

A Literature Survey on Automatic License Plate Recognition System (ALPR)

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Abstract- Automatic license plate recognition system is the optical character recognition which aims at extracting the number of license plate from a vehicle. In this paper we have discussed various existing ALPR systems, the basic algorithm used, the variations in the existing algorithm to improve the overall system. There are also a plenty of applications where this system could be used, among these criminal surveillance is one of the most wanted application. This system mostly concentrates on localization of license plates and then go on to extract the characters by using morphological operations such as dilation, eroding the image, dilating, filtering etc. All these morphological operations leads to the efficiency of overall system. ANPR is used by police forces around the world for law enforcement purposes, including to check if a vehicle is registered or licensed.

Index Terms– Automatic license plate recognition, ALPR, Vehicle, optical character recognition, localization, surveillance system.

I. INTRODUCTION

Automatic number plate recognition systems (ANPR) is based on the localization of license plate and recognition of characters by extraction. This whole problem is generally sub-divided into 5 parts:(1) image acquisition i.e. capturing the image of the license plate (2) pre-processing the image i.e. normalization ,adjusting the brightness , skewness and contrast of the image (3) localizing th license plate(4) character segmentation i.e. locating and identifying the individual symbol images on the plate,(5) optical character recognition. There may be further refinements over these (like matching the vehicle license number with a particular database to track suspected vehicles etc.) but the basic structure remains the same. Provide a means to overcome the drawbacks and deficiency of successful surveillance of the cctv cameras. The ANPR system is well developed in certain countries such as USA and Dubai, and existed from a longtime, but only in the late 90s it became an important application because of the large increase in the number of vehicles. The information extracted from the license plates is mainly used for traffic monitoring, access control, parking, motor way road tolling, and border control, making car logs for parking systems, journey time measurement for toll booth etc. by the law enforcement agencies. A guiding parameter in this regard is country-specific traffic norms and standards. This helps to fine tune the system i.e. number of characters in the license plate, text luminance level (relative index i.e. dark text on light back ground or light text on dark

background) etc. So the problem can then be narrowed down for application in a particular country. For example, in India the norm is printing the license plate numbers in black color on a white background for private vehicles and on a yellow background for commercial vehicles. The general format for the license plate is two letters(for state code) followed by district code, then a four digit code specific to a particular vehicle.

II. STEPS OF ALPR

The number plate background should not match the color of the vehicle It is a pattern with very high variations of contrast. If the number plate is very similar to background it's difficult to identify the location. Brightness and contrast is changes as light fall changes to it. The morphological operations are used to extract the contrast feature within the plate. The work is divided into several parts. The basic four stage algorithm for ALPR system is:

Image acquisition
License plate localization
Character Segmentation
Character recognition

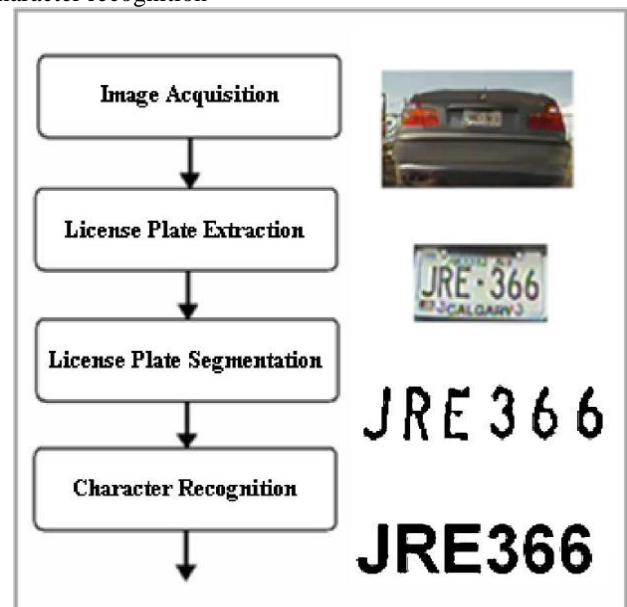


Fig.1: Four basic Algorithmic Stages.

First step among the 4 basic algorithms is to acquire all the raw images of the number plate, then the images are converted into grayscale or binarization is done. After grayscale conversion De-noising of image is done. After reduction of

noise the number plate localized. Then the character segmentation takes place and after segmentation the character is recognized.

- Input raw image
- Grey scale conversion
- Medianfilteringornoisereduction
- License plate localization
- Segmentation of the characters

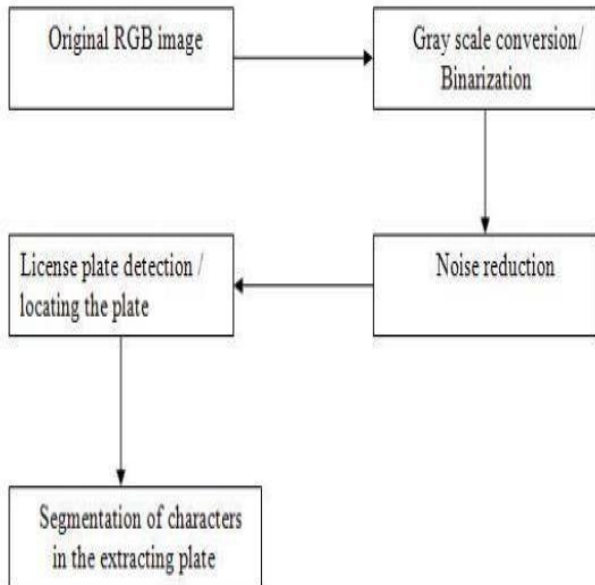


Fig.2: Block Diagram of proposed approach

III. OPERATIONS

- A. Raw Input Image: The images of number plates in RGB format are taken as input.
- B. Gray Scale Conversion: Input is taken as RGB image and it has to be convert to gray scale and the 8 bit gray value is calculated. After grey scale conversion the morphological operations begin which starts with dilation of an image, in figure 3 we show the process of dilation.



Fig.3: After Dilation of gray scale image.

We erode the image and apply median filtering technique after dilation of image, which is the basis of noise reduction or de-noising.

- C. Noise Reduction: Here, Median Filtering technique is used to reduce the paper and salt noise. We have used 3x 3 masks to get eight neighbors of a pixel and their corresponding gray value. After applying the median filtering technique we erode the image by a structural element in the form of any shape. We go on to find the morphological gradient for edge enhancement, then we convert the class to double for brightening the edges and perform the convolution of the double image. Figure 4 shows the convoluted image.



Fig.4: Convolution of the image for brightening the edges

- D. Contrast enhancement using histogram equalization Histogram equalization technique is used for enhancing the contrast of image

- E. Plate Localization The basic step in recognition of vehicle number plate is to detect the plate size. In general number plates are rectangular in shape. Hence we have to detect the edges of the rectangular plate. Mathematical morphology will be used to detect that region. Using Sobel edge detector we used to high light regions with a high edge magnitude and high edge variance are identified. Depending upon the threshold value edge will be detected from the input image.

- F. Character Segmentation: regionprops(). Function is used for character segmentation, which is a MatlabFunction.It measures a set of properties for each labeled region in the label matrix. Bounding boxes is used to measure the properties of the image region. After labeling the connecting components, the region will be extracting from the input image.

IV. LITERATURE SURVEY

Ms.Sushama, H.Bailmare, Prof. A.B.Gadicha[1] presented an approach based on simple and efficient morphological operation and sobel edge detection method. They also presented a simple approach to segmented all the letters and numbers used in the number plate. After reducing noise from the input image we try to enhance the contrast of the binarized image using histogram equalization. We mainly concentrate on two steps; one is to locate the number plate and

second is to segment all the number and letters to identify each number separately.

M. M. Shidore, S. P. Narote [2] implemented the number plate extraction, character segmentation and recognition work, with English characters. Number plate extraction is done using Sobel filter, morphological operations and connected component analysis. Character segmentation is done by using connected component and vertical projection analysis. Character recognition is carried out using Support Vector machine (SVM). The segmentation accuracy is 80% and recognition rate is 79.84 %.

Sarbjit Kaur, Sukhvir Kaur [3] implemented that automatic Number Plate Recognition (ANPR) system is an image processing technology that identifies the vehicles by tracking their number plate without direct human intervention and an application of computer vision. ANPR is an important method used in Intelligent Transportation System (ITS). They observed that their proposed ANPR approach works well for Low Contrast.

Atul Kumar, SunilaGodara [4] represented paper to provide the review of various existing techniques for Number Plate.

Raja Vikramdeep Singh, Navneet Randhawa [5] presented a system to recognize number from license plates from the front and rear of the automobile. Input to the system is an image sequence acquired by a digital camera that consists of a license plate and its output is the recognition of characters on the license plate.

J. V. Bagade, MSukanyaKamble, KushalPardeshi, Bhushan Punjabi, Rajpratap Singh [6] proposed to deal with the problem in toll collection in the parking lots. The human intervention makes the system very much prone to mistakes and inefficient that's why they propose the system which will automatically capture the vehicle's image and also pre process it by removing the effect of noise and blur with the help of image pre processing activities.

Anuj Kumar [7] proposed that Automatic Vehicle License Plate Recognition is an image processing and pattern recognition technique used to identifying vehicle license plate number from an image or video of a vehicle.

Dhiraj Y. Gaikwad, Pramod B. Borole [8] proposed objective to design an efficient automatic vehicle identification system by using the vehicle number plate, and to implement it for various applications such as automatic toll tax collection, parking system, Border crossings, Traffic control, stolen cars etc. The system has color image inputs of a vehicle and the output has the registration number of that vehicle.

Aniruddh Puranic, Deepak K. T., Umadevi V. [9] applied canny edge detection to detect the presence of vehicle and SVM to recognize the vehicle. In [12], Maximum Average Correlation Height (MACH) filter and Log r-theta Mapping techniques were applied to recognize the type of vehicle irrespective of scale and rotation variation of vehicles. The MACH filter was used for detection of targets in cluttered environment.

Prof. Pradnya Randive, Shruti Ahivale, Sonam Bansod, Sonal Mohite, Sneha Patil [10] proposed that ALPR is the technique of extracting the information from an image or a sequence of

images of Vehicle's Number Plate. The vehicles number plate photo will be captured by the android phone and then it will be send to the server. The server will perform the plate region extraction on the image and will convert it into grey scale. The Otsu algorithm will perform binarization and morphological operations on grey scale image. The number will be extracted using OCR algorithm. The server will send the correct result back to the android phone.

V. APPLICATION

ALPR system has wide ranged applications such as traffic surveillance for criminal detection, toll booth collection, parking management, distance travel management etc. The ANPR system for traffic surveillance could be installed on a bridge to track down the entire road way and record the motion of each and every vehicle. If a suspected vehicle is detected the proposed system looks for the entries in the database provided by the concerned authority such as local RTO to immediately find the details of the suspected person and inform the local police. In this way number of crime cases can be reduced by agreatextentandal so many such cases could be avoided in which the deriver runs off during an accident.



Fig.5: ALPR system installed on a bridge



Fig.6: An ALPR system installed on a pole

ALPR system should be installed on tower on some height from where the entire glanceat the traffic could be made.

Components Used in ALPR System

Camera

[18]The Camera itself consists of an infrared detecting camera, a general optical color detecting camera

and an infrared light emitting array of LEDs. The LED array beams infrared light in the direction of the infrared camera, which then captures the light reflected by the white background of the number plates of passing by vehicles, which appears white on the image.

The non-reflecting color of the characters and the vehicle's surface appear black. Direct sunlight enhances the infrared reflection, the LED array however is bright enough to recognize number plates in absolute darkness. The focal length of the infrared camera is adjusted to detect an overall width of one lane. The color camera with a lesser focal length generates images for overall view and alignment of the whole camera body. Both images are sent in intervals of 300ms to a Computer, where the installed software processes them. ANPR-systems can be either set up as shown in Figure 3 on a bridge construction over a carriageway or on the hard shoulder of a carriageway. In the latter case it is not possible to detect traffic on two lanes because the further lane will not be recognized optimally due to shadowing effects.



Fig.7: ALPR system recognizing the details of a car

VI. SUMMARY, CONCLUSION & FUTURE WORK

A. Summary

In general, an ALPR system consists of our processing stages. In the image acquisition stage, some points have to be considered when choosing the ALPR system camera, such as the camera resolution and the shutter speed. In the license plate extraction stage, the license plate is extracted based on some features such as the color, the boundary, or the existence of the characters. In the license plate segmentation stage, the characters are extracted by projecting their color information, by labeling them, or by matching their positions with template. Finally, the characters are recognized in the character recognition stage by template matching, or by classifiers such as neural networks and fuzzy classifiers. Automatic license plate recognition is quite challenging due to the different license plate formats and the varying environmental conditions.

There are numerous ALPR techniques that have been proposed in recent years. Issues, such as main processing procedure, experimental database, processing time, and recognition rate, are provided. However, the authors of [4] pointed out that it is inappropriate to explicitly declare which methods demonstrate the highest performance since there is a lack of uniform way to evaluate the methods.

B. Current trend and future work

The existing ALPR system has many deficiencies such as inaccurate results if the image is not of proper texture for example, if the image contains blurred or tilted license plates the results are always inaccurate. So the existing algorithm could be modified to produce better results. Furthermore, the character recognition has limitations such as number of characters which varies from region to region thus there is a great need of a universal algorithm for the same.

VII. CONCLUSION

We concluded that the image segmentation problem in license plate recognition for Indian License Plates has been examined in two stages: license plate Localization and extraction from the scene followed by the separation of the characters from the previously extracted license plate region background. Review of various papers led us to conclude that there are different techniques available for recognition of car number plate such as Sobel edge detection method, Automatic license plate recognition, Novel method used for detects edge & fill holes less than 8 pixels only, categorize features in each stage, identifying & recognizing car license plate. Therefore at this stage we use improved character segmentation method to reduce effort required for recognizing vehicle license number plate. Also, a more sophisticated version of this system can be implemented by taking inputs from live video feed and selecting the best vehicle frame for classification of vehicle types and recognizing the number plates using neural networks.

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