

# License Plate Recognition System Based On Color Features and Hybrid Classifier Using Feature Selection Technique

Chetan Patil  
M.Tech, Department of CSE  
PIES, Bhopal, India  
[E-mail](mailto:chetanhpatil@gmail.com)-chetanhpatil@gmail.com

Pankaj Kawadkar  
Asst. Professor, Department of CSE  
PIES, Bhopal, India  
[E-mail](mailto:kawadkarpankaj@gmail.com)- kawadkarpankaj@gmail.com

## ABSTRACT

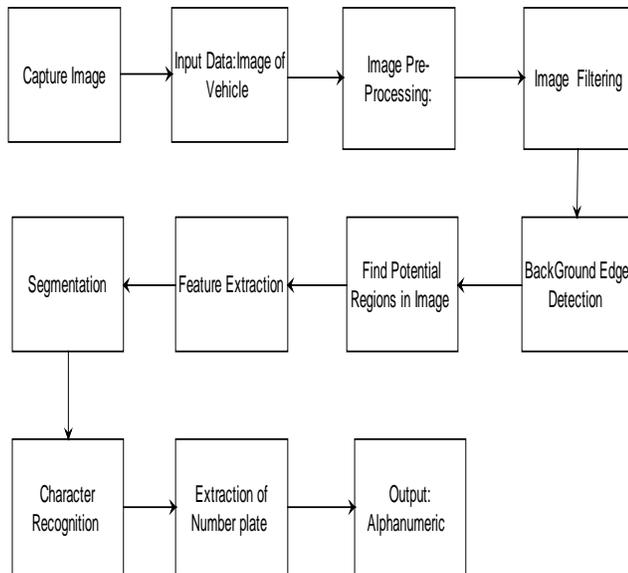
A license plate recognition system based on color features and hybrid classifier using feature selection technique is presented in this literature. The method presented here is based on a modified template-matching technique by the analysis of target color pixels to detect the location of a vehicle's license plate. In this paper a hybrid method of number plate detection is proposed. The hybrid method of number plate detection is a combination of partial feature extraction technique and feature optimization using teacher learning based optimization algorithm. The proposed algorithm of number plate detection is based on feature selection and feature optimization process. The methodology and architecture of proposed system includes Partial Feature Extractor, Feature Selection, Support Vector Machine and Teacher Learning Based Optimization Algorithm. For the selection of feature and optimization of used two different functions in TLBO algorithm, the selection of feature process satisfied the given condition of feature constraints then select feature and passes through matching of feature for the process of optimization. The proposed algorithm implemented in MATLAB software and used standard number plate image provided by Google database. For empirical evaluation used hit ratio and miss ratio of number plate image in given dataset. The detection ratio is better in case of hybrid method.

**Keywords:** - ANPR, ALPR, Traffic flow, TLBO.

## INTRODUCTION

Number plate recognition, is an important research field used in computer vision, pattern recognition, image processing and artificial intelligence, which is one of the most important aspects of the intelligent transportation system of human society in the 21<sup>st</sup> century. Recently, Number plate recognition can be widely used in road traffic security monitoring, open tollbooth, road traffic flow monitoring, the scene of the accident investigation, vehicle mounted mobile check, stolen vehicle detection, traffic violation vehicle-mounted mobile automatic recording,

parking lot automatic security management, intelligent park management, access control management and etc. It has a very important position in the modern traffic management and control system and has good application value. Meanwhile, Number plate recognition can also be used in other identification field. So it has become one of the key problems in modern traffic engineering field. [12] There is a need for intelligent traffic management systems in order to cope with the constantly increasing traffic on today's roads for that we need a intelligent toll gate system which can control large amount of traffic as well as able to maintain the data base regarding vehicles. This paper will explore and elaborate the proposed algorithm for ANPR. Automated Number plate recognition has many applications. Nowadays automatic Number plate recognition (ALPR) plays an important role in many applications like automated transport systems such as road traffic monitoring, automatic payment of tolls on highways or bridges and parking lots access control, access control, tracing of stolen cars, or identification of dangerous drivers. The input to the ANPR is a digital image, captured using low resolution camera. Number plate localization is very crucial step in that the overall system accuracy depends on how accurately we can detect the exact license plate location. The input can be in the form of still images or video frames from surveillance cameras. The processing can be done at either color or grayscale level. The process of Number plate localization includes rough Number plate localization. To find the approximate location of the Number plate, we find the rough location first and this will involve many irrelevant details like car bonnet or any Govt. approved texts. The main steps involved in Number plate localization are edge detection, morphological dilation operation and region growing segmentation. In order to have a reliable localization of Number plate in real dynamic environment, several steps and several choices are required.



**Figure 1: Steps for Image Pre-Processing.**

In the Edge detection process the gray scale image is changed to binary image i.e. black & white. As there is great difference between the contrast of the plate and background and this difference can be use for the detection of the edge of the Number plate. The final and the most vital step in the Number plate recognition system is the character recognition. After the character segmentation of the elements (characters and numbers), the final stage is the character recognition of the Number plate. Character recognition is a critical and inevitable phase in such an application, where the system is put up to deal with nebulous or distorted characters in the Number plate due to environmental hazards. Character recognition is the step where Number plate character is recognized. Character recognition is also called as optical character recognition (OCR). The rest of paper is organized as follows. In Section II state the problem. The Section III Related work IV discusses proposed methodology. In section V discuss performance evaluation and result analysis followed by a conclusion in Section VI.

## II PROBLEM STATEMENT

We studied various research paper in related to the number plate recognition. But we have not found much research paper in journal related to Indian license number plate because the Indian number plates are versatile (there is no any particular standard format for number plate). But in current scenario Govt. of India issues standard number plate and standard templates of characters and number's. In order to maintain traffic problem and controlling a crime and various agencies working in the field of Indian license plate recognition system. We found some general problem. Here we mention problem with references:

- Rate of recognition low.

- Creation of template [2][3][7].
- Recognition time is very high [11]
- Standard deviation error of most of the method nearer 5 to 10%.

In this paper, we perform the minimization of the recognition time of the license plate of the vehicle and maximization of recognition rate of the Indian License plate recognition system. We evaluate the performance of Indian license plate using hybrid classifier. In hybrid classifier we easily classify and recognize the license plate character and can easily detect the number in the plate. We improved the detection ratio of number plate. We also reduce the noise in the image. In our approach a hybrid method of number plate detection is proposed. The hybrid method of number plate detection is a combination of partial feature extraction technique and feature optimization using teacher learning based optimization algorithm. The partial feature extraction technique is basically used geometrical function for the feature extraction. The geometrical feature extraction technique used sine, cosine and tangent function for the process of number plate image proceeding. The feature extraction process passes through teacher learning based optimization technique (TLBO). The TLBO is basically dynamic based population based optimization algorithm.

## III RELATED WORK

In this section we give an extensive literature survey on the License plate recognition systems that have been a lot of interest from the community of research. Much research has been done on Chinese, Dutch, Indian and English license plates. A characteristic feature of research work in this area is that it is limited to only specific region, city, or country. This is due to the absence of equivalence among different license plates. This section gives an overview of the research carried out so far in this area and the techniques employed in developing an LPR system.

[1] In this paper, an Iranian vehicle license plate recognition system based on a new localization approach is proposed and also it is modified to reflect the local context as well as hybrid classifier that recognizes license plate characters is also proposed in this method. For detecting license plate of vehicle, a method which is based on modified template matching is used to analyze target color pixels. In this approach a modified strip search is utilized. The modified strip search enables localization of the standard color-geometric template utilized in license number plates of Iran and several European countries. This method also uses a technique called as periodic strip search to find the hue of each pixel. In the scenario when a set of target pixels is detected then it is analyzed to verify its shape and aspect ratio and match those with the standard license plate. This method cuts down the detection time by avoiding time

consuming image processing algorithms and transformation of image pixels.

[2] This paper presents a technique of recognition of number plates based on neural networks. In this method each number-plate in color image can be correctly located by analyzing number-plate colors which are classified by neural networks. The recognition of characters in number plate is done by combination of integrated methods such as neural networks and template matching. Experimental results using this approach show that the rate of number-plate location is approximately 100%, and the time required for locating number plate is less than 3 seconds. The proposed algorithm is not sensitive to variations in weather conditions, illumination and vehicle speed.

[3] In this paper, a hybrid approach of license plate recognition system based on Neural Network and Image Correlation for classification of characters is proposed. Image segmentation is done using Image Processing. The purpose here is to develop a more reliable hybrid system than individual one. This hybrid system that is consisting of transformation to gray level, histogram equalization, thresh holding and some novel algorithms is used in finding the character of license plate number. These algorithms were successively integrated in such a way as they will complement with morphological image processing methods. In addition Image correlation and neural network with LVQ (Learning Vector Quantization) learning methods were used for template matching extracted from license plate number.

[5] Automatic Number Plate Recognition (ANPR) systems find a very important role to trace stolen car, access control and monitor the traffic. The implementation of an ANPR system requires image capture using an Automatic Number Plate Recognition camera, and processing of the captured image. The image processing part combines two tasks plate localization and character recognition. This paper highlights an improved license plate localization (LPL) algorithm based on modified Sobel vertical edge detection operator and two morphological operations suitable for FPGA implementation.

[6] In this technique, computer can read the license number of vehicles directly from the captured images. This paper deals with the recognition of Indian car license plate recognition. The procedure in this technique includes four steps, Preprocessing, Segmentation and Normalization, Plate Localization and Optical Character Recognition (OCR). The operator used to identify the plate location is Morphological operator. Then the next step is applying the histogram equalization technique. For segmentation part, smearing and morphological algorithms are used.

[8] The proposed method involves segmenting moving vehicles using background subtraction. The vehicles are

tracked by using a color based particle filtering technique till the vehicle is in position to get captured by the camera device. The image of license plate is detected by converting it into LAB color space and contour in it are located using level set methods. To filter erroneous blobs in license plate image regularity and size properties of image are used. The Geometric feature extracted from the blobs of license plate are forwarded to trained neural network for classification process. The model is built on this study and the system is tested and verified.

[10] In this paper, a general approach for international vehicle license plate localization and recognition is proposed. A hybrid solution is presented by combination of basic machine vision techniques and neural networks. The proposed method deals with localization, segmentation and recognition. In the license plate localization, by performing some essential preprocessing and finding edges, the 8-connectivity of image background is eliminated which helps more appropriately separating of main image objects from the cluttered backgrounds. After that the method finds connected objects with 8-connectivity of the differentiated binary image. The binarization of license plate is based on local binarizing.

#### IV PROPOSED METHODOLOGY

In this paper we proposed a hybrid method of number plate detection. The hybrid method of number plate detection is a combination of partial feature extraction technique and feature optimization using teacher learning based optimization algorithm. The partial feature extraction technique is basically used geometrical function for the feature extraction. The geometrical feature extraction technique used sine, cosine and tangent function for the process of number plate image proceeding. The feature extraction process passes through teacher learning based optimization technique (TLBO). The TLBO is basically dynamic based population based optimization algorithm. The TLBO algorithm Work in two phases one is teacher phase and other is learner phase. Initially all data passes form student phase and satisfied some certain condition and converted into teacher. The optimized feature passes though the support vector machine classifier. The support vector machine is well known pattern classification algorithm.

In this section we discuss the proposed algorithm of number plate detection based on feature selection and feature optimization process. Initially used number plate image data base and passes through partial feature extractor and this feature extractor gives a shape feature of number plate image database. The extracted shape feature passes through TLBO algorithm and selects the proper feature and optimized the feature and finally passes through the support vector machine for classification of feature and finally detected the number plate and calculate the detection ratio

of detected number plate. The process of algorithm discuss step by step in below section. [7]

1. Select data set for feature extraction
2. apply partial feature extractor
3. Start generation of feature matrix in terms of shape feature.
4. convert feature matrix as row wise and make vector of these feature
5. Initialized a number of student feature  $N=100$
6. Compare the value of distance vector with student
7. If value of feature greater than vector value
8. Processed for new set of student
9. Check the value of teacher factor value  $TF=1$
10. After that generate new set of teacher.
11. These optimal value of teacher is passes through SVM
12. If the value of shape not classified go to the selection process of TLBO
13. Else optimized classified shape is generated.
14. the optimized shape feature passes through the liner support vector machine
15. support vector machine classified the shape value
16. finally detected the number plate
17. calculate the detection ratio of input number plate
18. exit

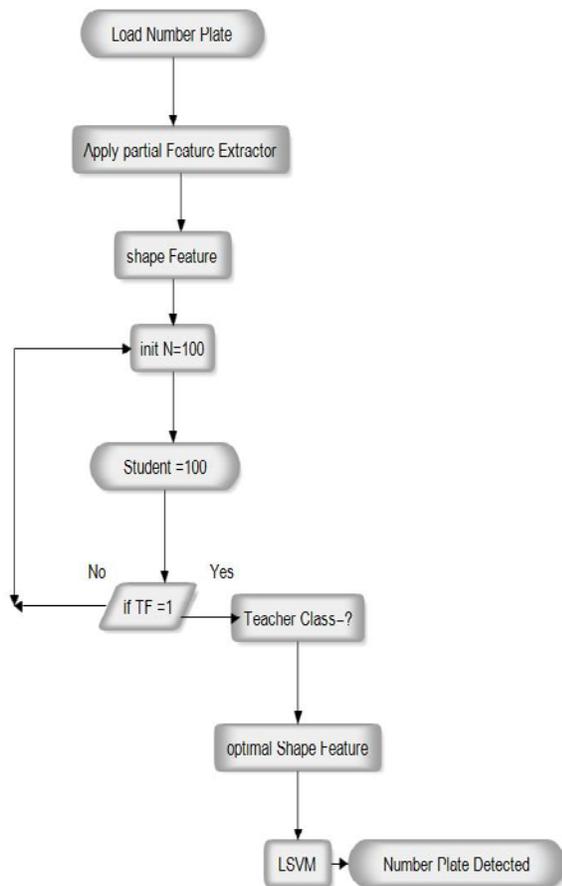


Figure 2: Block diagram of proposed model.

### V IMPLEMENTATION DETAILS AND RESULT ANALYSIS

In this section we discuss about the implementation details and result analysis. Automated License Plate Recognition (ALPR) is a technology that uses optical character recognition (OCR) to automatically read license plate characters. There are two types of ALPR: stationary, which uses infrared (IR) cameras at high fixed points, and mobile, which uses vehicle-mounted IR cameras. ALPR software suites use multiple cameras mounted on a vehicle. As the vehicle moves, it photographs license plates and transmits plate data to a database. The database may be a national database or it may be created at the local level and downloaded into the vehicle's onboard computer at the beginning of each shift. If the system detects a match, the officer receives an alert on his computer. A mobile ALPR can read up to 1,000 plates per hour and cover two or more lanes of traffic at once. In this we have analyze the performance of the License plate recognition system based on color features and hybrid classifier using feature selection technique. We tried to reduce the complexity of the detection and recognition of the license plate. The result in this paper are based on the performance of the hybrid and proposed algorithm.

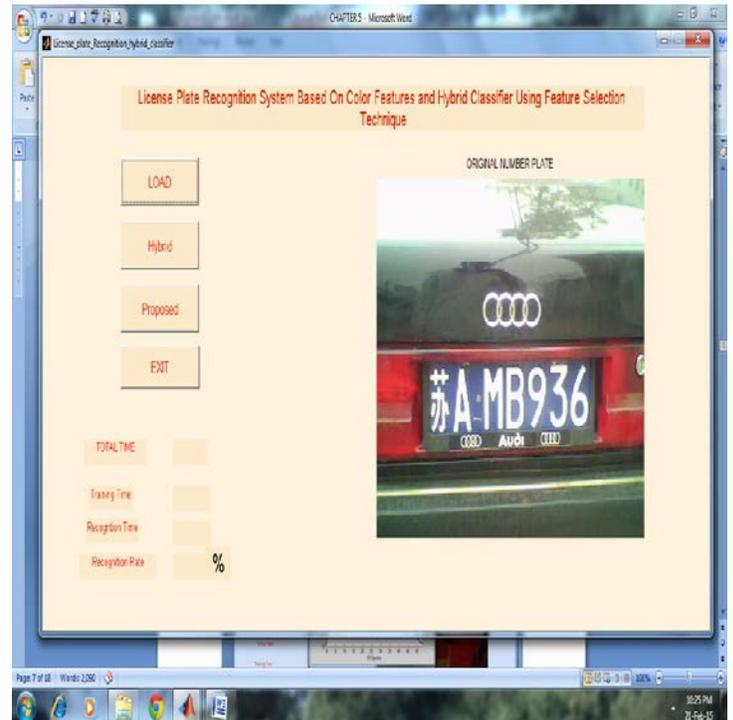


Figure 3: Shows that the Car 1 Inserted image for the method Hybrid.

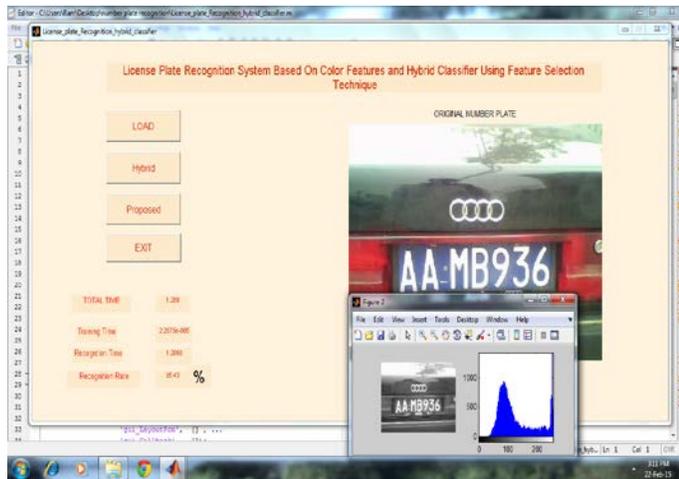


Figure 4: Shows that the Car 1 Number plate image for the proposed method and find the value of Recognition rate, time and training time.

Number plate	method	Recognition time(ms)	Training time(m s)	Recognition rate (%)
Car1	Hybrid	0.521	2.933	92.61
	Proposed	0.513	2.297	95.50

Table 1: Shows that the comparative result for car1 number plate image for the Hybrid and Proposed, and finds the value of Recognition rate, time and training time.

Number plate	method	Recognition time(ms)	Training time(m s)	Recognition rate (%)
Car2	Hybrid	0.559	2.981	92.39
	Proposed	0.514	2.884	95.28

Table 2: Shows that the comparative result for car 2 number plate image for the Hybrid and Proposed, and finds the value of Recognition rate, time and training time.

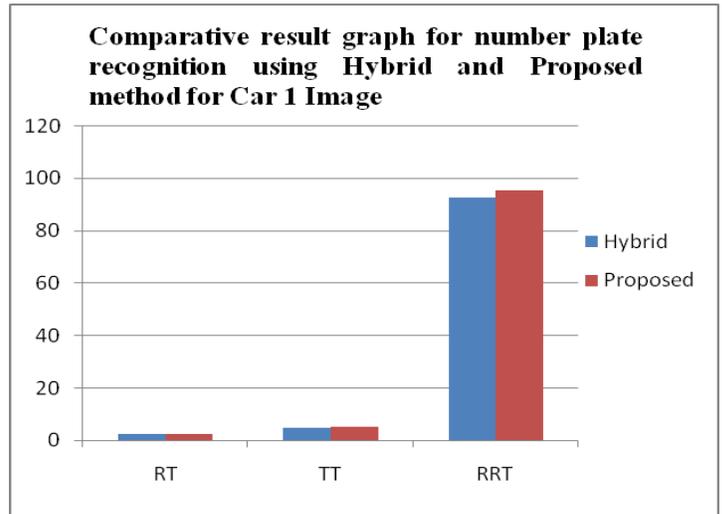


Figure 5: shows that comparative result analysis of hybrid method and proposed method for Car 1 image.

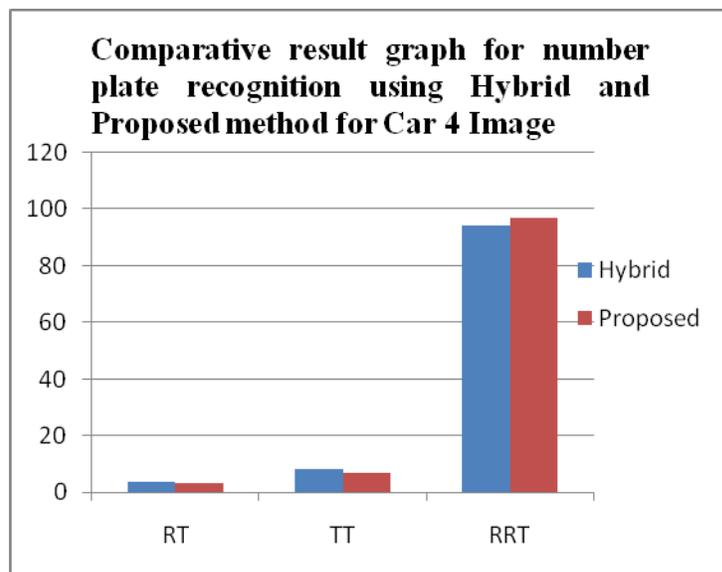


Figure 6: shows that comparative result analysis of hybrid method and proposed method for Car 4 image

VI CONCLUSION AND FUTURE WORK

In this paper we improved Number plate Detection System using partial feature extractor and features selection process by TLBO algorithm. After extraction of feature of number plate used feature optimizations technique for better selection of feature. The localized number plate image is transformed from layered form of transform function for extraction of color feature. The optimized feature selection process gives better result in compression of hybrid and

support vector machine based detection technique. In the process of feature extraction we used partial feature extraction function, partial feature extraction process implied as shape feature. The proposed method work in two phases in first phase used feature optimization and second phase used number plate detection. For the selection of feature and optimization of used two different functions in TLBO algorithm, the selection of feature process satisfied the given condition of feature constraints then select feature and passes through matching of feature for the process of optimization. The proposed algorithm implemented in MATLAB software and used standard number plate image provided by Google database. For empirical evaluation used hit ratio and miss ratio of number plate image in given dataset. The detection ratio is better in case of hybrid method.

The proposed algorithm for number plate detection is very efficient in case of individual as well as group number plate. The proposed algorithm used partial feature extractor function with TLBO algorithm. The process of feature optimization and feature selection is very complex for two different constraints function of optimization and detection. The optimization and detection increase the time complexity but incase the value of detection ratio. In future reduces the time complexity of proposed algorithm and improved the efficiency of overall system.

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