

# Vehicle License Plate Detection and Recognition System: A Review

Shubh Goyal<sup>1</sup>, Srijan Dube<sup>2\*</sup>, Niranjana Mali<sup>3</sup>, Prashant Udawat<sup>4</sup>

<sup>1,2,3</sup>Student, Department of Information Technology, SVKM's NMIMS MPSTME, Shirpur, India

<sup>4</sup>Assistant Professor, Department of Information Technology, SVKM's NMIMS MPSTME, Shirpur, India

**Abstract:** There is no fixed recognition system for identifying and recognizing a license plate, it has been discovered. As the texture and writing pattern are not the same hence, the plate design differs from one country to another. Detecting and recognizing vehicle license plates is a common and difficult task. We looked at some strategies for detecting and recognizing license plates in this paper. To recognize and understand the license plate, high-resolution cameras acquire an image of the vehicle.

**Keywords:** Automatic Number Plate Recognition (ANPR), Optical Character Recognition (OCR), License Plate (LP).

## 1. Introduction

Recent development in the computer software and related hardware technology have provided a value-added service to the users. Vehicle License Plate Detection and Recognition plays an important part in a variety of applications, such as highway traffic monitoring and automatic toll collection. Parking systems, plundered vehicle identification etc. Vehicle License Plate Detection and Recognition is integral for an automated future as detecting and recognizing a license plate is the first step in automating any process related with vehicles.

## 2. Procedure

The location of a license plate is related to the detection of the license plate in a still picture or sequence of photographs, i.e. moving photographs. The process of detecting a license plate begins with the removal of noise and superfluous areas from the image, with the focus being on extracting the region containing the license plate [1]. Picture processing is a technique for applying operations on an image in order to improve it or extract relevant information from it. It is a type of signal processing where the input is an image and the output can be an image or a feature / feature associated with that image. Image processing is one of the most quickly evolving technology today. It is also the focus of research in the engineering and computer science fields. Using picture capture tools to import the image examining and modifying the image the output of which might be a changed image or a report based on image analysis. The factors, which make the License plate detection task difficult to solve, are: Dust on License plates or

dirty License plates could make the license plate detection difficult as the system won't be able to recognize the specific area containing the license plate. The lighting condition are extremely important for this system as improper lighting system could make the detection of license plates difficult [2].

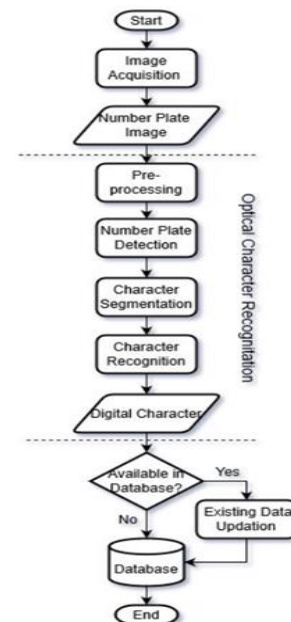


Fig. 1. Vehicle License plate Detection and Recognition System

**Recognition:** For the past few decades License plate recognition has been an important topic for research. In these areas, substantial advances have been made and various methods have been suggested. Optical Character Recognition (OCR) is a technique for converting various types of pictures taken by a digital camera into editable and searchable data. Optical Character Recognition (OCR) is a promising method for recognizing letters or phrases in images. It is a typical technique of digitizing printed texts in order to allow them to be electronically altered, searched, stored more compactly, and presented on the internet. Pre-acquisition, Pre-Level Processing, Segmented Processing, Post-Level Processing, and Feature Extraction are all steps in

\*Corresponding author: srijan.48@gmail.com

optical character recognition. By making changes in various techniques used in each stage one can get a better result.

### 3. Review Analysis

**Neural Network based Vehicle Number Plate Recognition System:** In this work they have developed a vehicle license plate recognition system (VNPR) that can be installed at the toll station and in the high security surveillance zone. The main objective of this thesis is to implement an autonomous system to control the process of payment of fees and allocation of parking in tolls and shopping centers. The genetic algorithm based on neural networks that was developed to detect and recognize the details of the vehicle's license plate as a digital picture is the work's peculiarity. Using low-level digital image processing techniques and neural network algorithms, identify the vehicle by identifying its VNPR [1].

**Automatic Number Plate Recognition Using CNN Based Self Synthesized Feature Learning:** In this article, they attempted to identify the status of a vehicle from the license plate using auto-generated functions on CNN. Based on car thefts, traffic rule violations in order to violate the limited area, image processing convinced them to put an end to these abuses. Inspired by Convolution Neural Networks (CNN) Feature learning capabilities, outstanding work is license plate image recognition and recognition achieved by Convolution Neural Network (CNN). License plate images can be obtained with a still camera. CNN's self-synthesized function is capable of recognizing vehicle status from license plate with a relatively high accuracy of 90% even with a very small training size. CNN has also proven its strength with distorted, skewed, and illuminated data sets. [2]

**Indian Car Number Plate Recognition using Deep Learning:** In this paper, they used the approach of a training-based pathway for vehicle number plate recognition. The major goal was to develop a reliable number plate recognition model that could function in a variety of lighting conditions and angles. They propose a training-based route for vehicle number plate identification in this study. The majority of prior work on automated number plate recognition (ANPR) systems has limitations in terms of their operating circumstances. Their major goal was to develop a reliable number plate recognition model that could function in a variety of lighting and angles. They created a recognition model by training on their manually collected car number plate dataset using YOLO V3. The algorithm has been tested over 640 images which are of different colours, and illuminations [3]. Using a features-trained neural network, improved OCR-based automatic car number plate recognition: This paper focuses on a new OCR-based license plate identification approach that employs a neural network-trained object feature data set. To enhance accuracy, a hybrid license plate recognition algorithm is developed and compared to existing techniques. License plate finding, license plate segmentation, and license plate identification are the three primary components that make up the system. The system is tested on 300 national and international license plate pictures of automobiles, and the findings show that the major criterion is met [4]. A novel zone-based method for detecting Indian

vehicle license plates: In this article, an adaptive template matching system is used to recognize the detected numbers in a zone-based license plate recognition technique. In this article, an adaptive template matching system is used to recognize the detected numbers in a zone-based license plate recognition technique. On the basis of the light impact on the captured photos, they are separated into different zones, and then the real position of the number plate is determined from other textual effects. The effect of edge detection and segment on each number and letter separately, has also been discussed for proper recognition. The effectiveness of the suggested technique is demonstrated through experimental data and a graph [5]. Multi-Style License Plate Recognition using Artificial Neural Network for Indian Vehicles: In this paper, plate localization and character segmentation is achieved by using morphological operations in combination with horizontal and vertical edge histogram [6].

**Detection and Recognition of Multiple License Plate from Still Images:** They presented a fast and successful process for the recognition of multiple license plates in both India and Spain. Automatic License Plate Recognition (ALPR) is used to identify the location of the license plate. The advantage of the proposed multi-plate method is its high precision in plate recognition. Their proposed method correctly recognizes multiple license plates on a single camera frame. Licenses with complex backgrounds are properly controlled and perform well. They concentrated on identifying and distinguishing numerous license plates from a single picture. The identification of license plates using a mix of mathematical morphological characteristics and edge statistics yields excellent results. Because they are overly sensitive to undesired edges, edge-based techniques are rarely utilized for complicated pictures. The researchers utilized a mathematical morphology based on non-linear neighborhood procedures [7].

**Smart Check-in Check-out System for Vehicles using Automatic Number Plate Recognition:** In this paper they wrote that ANPR is a method of identifying the number plate of the vehicle and extracting the vehicle number. The alphanumeric letters from the car number plate are extracted using image processing techniques, and the plate is then classified accordingly. They also proposed a method that contained the following steps Image Acquisition the first stage in ANPR is to acquire image data of vehicle number plate. Number Plate Detection is the second stage, the number plate will be detected in the input image. The factors like plate size, plate location, and plate background are taken into consideration as plate size is not standard. The extracted rectangular number plate is multiplied with binary image and its output image will contain required characters [22]. These characters are segmented using bounding box methods where a rectangular box is drawn over each character. This is the final step where separated characters are classified from the input image and converted to meaningful text in ASCII [8]. Text Recognition in Moving Vehicles using Deep learning Neural Networks: This study describes a method for recognizing text characters and digits on moving vehicle number plates. A camera linked to a Raspberry PI collects video of moving cars as part of the system. Frames from the video

containing car number plate images are extracted and then preprocessed to improve clarity and decrease blur. The region containing the text is segmented and applied to classification network. For feature extraction and character identification in vehicle number plate pictures, a deep residual network or ResNet-34 Convolutional neural network architecture with 34 layers is used in this study. Automatic vehicle number detection systems offer a broad range of uses, including collecting tolls on highways, tracking car entry and departure in government buildings, residences, and more, and might save time and annoyance to passengers.[9]

### 1) *Vehicle Number Plate Detection System for Indian Vehicles*

An effective technique for recognizing Indian car number plates has been created in the suggested algorithm. The method seeks to solve scaling and recognition of character location problems with a high accuracy rate of 98.07 percent. The VNPD System method based on template matching is presented in this article. The approach uses a modified version of Otsu's threshold partitioning method. By increasing the correlation between the templates, the scale variation between the characters was minimized. The use of template matching with Normalized Cross Correlation is offered as a method for dealing with scale variance. It obtained the accuracy of 98.07% [10].

A Necessary Review on Optical Character Recognition (OCR) System for Vehicular Applications: In this article, a picture of a vehicle's license plate is recorded and saved in a database. These photos will be used to identify a car in the future. This approach is useful for defense and traffic applications due to the rise in automobile-related crimes. In dissimilar references, this knowledge is referred as Automatic automobile discovery, Automatic number plate recognition, Car number plate recognition, Car Plate Reader, or Optical Character recognition. Artificial Neural Network-based, Cloud Computing-based, Hybrid-based, Template Matching-based, and Histogram-based are some of the techniques utilized to create an Automatic Number Plate System. The accuracy of the number of plates using the OCR technology is verified using these methods [11]. A New Approach for Vehicle Number Plate Detection: They presented a novel method in this work to enhance detection in low light and overexposure situations. The picture of the car is taken and preprocessed utilizing grayscale and binarization methods. The resultant image is passed on to the next step that is plate localization, for extracting the number plate using CCA (Connected Component Analysis) and ratio analysis. Various filters are used to de-noise the number plate. CCA and ratio analysis are used to segment the characters on the number plate. Finally, methods such as SVC (linear), SVC (poly), SVC (rbf), KNN, Extra Tree Classifier, LR+RF, and SVC+KNN are used to compare the identified characters. The proposed techniques helped their system to detect well under dim light, over-exposed images and those in which the vehicle is angled. [12]

### 2) *Real-time Vehicle License Plate Detection by Using Convolutional Neural Network Algorithm with Tensor Flow:*

They presented a car license plate identification system utilizing Tensor Flow and a convolutional neural network

(CNN). Their study was broken down into three stages: data pre-processing, training/testing, and evaluation of the results. The training model of vehicle license plate detection created by using CNNs algorithm in Tensor Flow with 25,000 steps and 8 batches in the training process has a high accuracy of 70-99 percent [13].

### 3) *The Proficient ML method for Vehicle Detection and Recognition in Video Sequence:*

Their research explored how deep learning may be used to monitor cars and recognize license plates. For vehicle detection and vehicle number plate detection, this study used the CNN (Connected Component Analysis) and segmentation techniques. Their proposed model gives the fundamentals of current neural networks and how they interact with computer vision applications. It can increase the accuracy of the proposed model with a pre-trained model by employing the key components of neural networks. Finally, applying the CNN model obtained more accuracy in the character recognition phase [14].

## 4. Challenges

1. Low file resolution, which is generally caused by the plate being too far away, but can also be caused by the use of a low-quality camera.
2. Images that are smeared, especially motion blur
3. Due to overexposure, reflection, or shadows, there is poor lighting and low contrast.
4. A tow bar or dirt on the plate, or an item covering (part of) the plate.
5. Examine license plates that are different in the front and rear due to towing trailers, campers, and other vehicles.
6. During license plate reading, the camera's angle of view changes due to a vehicle lane shift.
7. A unique typeface that is commonly used for vanity plates (some countries do not allow such plates, eliminating the problem).

## 5. Conclusion

In this study, various approaches for Number Plate Recognition are investigated, including the use of a convolution neural network (CNN) to extract data and OCR (Optical Character Recognition) software designed particularly for use with NPR (Number Plate Recognition) systems. This paper discusses 'feature-based number plate localization' for locating the plate, 'image scissoring' for character segmentation, and statistical feature extraction for character recognition. Different license plate recognition algorithms are also explored in this paper, including ResNET CNN network. Choosing a specific recognition algorithm depends on the application required. Explanation of problems of Number plate recognition, as well as thorough discussion of recent recognition systems are presented.

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