faster efficient and accurate at the same, by using these pre trained models we have now the option of easily re training and deploying the model within a matter of hours. The growth of CNN architecture is on the rise, its popular and is also a powerful machine learning model for image detection. fitting, make it an attractive option for use in real-world applications.

In conclusion, this study has made great strides in creating a machine learning model to Automatically and Efficiently Detect number plates. The team is also creating a website to make these insights more accessible to consumers, and the model generated output will be stored in a real time database which later will be used to give useful insights to whoever chooses to use this model.

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