TRAFFIC SIGN DETECTION & CLASSIFICATION WITH 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, two different computer vision models have been applied and then compared with each other. They are YOLOv5 (You Only Look Once), Faster R-CNN (Faster Region Convolutional Neural Network). To increase the accuracy level of the models, proper development and alteration has been applied.

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

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 that many drivers and passersby don't know the meaning of road signs. The aim of our project is to build a system which will help drivers and passersby or AI to recognize the traffic signs even in bad light. Moreover, it will also help the drivers and passerby 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 found different precision results and thereby got different comparison data. Beside this, there are some similar works on individual models among our three. We tried to achieve improvement on our individual models too.

In the future, we plan to develop our project for automated cars also. We used two different models and compared their accuracy. The models we used are YOLOv5 and Faster RCNN. Our system faced some barriers during the implementation such as bad lighting, different camera angles, corrupted data in the dataset etc.

2. 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]

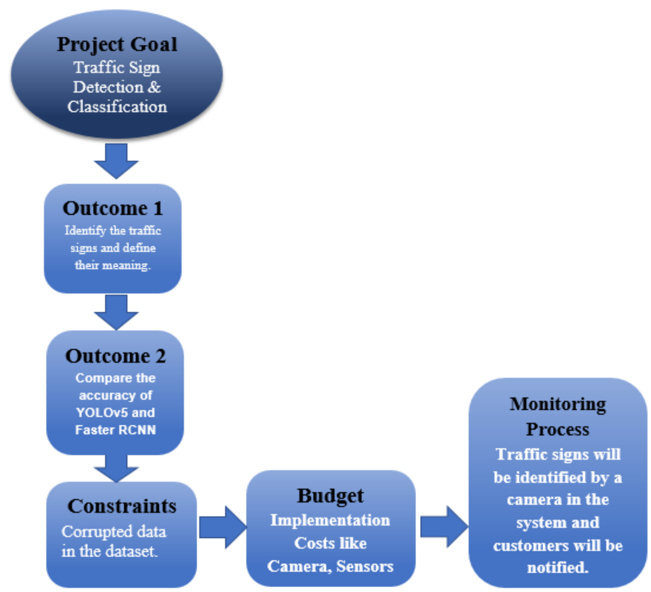
In this paper, they worked with Railway Traffic Signals. Here they followed a procedure that consisted of two steps for detecting the static and the blinking states. They used YOLOv5 for detecting the railway signals. For dataset they used FRsign dataset which was consisted of almost 100,000 pictures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

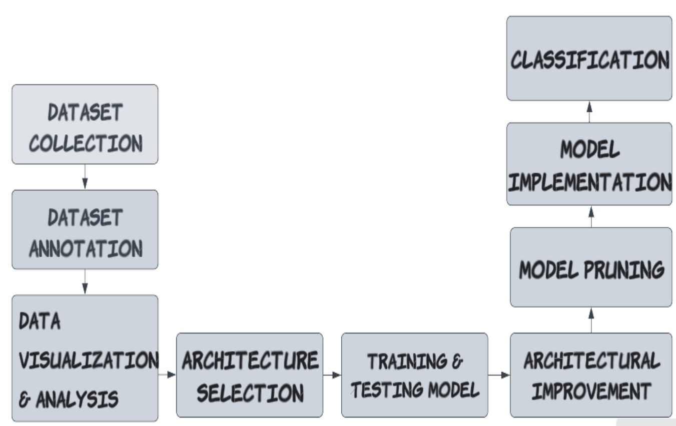
3. SYSTEM BACKGROUND

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 tried to find a new approach to find a more precise model and different comparison results. Most of the other related works regarding this idea used YOLOv2 but we used 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 or a passerby on foot 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, lack of proper knowledge etc. In our system, when a driver or a passerby approaches any traffic sign, the sign will be detected and the person will be notified. The notification will be shown b on the screen by the bounding box. The system will notify the person within approximately 2-3 seconds before passing that signal. So, we will be trying to implement this system where people 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, our results can determine the difference between life and death.



4. METHODOLOGY

We followed the methods to build our system which has been shown below step by step:



5. Result

After implementing our project, we have experimented with the model on various test images. We had 48 different types of traffic signs. We have augmented our dataset so that the data size could get bigger. We have many different traffic signs but the instances of their repetition are not the same. For example, the traffic sign ‘priority road’ and all the speed limit signs are there for the most number of instances in our dataset. Where other signs which are not so popular like, ice or roadworks are repeated the least number of times. Therefore, the signs which have the most instances are trained better. So when detecting, those signs were getting detected with more accuracy. 85-90% or more. But there are also many signs which are getting low accuracy for the reason mentioned earlier.

Beside this, some images on our dataset were blurred. We tried our best to cut out those images but still some remained. While detecting those images, our two models also performed not so good, sometimes even not recognizing the sign at all. But in most cases our model performed well and detected the signs with 85-90% accuracy or more. Although, as we used two different models, for some signs one model performed better than the other and vice versa.

After analyzing the performance of our two models, we have noticed that yolov5 has performed better in most cases than faster RCNN, But for some signs detection, faster RCNN performed better. We trained yolov5 on 200 epochs while training a faster RCNN model on 800 iterations. And we got better values of Yolov5 on training. The training mAp value of Yolov5 is 0.41 on the 200 th iteration.

Yolov5 was a more user-friendly and convenient model to use than the faster RCNN. We faced some difficulties with faster RCNN at first. Then we used the detectron2 platform for finalizing our faster-RCNN model.

Below, we are giving the graphs we gathered from faster RCNN and Yolov5. We used clearML for yolov5. We tried to run our faster RCNN model on clearML but somehow it was not connecting. That’s why we used the tensorboard of tensorflow2 in that case. We also have the tensorboard graphs for the yolov5 as well. The graphs are given below -

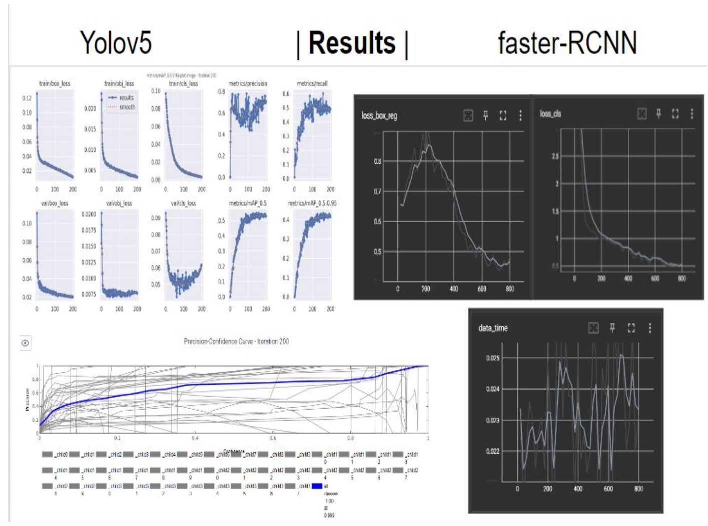


Fig: Comparisons of graphs of Yolov5 & faster Rcnn

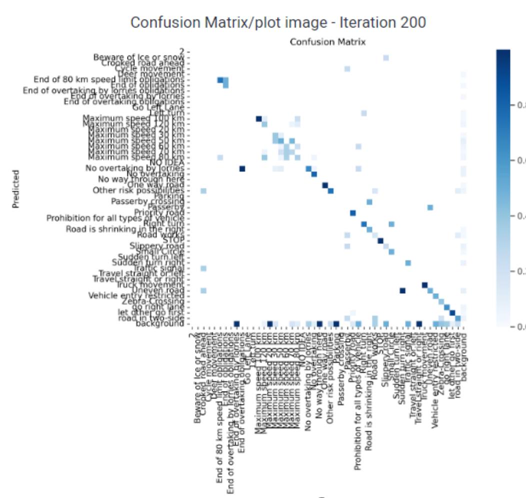


Fig: Confusion Matrix Of Yolov5

6. Conclusion

We determined the best model among the two mentioned in this paper by comparing them at the end of our task..We found Yolov5 is giving more precise values than faster Rcnn while testing. Also, in terms of training values, Yolov5 is giving better values and taking shorter time to be trained than faster-Rcnn. 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 and educate the ignorant people about the social awareness about road safety.

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