# Automatic License Plate Recognition with YOLOv5 and Easy-OCR method

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***Abstract:*** ***In this era of ever-increasing technology, there is a vast demand among people for a safe and secure day-to-day lifestyle and travel. The number of automobiles on the road has risen steadily during the last decade. 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 (YOLO), is used for object detection and Easy-OCR for character recognition. ALPR (Automatic License Plate Recognition), 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.***

***Indexed Terms— ALPR(Automatic license plate recognition), Deep Learning, EasyOCR ,OpenCV, YOLOv5***

## I. INTRODUCTION

Deep learning and neural networks have gained momentum in the past few years, which has led to the development of automated licence plate recognition (ALPR). This can be used in public places to monitor things like traffic safety enforcement, automatic toll tax collection, car park systems, and automatic vehicle parking systems. ALPR is a process that involves acquiring and analyzing the images from traffic surveillance cameras. The frames from the videos must first be extracted. The second step is to locate the region of interest in the photos that have been collected. This process can be performed using edge detection.The next step involves Character Segmentaion performed by identifying the regions where the characters are located.Object detection software often use a combination of natural language processing and deep learning approaches to accomplish this task. CNN is popular because of its versatility in jobs like picture categorization and object recognition.

Object detection applications employ convolutional neural networks (CNN). Image categorization, character recognition, and object identification are all common uses for CNN.It is particularly effective in the domains of information recovery due to its efficacy outcomes. A neural network that is built on specific regions is known as a regional neural network. Due to its processing complexity, it is not appropriate for real-time application. complexity of the application YOLO (You Only Live Once) architecture is a popular term for "You Only Look Once" architecture. It's a more efficient architecture that can detect objects in real time.

Easy-OCR is used to recognise the characters on a licence plate that have been detected, and it returns the characters in the same order as before, but in text format. The result can be plotted on an image to be visualised or can be saved in a database.

## II. RELATED WORK

The Literature Survey was carried out in great detail using existing ALPR methodologies and technologies, such as Chen's YOLO darknet deep learning algorithms for Taiwan number plate identification.This technique is carried out using a regional neural network. It's made up of seven convolution layers and a sliding window technique. Abdullah has collected over 1500 license plate images

from Bangladesh. A deep learning model based on a multi-layered system was used to process the image data. For detection of digits on the plate, YOLOv3 is used to detect where the license plate is located on the vehicle.

Rayson has proposed an automatic licence plate recognition system with a 96.8 percent recognition rate. In this project, the YOLO algorithm is used. Because of its high Frames per Second (FPS) rates, it can distinguish multiple vehicles in real time, such as four vehicles at a time in a single scene. Some number plate images are influenced by the environment, such as lighting, bad weather, traffic, rainy weather, and so on. Taking these factors into account, Hsu [3] developed a method for detecting licence plates using a deep learning model based on YOLO and its variant YOLO-9000.

The image had been preprocessed by Abdussalam. Prior to using deep learning techniques for number plate detection, i.e.Skew Detection was one of his specialties, and he also provided correction for even better results. Lele Xie [2] proposed an additional method, the MD-YOLO model, which is based on convolution neural networks. In real-time situations, predicting the angle of rotation and a quick convergence over union evaluation strategy are proposed for attempting to deal with rotational problems.

As demonstrated by Dhedhi[3], the YOLO method will detect skewed licence plates more effectively than existing digital image processing approaches. According to Bhavin, the accuracy is 82 percent with some fault tolerance. Pinto used YOLOv4 for both licence plate detection and recognition. They achieved 95 percent accuracy in number plate detection and 96.2 percent accuracy in number plate recognition.

Mr.Vitalii Varkentin[4] proposed a YOLO-based technique for number plate detection and recognition that has a 73 percent accuracy. Another person, MJ Prajawal, has explained the various convolution neural network methods for helmet and number plate detection, employing the YOLO V2 convolution neural network for the detection of license number and riders without helmets.

Silva[5] presented a method for recognising the characters on a number plate that employs supervised classification techniques.They modeled the pixel sequence behavior in texts to describe the character classes. They determined the pixel behaviors in each class. The authors' major goal is to achieve good real-time performance. As a result, the time complexity of the performance methodology was assessed. Their algorithm can recognize 92.33 characters per minute, this approach of this work is interesting since it is based on pixel behaviors.

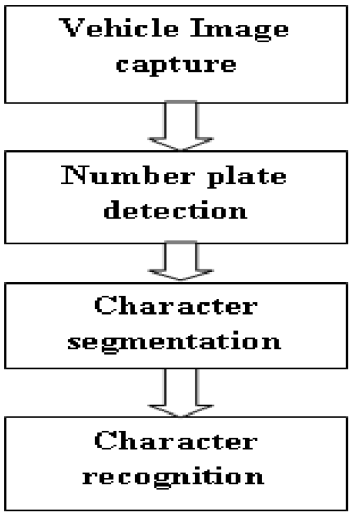


Fig -1: Stages of ALPR

## III. PROPOSED METHODOLOGY

The present proposed methodology involves 3 steps: OpenCV is being used to recognise images, the YOLOv5 model is being used to detect licence plates, and Easy-OCR is being used to recognise optical characters.

### 3.1 Image Acquisition

Python includes libraries for image and video processing. One of them is OpenCV. OpenCV is a large library that can be used to perform a wide range of image and video processing operations. We can extract video from the camera using OpenCV. It enables you to create a video capture object that can be used to capture movies with a camera and then perform operations and pre-processing on them.

### 3.2 License Plate detection

The project's initial stage is to extract the vehicle's licence plate from a picture or video. Object detection mainly involves two steps: 1) object localization 2) object classification. Object localization means locating an object in the image or video, and object classification means classifying the object, whether it is a car, bus, or truck, and so on. In our project we use the YOLOv5 model, the latest version of YOLO, which is a Single-Step-Deep-Learning object detection model. YOLO stands for "you look only once." As it goes by its name, the model looks at the image only once. Out of all the algorithms out there, YOLO is considered to be the fastest model and is suitable for real-time object detection. This model is GPU centric, which means it takes the use of a single GPU.

YOLOv5 mainly consists of 3 important parts:
1) Model Backbone
Model Backbone is mainly responsible for feature extraction from images, where features can be edges, shapes, lines, etc. For this, we employ a Convolution Neural Network (CNN), which has layers such as kernel, stride, and batch normalisation.The CSP (Cross Stage Partial networks) are the main backbone for feature extraction. These are based on the Densenet, which is mainly used to connect CNN layers.

2) Model Neck
Feature pyramids are used to recognise elements in the image of varying sizes and produce multi-scale predictions. This is achieved through the usage of feature pyramid networks. YOLOv5 makes use of PaNets for FPN (Feature Pyramid Networks).

3) Model Head
The final detection stage is Model Head, which leverages anchor to locate vectors with class probabilities, objectness scores, and bounding boxes.In a deep neural network, activation functions are very significant. In the middle and buried levels of YOLOv5, Leaky Relu is used, and in the final layers, the Sigmoid function is used. SGD and Adam are the optimization functions employed. The YOLOv5 model uses the Pytorch framework and includes 191 layers.

The following are the major reasons for using the YOLOv5 detection model in our project:

With YOLOv5, we can have custom object detection by training the custom datasets. It gives us different models to choose from according to our custom datasets. It also uses data augmentation, which combines images to give new data, which can help the model perform well with new data. It combines K-means with a genetic algorithm to give the K-means evolved anchor boxes.

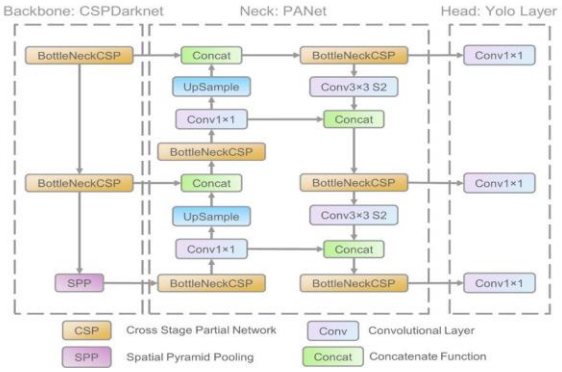


Fig-2: Network Architecture of YOLOv5


Fig-3: Yolo Model methodology

3.3 Optical Character Recognition
Optic Character Recognition (OCR) is a extensively used method to work in a digital environment on lines which are colourful. optic in the sense that the details seen through the mortal eye are honored. Easy-OCR is a python package that holds Py Torch as a backend tutor, which provides extreme delicacy. Easy-OCR detects textbook from images in real time while running with a high- end deep literacy library. For detecting in coloured fields, Easy-OCR supports 42

languages. and also or the read text system, Easy-OCR offers several hyperactive-parameters. The hyperactive- parameters are included under each sub caste of the processing medium. easily, in the decoding sub caste, Easy-OCR supports" greedy"," beam search", and" word beam search". In textbook recognition, it first detects and identifies the bounding boxes of the textbook present in the image or document. Second, it identifies the characters. Deep literacy models are used in order to descry characters and words in an image or document. Easy-OCR's affair contains a nested array where the first element gives the match axis which can be used to mark the textbook within the image, the alternate element gives the factual textbook which is present on the source, and the last is the confidence value. The GPU is used to accelerate Optical Character Recognition.


Fig-4:Image Enhancemnat of ROI


Fig-5: Bounding boxe for character segmentaion

## IV. RESULTS AND DISCUSSIONS

For object detection and optical character recognition, we employed two primary models: YOLOv5 for object detection and Easy-OCR for optical character recognition in this project. The YOLOv5l model was used to train our unique dataset for licence plate detection. The model uses images of 640 pixels, which are good enough to detect and recognize license plates. The model is tuned by training with 500 epochs and a batch size of 8 for good accuracy. For character recognition, we use Easy-OCR. Easy-OCR is far too similar to the mortal eye. However, and more likely if the mortal eyes can see the original source easily, also it's possible to achieve good OCR results. The easier it is to separate characters from the background, and the more advanced the delicacy of OCR will be, the greater the quality of the original source image is.

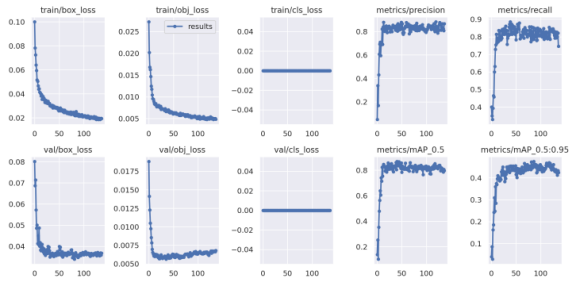


Fig -5: Percision and Loss of Yolov5 model

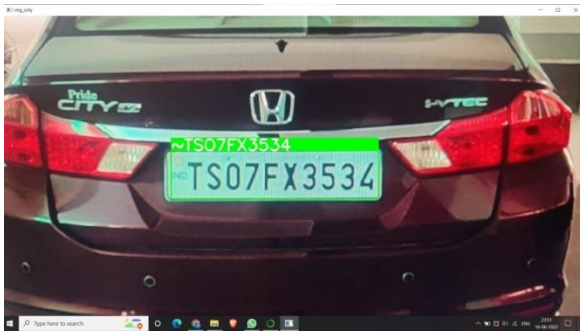


Fig-6: Car license plate recognition

## V. CONCLUSION

### A. *Figures and Tables*

By integrating YOLOv5 with Easy-OCR, we are able to develop real-time Automatic License Plate Recognition in this proposed work. 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. Easy-OCR gives us 95% accuracy for character recognition. There are many use-cases where ALPR can be used. This can be used for speed detection, traffic rule violations, unattended parking lots, vehicular attendance systems, toll collection, etc. The main advantage of ALPR is its speed for detecting and recognizing license plates, which other applications fail to do.

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