

A survey on Number plate recognition systems

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Abstract

Now in these days the traffic on road is increases much frequently. In addition of that to manage the road traffic various efforts are also prepared. In this context the vehicle number plate recognition is a valuable step to identify the vehicle and their identity. In this paper the review of such kind of vehicle recognition system is prepared. In addition of that for improving the accuracy of number plate recognition a new model based on existing technique is prepared. That model claims to provide the efficient and accurate recognition. In addition of that the future extension of the proposed work is also included.

Keywords- image processing, vehicle number plate recognition, OCR, feature extraction, pattern recognition

Introduction

Automatic Number Plate Recognition (ANPR) is highly accurate framework equipped for perusing vehicle number plates without human intercession using fast picture catch with supporting light, identification of characters inside the pictures gave, check of the character groupings similar to those from a vehicle tag, character acknowledgment to change over picture to text; so ending up with a set of metadata that distinguishes a picture containing a vehicle tag and the related decoded content of that plate [1]. Automatic Number Plate Recognition (ANPR) is the procedure of naturally finding and extricating license plate information. Access control systems, toll road payment collection, parking entrance control, and border crossing security are some of the many applications in this area where, ALPR can be effectively used. Accurate automatic reading of plate information from an image or a video is a challenging task due to several reasons. Depending on the acquisition time, environment, and climate changes, the background of the vehicle and lighting conditions may vary. The angle between the vehicle and the camera can also vary and can have a significant impact on accurate detection of plate contents. In addition, variations in fonts, colors, use of background images and plate standards make the task of automatic license plate recognition quite challenging [2]. To automatically recognize a Number Plate (NP), three stages are applied: Number Plate Localization (NPL), Character Segmentation (CS), and Optical Character Recognition (OCR). The NPL is the stage where the NP is detected from the input image. The CS can be considered as a link stage between NPL and OCR where each character of the NP is segmented. In the final stage, OCR deals with translating the segmented plate characters from image format into a text format [3].

Now a day's Automatic Number Plate Recognition (ANPR) technology is widely used to help identify and stop criminality at a local, force, regional and national level, including Organized Crime Groups and terrorists. The ANPR system provides lines of probe and clue in the inspection of crime and is used by law enforcement agencies throughout England, Wales, Scotland and Northern Ireland.

A. Type of Number Plate Recognition System

The ANPR system can be used different type of techniques to recognize the number plate from the vehicle. Some of techniques are mentioned below:

- Automatic Number Plate Recognition System using super-resolution technique.
- Automatic Number Plate Recognition system using modified Stroke Width Transform.

- Automatic Number Plate Recognition System for vehicle identification using optical character recognition.
- Effect of Character Spacing on the Performance of Automatic Number Plate Recognition (ANPR) Systems through Simulation.
- An Automatic System of Vehicle Number-Plate Recognition Based on Neural Networks.

B. Optical Character Recognition

While number plate recognition has special type of OCR technology, today optical character recognition (OCR) technology is considered strictly a type of technology - mainly software - that lets you scan paper documents and turn them into electronic, editable files [4]. OCR (optical character recognition) is the recognition of printed or written text characters by a computer. This involves photo scanning of the text character-by-character, analysis of the scanned-in image, and then translation of the character image into character codes, such as ASCII, commonly used in data processing. In OCR processing, the filtered in picture or bitmap is broke down for light and dim zones keeping in mind the end goal to recognize each alphabetic letter or numeric digit. At the point when a character is remembered, it is changed over into an ASCII code. Special circuit boards and computer chips designed expressly for OCR are used to speed up the recognition process [5].

Optical character recognition is the electronic conversion of optically processed characters. Character recognition can be offline or online, in online character recognition computer recognitions the character when it is detected.

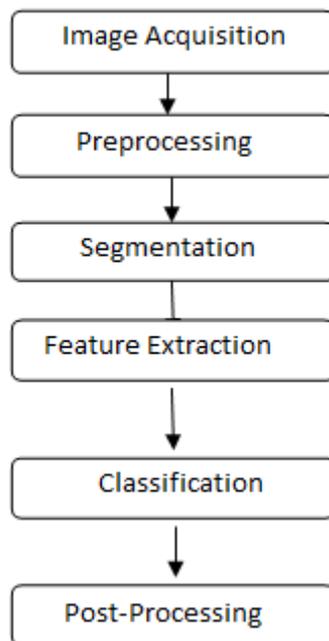


Figure 1 Traditional working steps of character recognition

In this traditional method of OCR, there are three important steps which are segmentation, Feature Extraction, and Classification. In segmentation we determine the elements of an image. The second important step is to seize the important characteristics of each character which distinguish each symbol; feature extraction is performed mainly through analyzing the distribution of points, through transformation, series expansion and structural analysis. The third important step of recognition is the classification, identifying each element characters and assigns it to the correct character class [6].

Among these main steps, the most significant part is usually the image preprocessing step which enhances/improves the input image to a level that characters can be segmented in a correct method. Therefore, the reliability and accuracy of the ANPR systems rely on the methods that are used in preprocessing. Based on the importance of the pre-processing steps used in approaches to ANPR, we can compare various edge detection filters involved in the process of plate recognition. Edge detection

can be identified as a sub-process of the pre-processing techniques that can be applied to an input image-tasks such as gray scaling, binary conversion, noise removal, performing morphological functions to recreate or develop the images acquired- can be considered as some of the other tasks which can be performed before an image is passed through edge detection in the preprocessing phase. By applying edge detection filters, the image is converted into an image with boundaries of the objects which exist in input image. This narrows down the process of identifying characters so that the objects identified through processing boundaries can be used to segment the characters, which are then used in character recognition. Sobel, Canny, Gabor and Log-Gabor edge detection filters are the four candidate methods which will be analyzed. These are the filters/algorithms normally used in APNR [7].

II. BACKGROUND

This section provides the different comparative studies and the advantages and limitations of existing methodology.

A. Pros and Cons of the Edge Detection Methods

The table 1 shows the advantages and limitations of various edge detection approaches.

METHOD	PROS	CONS
Sobel Edge Detection	<ul style="list-style-type: none"> •Ease of application •Ability to detect edges along with the 	<ul style="list-style-type: none"> • Responsive to noise existence •Less accuracy in detection
Canny Edge Detection	<ul style="list-style-type: none"> • Use of probability theorems in computing error rate •Localizing and responsive ability •Enhanced SNR •Tolerance to 	<ul style="list-style-type: none"> •Computational complexity involved in edge detection •Existence of false zero crossings when measuring edges
Gabor Edge Detector	<ul style="list-style-type: none"> •Accuracy of in locating edges •Involving 	<ul style="list-style-type: none"> •Less responsive to variations of gray intensity levels when detecting edges of

	pixels	and corners
		<ul style="list-style-type: none"> • DC component exists
Log-Gabor Edge Detector	<ul style="list-style-type: none"> • Ability to detect edges along with the orientation as well •Built with fixed features for every direction 	<ul style="list-style-type: none"> •Considers existing edges as well when performing detection •Responsive to noise existence

B. Factor Influencing OCR Technology

The accuracy of OCR systems is, in practice, directly dependent upon the quality of the input documents. The main difficulties encountered in different documents may be classified as follows [8]

Table 2. Factor Influencing OCR

Factors influencing OCR	Recommended actions for historic newspaper projects
Quality of original source	Use original hard copies if budget allows (digitization costs will be considerably higher than for using microfilm).
Bit depth of image.	Scan the image as grayscale or bi-tonal.
Image optimization/ binarization process	Image optimization for OCR to increase contrast and density needs to be carried out prior to OCR either in the scanning software or a customized program. If the images are grayscale, convert them to image optimized bi-tonal (binarisation).
Quality of source (density of microfilm).	<ul style="list-style-type: none"> Obtain best source quality. Check density of microfilm before scanning.
Skewed pages	De-skew pages in the image pre-processing step so that word lines are horizontal.

These imperfections may affect and cause problems in different parts of the recognition process of an OCR-system, resulting in rejections or misclassifications.

III. Literature Survey

As per the previous research Vehicle Number Plate recognition conveys a critical part in various applications for instance activity observing on expressway, programmed toll expense, parking garages get to control, recognizable proof of ravaged vehicles and so forth. It was first utilized in 1976 in United Kingdom at a police headquarters. Model frameworks were presented in 1979 and contracts were gave leading business frameworks. This type of modern secured technology is now used in various restricted areas, such as parliament house, military area, Supreme Court and so on [9].

Swapnil et al.[6] discussed the complete methodology to implement character recognition, it has been observed that template matching a feature extraction method when applied with ANN (artificial neural network) i.e. the back propagation despite of low convergence rate of back propagation and pattern dependency offer several advantages in pattern recognition rate, we observed that feature extraction is probably the single most important factor for gaining high accuracy.

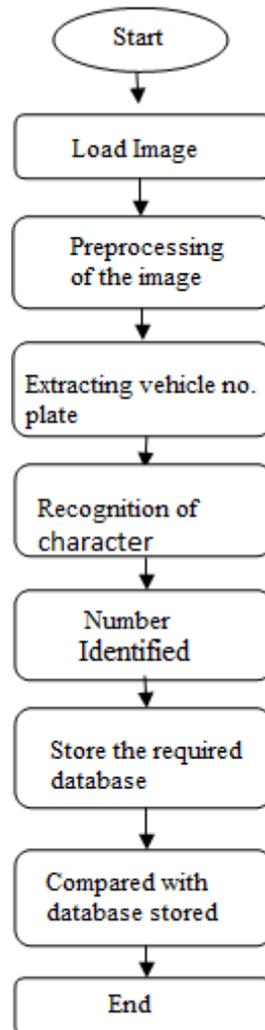
Lubna et al.[7], presented a comparison of different edge detection filters. Pre-acquired images of number plates were used as inputs. Pre-processing involved combinations of thresholding and noise removal. Segmented characters were matched with the database characters using template matching method for recognition of plate characters.

In this paper we use the OCR technology to recognize the characters or numbers form the number plate. As we discussed in previous section that the OCR technology used major five steps for the character recognition i.e. pre-processing, segmentation ,feature extraction, classification and post- processing.

The pre-processing stage takes raw images and then applied thresholding, binarisation and noise reduction process on it. The segmentation stage takes in a picture and isolates the diverse parts of a picture, similar to content from designs, lines of a passage, and characters of a word[10].

The significant phases of OCR innovation are highlight extraction, characterization and acknowledgment. The element extraction organize is utilized to extricate the most significant data from the content picture which causes us to perceive the characters in the content. The determination of a steady and delegate set of highlights is the core of example acknowledgment framework plan. The grouping stage utilizes the highlights extricated in the past stage to recognize the content portion as indicated by preset principles. The post-preparing stage is utilized to additionally enhance acknowledgment.

In this paper we will utilized the element extraction method to perceive the numbers frame the number plates. OCR apparatuses recovered the content from the pictures by applying highlight extraction system. In our method we will use canny edge algorithm to extract the numbers from the character set by using the edges of the images.



The proposed model for the automatic vehicle number plate recognition is demonstrated using figure 3. The proposed system is developed with the different components that help to recognize the characters efficiently. Initially as input of the system 10 digit number plate image is produced. This image is segmented in 10 parts vertically. These parts of image are preserved in a separate database. After this step each character is extracted from the database and their edge feature is computed. For computing the edge feature the data canny edge detection technique is applied on image. On the other hand a database with the character set is prepared that contains the 0-9 and A-Z characters. In further the data is processed using the similar edge detection technique. Finally the SVM classifier is used to train over these character patterns. Additionally the trained SVM is used to predict the characters of the input

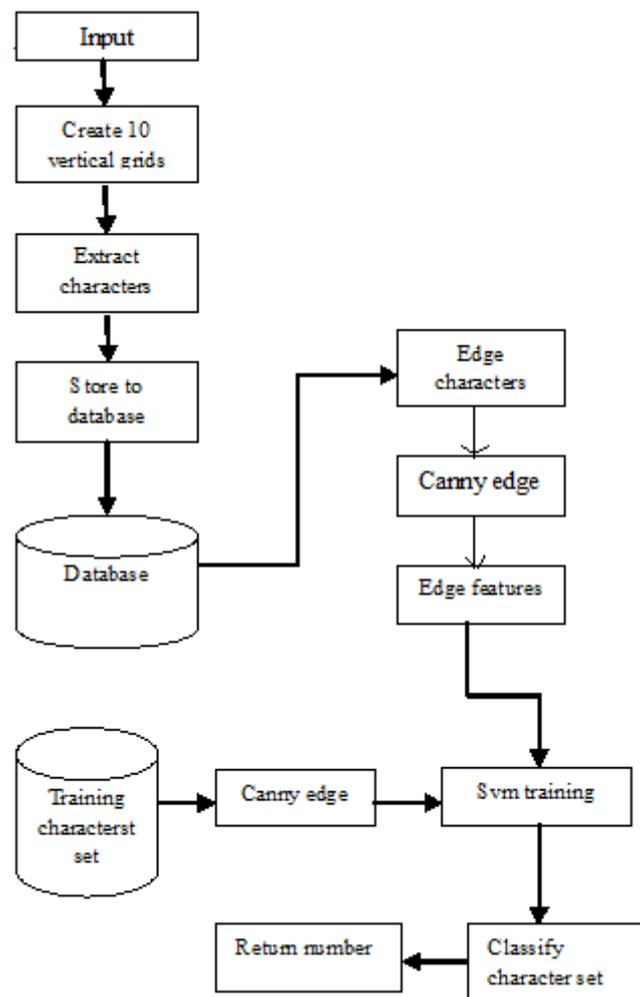


Figure 3 proposed model

image. During this process of recognition the performance of the system is also computed and used for further results analysis. This paper provides the basic overview of the proposed data model which is implemented further and their performance outcomes are demonstrated.

V. Conclusion And Future Work

This paper presents an effective technique for ANPR. This technique will work in various scenarios like color, type and size. In our method we will use feature extraction method rather than template matching method, because template matching requires an accurate pattern for matching the template. The proposed model will developed using MATLAB. We can use SVM for training the datasets. In addition, the segmented images will be used. The method is so competent that it doesn't matter whether the vehicle is in stationary or running at a high speed. The presented technique can be used in cosmopolitan area, toll booth and any protected parking lot etc.

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