IEEE Access

Received 27 July 2024, accepted 28 July 2024, date of publication 25 October 2024, date of current version 29 October 2024.

Digital Object Identifier 10.1109/ACCESS.2024.10730878

RESEARCH ARTICLE

Helmet and Number Plate Detection using YOLOv8

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This work has been supported by the Cyber Security Research Centre Limited (CSCRC) whose activities are partially funded by the Australian Government's Cooperative Research Centres Programme.

ABSTRACT In an era embarked by technological advancements, enhancing the efficiency of law enforcement processes is crucial for maintaining public safety. This paper presents a comprehensive study on "Helmet and Number Plate Detection using YOLOv8," focusing on developing an intelligent system to automate the monitoring of traffic rule violations. By leveraging the YOLOv8 object detection algorithm, we conducted extensive data collection and preprocessing to train our model on real-world traffic scenarios. Our system was trained on a dataset of 3000 images with text annotations, achieving a precision of 92.55% for helmet detection and high accuracy in number plate recognition. The results demonstrate the system's robustness in varying lighting conditions and congested traffic environments. The integration of an advanced API for number plate recognition further enhances the system's performance. This study aims to contribute to traffic management optimization by automating the identification of violations related to helmet usage and proper display of vehicle number plates, ultimately enabling efficient challan generation and improving road safety.

INDEX TERMS FYOLO , deep learning , traffic management , Helmet detection , number plate detection.

I. INTRODUCTION

The massive increase in traffic on the roads has created a huge demand for control. In this case, it is practically impossible to manually monitor fast-moving cars on the road. Energy and time will be wasted. This will bring great and incalculable difficulties when tracking manually. There are already solutions for tracking license numbers using machine learning algorithms.

Automatic License Plate Recognition System ANPR is an important step in traffic automation. Nowadays cars are used more, so traffic control is tighter[21].

Traffic information is difficult to store and store. Automatic card identification systems can be used to better manage vehicles and automatically collect and store vehicle information [2].

But in real time, algorithms fail due to the complexity of their real time operations. For this reason, it is necessary to develop a technology that helps the tracking of vehicles by performing the most effective license tracking.[1]

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Use of license information: Finally, after transcoding, license numbers are stored in a file for integration with other IT systems. It can be used to compare license against license list databases or whitelist and blacklist databases. The software retrieves information about the vehicle, such as the owner's name and address, if found in the database

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ANPR is the basic automation level of transportation.

II. LITERATURE SURVEY

Numerous techniques have been proposed and used for license plate recognition in the literature: finding the region of license plate from captured images, enhancing digital image, segmenting each character and focusing on character recognition. know the system [3] The field of Automatic License Agreement (ALPR) has made great progress in recent years with a lot of research exploring different methods and techniques.

consumption and processing time commonly encountered in ALPR systems.[4]

- The primary objective of the study is to resolve these issues and consequently enhance the performance of ALPR techniques. The research findings demonstrate notable improvements when compared to existing models, marking a significant advancement in the field of ALPR technology [5].
- A team of researchers, including Falguni Verma, Firoz Khan, Farhan Gupta, Faisal Johri, Fiza Patel, conducted a study focusing on the integration of YOLOv5 into the ALPR (Automatic License Plate Recognition) field [6]. Although specific information about their research is unavailable, their work highlights the application of YOLOv5 in license plate detection and recognition, showcasing its potential in this domain [7].
- Mohammed Umer Farooq and his research team, including Saad Ahmed, Mustafa Latif, Danish Jawaid, Muhammad Zofeen Khan, and Yahya Khan, conducted a study that specifically targeted ALPR (Automatic License Plate Recognition) using Easy OCR [8]. Their research focused on integrating EasyOCR into the ALPR system to achieve precise license plate recognition. The study showcased the efficacy of EasyOCR in extracting and recognizing alphanumeric characters from visible license plates, highlighting its capabilities in this context.

Building on these existing studies, this study aims to be the first to integrate YOLOv8 and EasyOCR into an ALPR system, exploring their joint capabilities in advanced license verification and verification of accuracy and efficiency [9]. Using the unique features of YOLOv8 and the powerful text recognition capabilities of EasyOCR, this research aims to advance the state of the art ALPR systems and contribute to general computer vision and pattern recognition.

III. PROPOSED METHODOLOGY

An ANPR system consists of a digital video recorder (camera), a camera, and different systems for video analysis. The steps are as follows.

- Photo input and image capture: First, the camera license certificate camera captures a photo or video (video stream or video stream) with one or more licenses.[10]. Often infrared lights are used to allow cameras to take pictures of license plates at night, allowing ALPR to operate around the clock.
- Scan and collect licenses: Scan licenses on images using machine learning and computer vision. Different methods differ in material requirements, including complexity, speed, and accuracy. One of the best ways is to first use the product search to find the cars and then find the license on the box with this border [11]. This is usually done by searching for different backgrounds and licenses. When the license is detected it is clipped and normalized (sharpened, warped and enhanced).
- Remove plate and read: Then use OCR software for plate area, return plate with number of letters read. OCR software can be optimized for different characters so that the same ANPR can be used in different countries. The output of an ANPR system is usually a license plate number along with a regional or national identifier [12].
- Use of license information: Finally, after transcoding, license numbers are stored in a file for integration with other IT systems. It can be used to compare license against license list databases or whitelist and blacklist databases. The software retrieves information about the vehicle, such as the owner's name and address, if found in the database.

$$\mathrm{mAP} = \frac{1}{N}\sum_{i=1}^{N}\mathrm{AP}_i \quad (1)$$

Mean Average Precision Formula

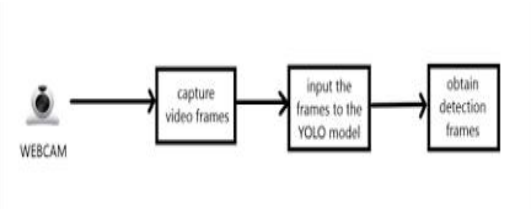

Fig. 1. Image Acquisition process

Plate Localization: Plate Localization is the step of connecting the plate on the big stage. The location of the license is confirmed, and the output is just a thumbnail containing the license. The database contains 1000 license images distributed during training and testing. For the training, we took 800 images and labeled them with tags, similar to the process done in car detection. After the diagnosis is complete. All detected licenses are stored in separate files to identify the character [13].

We need to use different product search algorithms to determine that the license plate is a product and to recognize it. There are two different points in the picture, scatter and area.

Classification is nothing more than classifying an object such as a car, bicycle, or person, and location is where an object is represented in a picture by drawing a bounding box on it. Object detection is integration of classification and localization of objects in an image. A useful GPU-centric algorithm we recommend for detecting regions of images is the YOLO algorithm (You Only Look Once) [14]

- Character Segmentation: Convert license plate image to grayscale. Then, a two-dimensional filter is applied to the grayscale image. The double-sided filter is a non-linear, noise reduction and smoothing filter that preserves edges [15]. Each pixel changes with the weighted value of neighboring pixels.

It will preserve the edges, especially while removing noise from the image. Next, Canny's edge detection is used. The edge detection process consists of five steps:

- Apply a Gaussian filter to remove noise in image.
- Find reference gradient.
- In Figure Use maximum limit to remove bogus response from edge detection.
- Use the double threshold to determine the potential margin.
- Remove other edges that are not associated with strong edges by hysteresis. After finding the edges, trace the image.[16]. The extracted segmented characters are sent as input for character recognition.

IV. SIMULATION AND RESULTS

After Training the data from our dateset these are the results from the algorithm. The graph below shows a Confusion matrix which show the True Negative, False Positive values we get after getting training the model.

This shows that the model has predicted the accuracy of the of the model by 84%.

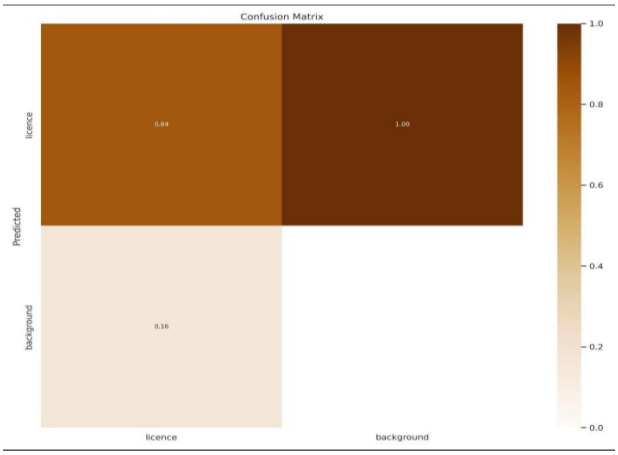

Fig. 2. Confusion matrix

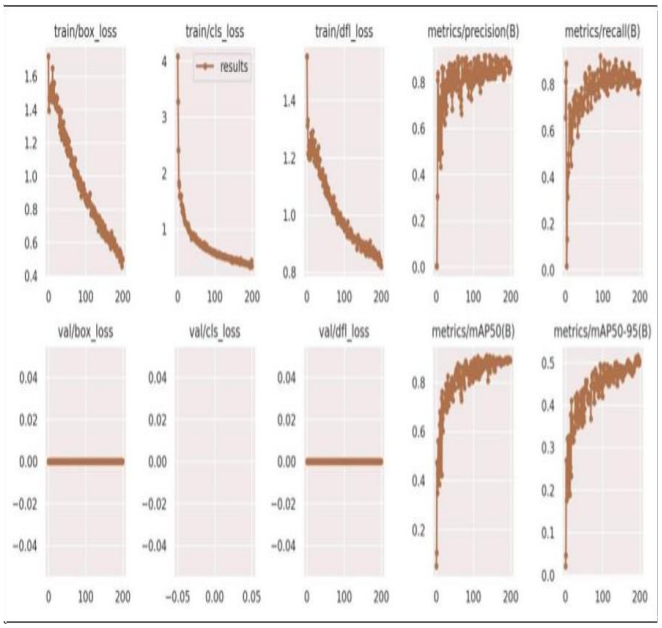

Fig. 3. Mean Average Precision and Box loss.

Results: These are the results of our model using YoloV8 detecting and capturing the licence plate of the vehicles in real time video. These are the snapshots from the real time footage where the model is easily detecting the plates with an accuracy of 86%.

Fig. 4. Result 1

Fig. 5. Result 2

V. Conclusion

In this paper, an automatic license plate recognition system using license plate is presented. The system uses image processing techniques to identify vehicles from data stored on a computer. The system works satisfactorily in many situations and different license types The ANPR system works well, but there is still room for improvement. The speed of this ANPR system can be increased using advanced cameras. So that clear photos of the car can be taken.

The OCR method is sensitive to misalignment and different dimensions, so must generate different types of templates for different RTO specifications. Statistics can also be used to verify and confirm traffic card results. Currently speed, text on bus, slope in image etc. There are some restrictions such as These limitations can be removed by further improving the algorithm.

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