Automatic Number Plate Recognition System for Vehicle Identification Using Yolov5

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ABSTRACT: Identification of the vehicle is a major task in now a day because of various region like violation of traffic rules in signal, parking the vehicle in no parking area, driving the vehicle above speed limit, missing of vehicle ie, identification of stolen vehicle, these are the some of the major problems and these problem are time consuming to resolve them and reduce the time in solving the problem we use yolov5 algorithm in such a way that it can capture the vehicle image, identify the number plate and processing the required data to server in this way the ANPR system works, which reduce the time and also increase the efficiency. In a convolution Neural Network algorithm is used and the delicacy and effectiveness are veritably low. In the proposed system, Optical Character Recognition is enforced. The proposed system is done in real-time and also the delicacy is high. In the proposed system, YOLOV5 can identify in real time apart from the trained data.

Keywords: Automatic Number Plate Recognition (ANPR), deep learning, convolution Neural Network (CNN), Number Plate, Optical Character Recognition (OCR).

1. INTRODUCTION

Automatic Number Plate Recognition is a computer vision technology that efficiently identifies a vehicle's registration plate from images without the necessity for human involvement. Traffic violation, toll collection, and vehicle owner identification have become major issues globally. Therefore, the ANPR framework should be developed as one of the potential solutions. Recently several ANPR systems have been proposed. In recent years, the majority of ANPR applications are based on real-time detection of Number plates. As a result, there are certain drawbacks since they depend on the vehicle's availability within a short-range and visible to the camera. Otherwise, non-real-time applications we need to focus on improving the quality of captured images, including number plates, to improve the accuracy of the object detection at large distances. Although ANPR systems are based on specific methodologies, it is still a particularly challenging task because some of the variables, such as high vehicle speed, intensity of light on night time and non-uniform vehicle registration plates, will significantly affect the overall rate of recognition and the expansion of the video camera deployment in every intersection under the Intelligent Transportation System will cause the production of an enormous number of video streams. The external environmental conditions and the variety of registration plates are the primary concerns of the license plate recognition problem. Consequently, the environmental side, such as varying illumination, colour, dirt, shadows, or non-uniform background patterns, significantly influences in identifying the

number plate. Hence, varying illumination can degrade the quality of the vehicle image, and background patterns add extra difficulty to the number plate location process. Otherwise, registration plate position, quality, size, color, character sharpness, language, and tendency all pose significant challenges in constructing a reliable ANPR framework.

2. LITERATURE REVIEW

Automatic Number Plate Recognition is a surveillance system that captures the image of vehicles and recognizes their license number of a stolen vehicle, violation of the traffic rules. The discovery of stolen vehicles can be done productively by using the ANPR systems located on the roadways. Our proposed system is grounded on a recognition system in which the vehicle plate image is attained by the digital cameras and the image is reused to get the number plate information. In the being system, a Convolutional Neural Network algorithm is used and the delicacy and effectiveness are veritably low. In the proposed system, Optical Character Recognition is enforced to find the character of each and individual letter in the number plate.

With the tremendous development in the vehicular sector every day, tracking individual automobiles has become a very difficult task. With the use of surveillance cameras on the roadside, this idea proposes an automatic vehicle monitoring system for vehicles moving very quickly. Obtaining real-time CCTV footage is an extremely time-consuming task. To solve this problem, an efficient deep learning model, which is called You Only Look Once, is used for object detection and Easy-OCR for character recognition. ALPR, one of the most extensively used computer vision applications, is the subject of the proposed work. It includes technologies such as object identification, OCR, character segmentation, and character recognition, among others. The system only requires a camera and a good GPU**.**

The major cause of road accidents in India is over speeding. The population of India makes it difficult for the police to monitor every single vehicle that breaches the traffic rules. Many solutions have been proposed to maintain traffic and make the drivers and pedestrians follow the traffic rules, especially the speed limit. To resolve this issue, this research aims the development of a deep learning model which is capable of predicting the registration number of a certain vehicle in the road and this reach helps to turn the normal city into a smart city. By applying the model in real life, the vehicles which involve in traffic crimes a repeated number of times can be identified and the driving license of the driver can be blocked. This deep learning model is constructed using the convolutional neural network theory and is very easy to test and train. The efficiency of the model is monitored using three parameters named recall, precision, mean average precision.

This paper suggests an automated vehicle tracking system for the fast moving vehicles with the help of the surveillance cameras on the roadside. The process of getting CCTV footage in the real time background is very tedious process. To cater to this problem, an efficient deep learning model such as You Only Look Once (YOLO) is used for object detection. The proposed work consists of four main steps. In the first step, video footage is converted into images and the car is detected from each of the frames. In the next step, license plate is detected

from the detected cars. In the final step, the number plate characters reading are recognized from the detected number plates. The proposed deep learning model uses Image AI library to make the training process easier. The accuracy of 97% is achieved for car detection, accuracy of 98% is achieved for number late localization and accuracy of 90% achieved for character recognition.

v) In [7], a number plate recognition system is created using Convolutional Neural Network. The images taken from a camera is preprocessed by converting the RGB image to gray scale, noise removal and binarization. Then the license plate is extracted by using Connected Component method depending upon the properties such as major axis length, minor axis length, area and bounding box etc., the characters in the extracted license plate is segmented using horizontal and vertical scanning. Finally, the characters are recognized using Convolutional neural network. The dataset used to train the CNN consists of 1000 images for each 36 characters. Out of 36,000 images, 30,000 samples are used as training data and 6000 for testing data. They used descent algorithm to minimize cross-entropy with a learning rate of 0.5. The overall accuracy obtained was 97%.

3. YOLOV5 ALGORITHM

As the name states, the algorithm scans the image just once for detecting a particular object and gets it done in the first try itself. The YOLO algorithm is developed using the Convolutional Neural Network (CNN) theory of deep learning system that can take an image as input, of vehicle objects as a picture. The Visual Cortex's organization is comparable to the connective theory of neurons in the human brain, and the CNN algorithm is based on it. The CNN approach can categorize pictures in several convolutional layers, reducing the number of deep learning models required to complete a job. The YOLOv5 algorithm is said to be one of the fastest object detection algorithms as it can predict real-time objects along with the objects from saved images. The YOLO algorithm can be easily modified to a way it can detect the required objects from the images with higher accuracy and minimal error rate. Unlike classifier-based approaches, the algorithm is trained on a loss function that explicitly correlates to recognition accuracy, and the complete model is learned concurrently. The You Only Look Once the algorithm has a stronger generalizing representation of objects than other models, which makes it appropriate for applications that need quick and reliable object recognition

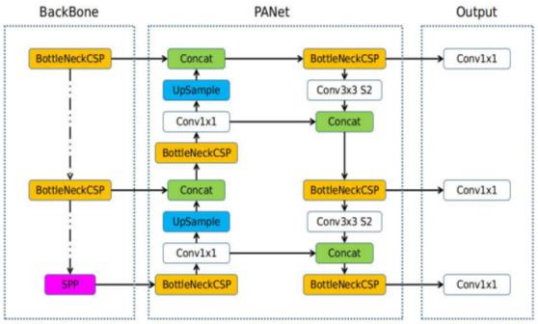

Fig:1 Yolov5 architecture

4. PROPOSED WORK

4.1) Identifying the image

Vehicle Detection is the first step after the image acquisition. The system is developed to assist the algorithm in all dynamic environments and aids the system in number plate recognition. Camera is the significant component for any ANPR system, this system is built in cameras using their location point. Image acquisition can be done from CCTV footage of Traffic control, stolen cars tracking, Border crossings, parking system cameras. The videos are converted into frame by frame and every frame is processed for the detection

of the vehicle.

Fig:2 vehicle identification

4.2) Conversion to gray color

A Gaussian filter is a linear filter. It's usually used to blur the image or to reduce noise. The Gaussian filter alone will blur edges and reduce contrast. The Median filter is a non-linear filter that is most commonly used as a simple way to reduce noise in an image. The vehicle images are converted to gray scale, to eliminate the color of the vehicle and reduce the brightness or sunshine which is reflected from the car body.

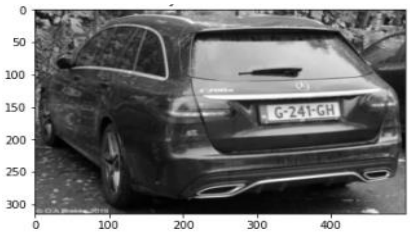

Fig: 3 Gray color

4.3) Filtering the gray color to bilateral

Bilateral filter is applied on the grayscale image. A bilateral filter is an edge preserving, non - linear, noise reduction and smoothening filter. Each pixel is replaced with the weighted intensity values of the neighborhood pixels. Specifically, it will preserve the edges while removing the noises in the image.

Fig: 4 bilateral

4.4) Edge Detection

Edge detection is a technique used in image processing and computer vision to identify the boundaries of objects within an image. The process involves analyzing the changes in intensity of adjacent pixels in an image, and identifying points where there is a sudden change in intensity, which usually corresponds to a boundary between different objects or regions in the image. There are various algorithms used for edge detection, including the Sobel, Prewitt, and Canny operators.

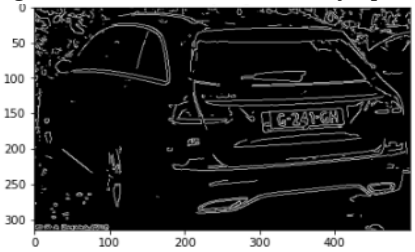

Fig:5 Edge Detection

4.5) Identifying the number plate

The project is mainly based on the identification of license plate in real time using yolov5 the number plate is identified and highlights in a rectangular shape, for further extraction of the single alphabet the further segmentation is done.

Fig: 6 extracted license plate

4.6) Segments the number

After identifying the number plate, the rectangular number plate is cropped in a rectangular shape and then the colored plate is converted in to the black and white which helps to segregate the individual identification of the individual number. The extracted segmented characters are sent as an input for character recognition

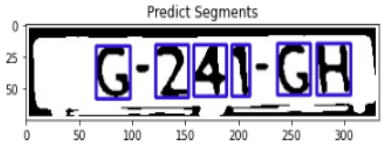

Fig: 7 yolov5 architecture

4.7) Character recognition

Optical Character Recognition (OCR) is the conversion of images printed text into a machine text. There are several OCR engines. This system uses Tesseract - OCR engine. The engine path must be

specified and added. The segmented characters are given as input to OCR. The OCR will recognize those characters.

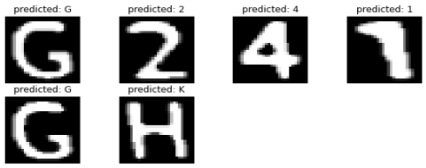

Fig:8 Identified Character

5. RESULT AND DISCUSSION

The results obtained by implementing the proposed work is discussed here, for object detection and optical character recognition, we employed two primary models: YOLOv5 for object detection in real time and optical character recognition in this project. These YOLOv3, YOLOv4, YOLOv5, model are used to train our dataset. For this purpose, more than 500 images were used to train the model and 186 images are used to test the trained model. The precision and the recall value along with the mean average precision of the YOLO algorithm during every epoch. By the end of the 25 epoch, it is found that the precision has reached its maximum, and in similar way loss of 25 epoch has gradually reduced which is nearly equal to zero the easier it is to separate number plate from the car image.

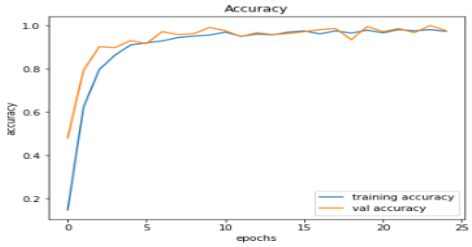

Fig: 9 Training Accuracy

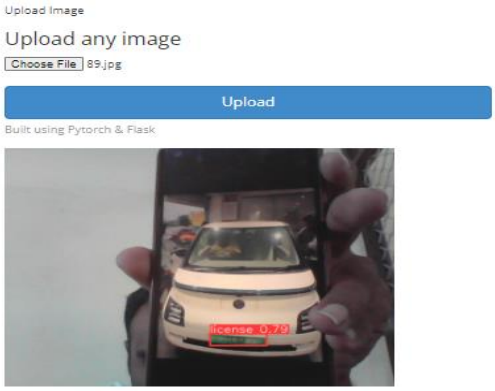

Fig: 10 live recognition

Fig: 11 Trained output image

6. CONCLUSION

By integrating YOLOv5, we are able to develop real-time Automatic License Plate Recognition in this proposed work and also it can identify the non-trained data image files. These models use the GPU to improve their speed for object detection and character recognition, which makes them suitable for real-time applications. We have successfully trained our YOLOv5 model with our custom dataset for object detection. There are many use-cases where ANPR can be used. This can be used for speed detection, traffic rule violations, parking area violation, toll collection, etc. The main advantage of ANPR is its speed for detecting and recognizing license plates.

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