TRAFFIC SIGN DETECTION & CLASSIFICATION USING DEEP LEARNING AND MODEL COMPARISON

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ABSTRACT

In the modern era of vehicles, road accidents have increased significantly. So in this generation of modern technology and automation, intelligent agents can be applied in various ways for reducing traffic accidents. The role of object detection in automated vehicles and notifying drivers can't be denied. This work is on traffic sign detection and classification, so this is in the computer vision sector. In this project, three different computer vision models will be applied and then compared with each other. They are YOLOv5 (You Only Look Once), Faster R-CNN (Faster Region Convolutional Neural Network) and SSD (Single Shot Detector). To increase the accuracy level of the models, proper development and alteration will be applied.

Keywords- Image Detection & Classification, Traffic Sign, Yolov5, Faster R-CNN, SSD.

1. INTRODUCTION

Now -a- days traffic accidents are a common occurrence in this modern world. On average 3,700 people are dying around the world everyday in road accidents and the number reached more than 1 million if we consider the time period of a year. [1]

One of the main reasons behind these accidents is not seeing the traffic signs properly due to bad daylight or bad weather and thereby not recognizing the traffic signs. Another main problem is many drivers don't know the meaning of road signs. The aim of our project is to build a system which will help drivers or AI to recognize the traffic signs even in bad light. Moreover, it will also help the drivers who have bad eyesight.

There are few works which have similarities with our project. Some of them worked with YOLOv2 but in our project we will use YOLOv5 instead of YOLOv2 because of its capacity of reducing inference speed.

Again, we will try to find different precision results and thereby get different comparison data. Beside this, there are some similar works on individual models among our three. We will try to achieve improvement on our individual models too.

In the future, we plan to develop our project for automated cars also. We will use three different models and compare their accuracy. The models we plan to use are YOLOv5, SSD and Faster RCNN. Our system may face some barriers during the implementation such as bad lighting, different camera angles, corrupted data in the dataset etc.

2. DATASET

German traffic sign images are being used as our dataset in this project. There are more than 700 pictures in this set of data. Kaggle is the source of this dataset. We plan to add more images from different sources too.

After collecting the dataset, we have annotated and labeled it. Roboflow website was used as the annotation tool. Among 740 images, 519 were divided for training, 147 for validation, 74 were for testing. And we have about 50 different classes.

During annotating the dataset, we had faced various problems like some pictures were blurred and not clearly visible and some traffic signs were not well known so we faced little hassle in finding out the meaning of those signs.

After annotating and labeling, a CSV file has been generated.

Fig 1. Sample Annotated Image

3. RELATED WORKS

In this paper, they discussed a method of traffic sign recognition and compared three different models (YOLOv2,SSD,faster RCNN) to determine which has the best accuracy. They trained all the different three models with five different classes of objects and then tested them. They used Tensorflow2 and for the dataset they used 'German Traffic sign dataset'. They used mAp, FPS as evaluation parameters. As a result they found that the accuracy of YOLOv2 is better than Faster RCNN and SSD by 3.5% and 21% respectively. Besides, YOLOv2 was 3 times quicker than Faster RCNN .[2]

In this paper, they worked with Railway Traffic Signals. Here they followed a procedure that consisted of two steps for detecting the static and the blinking states. They used YOLOv5 for detecting the railway signals. For dataset they used FRsign dataset which was consisted of almost 100,000 pictures of traffic signals. [3]

In this paper, they detected traffic signs based on YOLOv5. For implementation, they used the Iraqi Traffic Sign Detection Benchmark (IQTSDB) dataset. According to the experiment, YOLOv5 showed high efficiency in different weather conditions and was also efficient in detecting different sizes of traffic signs such as small, medium and large. They compared the mAp value to YOLOv2 and YOLOv3. [4]

Here they detected traffic signs using Faster R-CNN. The most positive part of this project is they did not extract image features manually and could segment the pictures to automatically get candidate region proposals. Their mAp value was 0.3449. [5]

4. SYSTEM BACKGROUND

For reducing traffic accidents, following traffic signs can be very useful. There has been many works on this aspect on developing a traffic sign detection system. Many of them were successful with different models. We will try to find a new approach to find a more precise model and a different comparison results .Most of the other related works regarding this idea used YOLOv2 but we are planning to use YOLOv5.

In the roads, there are traffic signals in critical path sections such as turn points, rail crossings, highways etc. When a driver along with his vehicle comes to these points where traffic signs are located, it is really difficult to notice and realize the meaning of signs all the time due to bad light, bad eyesight etc. In our system, when a driver approaches any traffic sign, the sign will be detected and the driver will be notified. The notification will be either by a text message shown on the screen or by generating a voice signal to the driver. We are planning to notify the driver within approximately 4-6 seconds before passing that signal.

So, we will be trying to implement this system where drivers of all ages can use this system easily and have easy entrance. The main challenges will be to make sure it is working perfectly as many lives are depending on the accuracy of our system. So we need to work on improving our accuracy. Besides, high precision vs low precision can determine the difference between life and death.

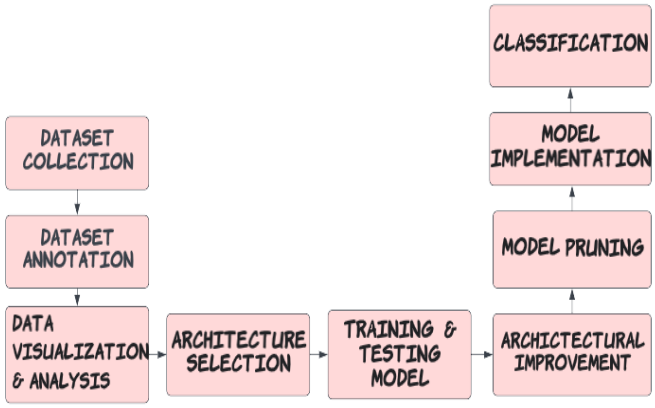

Fig 2. Working Plan

5. CONCLUSION

We plan to determine the best model among the three mentioned in this paper by comparing them at the end of our task. Detection and classification are our basic goal but comparison of the three models is our ultimate goal. By the detection and classification of the traffic signs on road we will try to help the mass population by reducing accidents, increasing traffic awareness, motivating drivers to drive safely, encouraging authorities to implement more signs on the road and many other motives are working behind our system, so that the various causes of road accidents can be resolved. In short words, we plan to make our system useful in the real world and help to reduce traffic accidents.

6. REFERENCES

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