

Institutionalising the People's Vehicle

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ABSTRACT

Exploiting the Object Detection Methodology, the solution is expected to detect vehicles, obstacles or threats in the vicinity; also read the lane markings. It has the potential to ensure safety by monitoring and complying to lane discipline using cameras and sensors. With defined thresholds, the solution ensures an immediate guided action in case of any breach (example a Buzzer Alert to the Driver). This will help drivers to remain alert and prevent potential mishaps.

Keywords - Deep Learning, Object Detection, Sensors, Distance Measurement, White Line Tracing, Sensors.

I. INTRODUCTION

Technology is getting smarter by the day and human expectations are growing exponentially in this area. Technology which was considered as a luxury till a few years back has been commoditized and is part of every-day life and has entered every industry and sector. Automobile Sector is leading the adoption of tech in the areas of Machine Learning and Artificial Intelligence. Unfortunately, high end technology is limited to luxury brands and that is where our solution will bridge the gap in getting this tech to people's vehicles. Today Automobile Industry is investing millions in safety of their passengers. With this paper, we are attempting to provide detailed solution for passenger's safety.

The solution will continuously monitor the "lanes" on the road it will also detect the objects surrounding

the vehicle in which the smart solution is installed. Secondly, it will be a boon for people who can't avoid their phones while driving; however artificial intelligence will help them by giving alerts. The main objective of this research is to mainly focus on roads, moving objects, distance measurement and giving timely alerts.

II. DATASET

The research is based on using images as training dataset. Camera will capture live stream and solution will take action as soon as objects are detected.

A. Dataset Description

Dataset used in our research was taken from COCO. COCO stands for Common Objects in Context. It consists of 90 classes from vehicle to household items. Since COCO dataset has many capabilities like object detection, captioning detection etc., we have only

used the object detection part of it. The downloaded zip file size was 1.4 GB which consist of image and text which holds the name of classes. The images are more than 1 million.

B. Data Preprocessing

For every problem to get resolved it is very important to get the right dataset. The story doesn't add even after getting the data. One has to understand the data and later take needed steps on pre-processing. So, for every problem statement pre-processing step will differ. In this research we have taken pre-processing steps like converting the classes into numeric categories. The reason we had to do this was for the model to understand the given categories. Hence, each label has a given allocated category to it. Once the object is detected, we can reverse the process from category to labels.

III. METHODOLOGY

The methodology approach is twofold, Deep Learning Model configured along with hardware

A. Deep Learning Model

For any research to be implemented in real world, it is necessary to have a strong deep learning network with possibly highest accuracy. Considering that this research is expected to apply on vehicles, our main objective is to detect objects with a combination of cameras and sensor. For Proof of concept (POC), a trial model is created to analyze the authenticity of the solution in real world, we have implemented pre-trained model with the programming language of Python.

There are few important libraries in Python which we have implemented in our research.

1. Python – It is one of the languages which is used by many data scientist and analyst to solve day

to day problems. It is one of the powerful languages to solve CNN because it gives many ready to go libraries. It is very efficient and reliable to implement it.

2. Pre-Trained Model- It is the model which is already trained and available for assessments - Advantage of using a Pre-trained model is it save time and complexity while training the model. Disadvantage is it may not give 100% accuracy.
3. Resnet-18 – It is the image classifier model trained on COCO dataset. It is a Convolutional Neural Network which has 18 deep layers. It can classify 1000 object classification. It takes the input of 224*224.

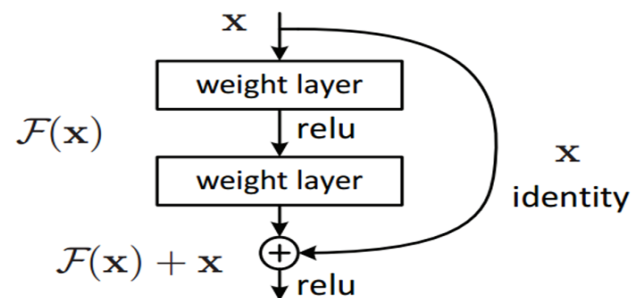


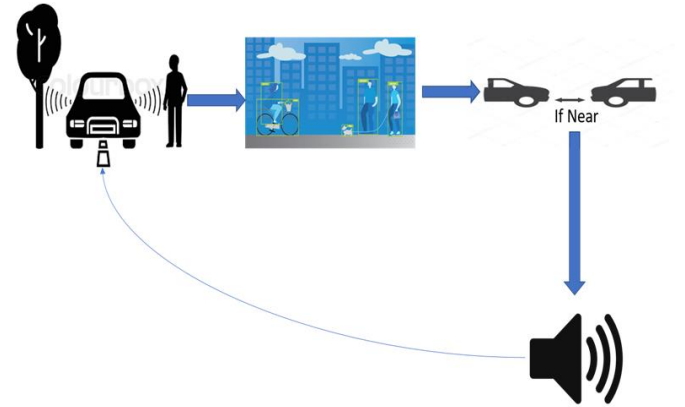
Image Source – [2]

4. TensorFlow Model – It is a google developed library which can predict many problem statements. It is the framework which creates the deep learning network that solves the object detection problems. There are many pre-trained models with TensorFlow which is called as “Model Zoo”. It is a handy framework which depends on few libraries like PIL (Python Imaging Library), matplotlib etc.
5. Detecting Lane Marking - We have added the images and videos of lane marking (white lane on road) available on Kaggle and converted it into RGB to HSV, the motive was for line segmentation. Since it is relatively simpler to

work with greyscale where pixels are represented with a single value to represent background with 0 - 255.[7]

IV. EXPERTISE SYSTEM.

Here is the workflow of our very own.



B. Hardware

To implement the above solution in real world, it is essential to have reliable hardware to support it.

We have used modules like Raspberry Controller, USB camera and Ultrasonic sensors to conclude our POC.

1. Raspberry Pi- It is a key hardware component to implement our deep learning model. The camera and sensors are configured here. We have used Raspberry Pi version 4 which have SD card slot expanded up to 64 GB and processor of 8 GB.
2. Camera- USB Cameras with 5 Megapixels resolution captures and detects objects. In a standard 4wheeler, a set of 4 cameras are used to have a complete 360-degree view. With each camera on each side attached to a USB connector with the help of Expansion board.
3. Sensors. – To detect the obstacle or threat, an ultrasonic sensor is attached to Raspberry Pi with the help of Jumper wires. Here, a threshold is set for measuring distance. Threshold is set about 40 centimeters wherein if another vehicle comes less than the threshold value then it will alert the user.
4. Speaker- It is used to alert the driver when the object is near and threshold is breached. It will alert even if the car is compromising the lane discipline

These were the components used for building Proof of concept. Every module of the hardware and deep learning model was optimally used to achieve the set objectives of the solution. Software was converted to Tensor Flow lite to get feasible for Raspberry pi to process it.

A. Workflow Steps

- The camera and sensors would start as soon as the driver starts the car
- After moving, camera will start capturing real stream and pre-trained model set in the raspberry pi will help to detect objects.
- In parallel, Sensors will detect the distance between two objects
- If object is detected closer to the vehicle or breaching set parameters, it will alert the driver with the speaker
- Cameras and Sensors continue to run in the background to monitor and find the objects.
- Ultrasonic sensors will be configured for accurate and precise measurement
- Camera will be on all four sides capturing and detecting objects
- Speaker will alert the user when objects breach parameters

V. CONCLUSION

After testing the whole process, Evaluation of resnet model is 89.6% [4], retrained comes with its pros and cons and cannot be implemented in real life scenario where value of life is important.

We can therefore conclude that Pre-trained model is efficient for the purpose of a POC. For safety purposes it is inevitable that the required models will have to be trained so that it captures more classes. The processing speed for detecting objects in real time should be faster and efficient.

Future scope

The scope is to implement in real time scenario and in real time vehicle. Training our model, we will implement with Deep Learning concept. Implementing our CNN model by training our objects with more set of training, validating and testing images. We can also apply for self-braking system in case when distance is too close and there is no gesture from driver.

We have taken the following reference for our research. Authors have worked on similar lines and it helped us to do more research on similar lines.

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