

Survey: On Vehicle Number Plates Detection Techniques

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Abstract – In recent years, traffic congestion and vehicle stolen has become a significant problem. To avoid this and to provide safety also, vehicle number plate recognition is the most important and challenging area because the number plates are different in shapes and sizes and also have different color in different countries. In India, the most common vehicle number plates used are yellow or white as background and black used as foreground color. Not only considering the safety aspect, this system can be applied to monitor road traffic such as the speed of vehicle and identification of the vehicle's owner. This system is designed to support the authorities in identifying the stolen vehicle not only for car but motorcycle as well. In this paper, we study different techniques to track the number plate mainly which is necessary for vehicle identification to catch the stolen vehicle. Also it will helpful in other application areas and we can find out advantages, disadvantages and accuracy of these techniques.

Keywords – Traffic Congestion, Number Plate Detection, Character Segmentation, Character Detection.

I. INTRODUCTION

Nowadays vehicles play a very important role in transportation. Also the use of vehicles has been increasing because of population growth and human needs in recent years. Therefore, control of vehicles is becoming a big problem and much more difficult to solve.[11] Automatic recognition of license plate is very important because cars are increasing in number and it is very difficult to manage and monitor manually. Due to the increasing number of stolen vehicles, detection of traffic rule violation from year to year and to guide authorities, researchers had introduced various methods to detect the character and number in plate number of different types of vehicles. Automatic vehicle number plate recognition (ANPR) was invented in 1976 at the Police Scientific Development (PSD) Branch in UK for safety, security and to track stolen vehicle. The prototype was already implemented in 1979. It was commonly used in parking lot areas and road traffic monitoring system [4]. The vehicle owner identification becomes very necessary to track the user who violates the rules of traffic or driving too fast in more populated area. And with the manual traffic control process, it is not possible to track vehicle owners those breaks traffic rules and punish them. Thus to automate this process, we need to have some computerized system so that it is possible to catch the current activities and to locate the license plate number using different processing techniques. Every country has one unique number is allocated to each vehicle for the identification of that vehicle and its owner. The systems like ANPR was playing very important role in real life applications such as

parking payment management, traffic controlling system, catching the vehicle which breaks the traffic rules, stolen cars etc. [1].

ANPR algorithms are generally divided in 4 steps: (1) Vehicle image capture (2) Number plate detection (3) Character segmentation and (4) Character recognition.

As it is shown in Fig.1.1, the first step to capture image of moving vehicle looks very easy but it is a difficult task as it is very difficult to capture image of moving vehicle in real time in a manner such that no one of the component of vehicle especially the vehicle number plate should be missed. Presently number plate detection and its recognition processing time are less than 50 ms [4] in many systems. The success of fourth step depends on how many second and third step is able to locate vehicle number plate and separate each character. These systems follow number of different approaches to locate vehicle number plate from vehicle [2].

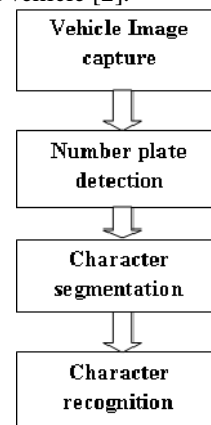


Figure 1.1. Conventional ANPR system [2]

II. REQUIREMENTS FOR IDENTIFYING LICENSE PLATE

There are 7 primary algorithms that the software requires for identifying a license plate:

1. Plate localization – It is used for finding and isolating the number plate on the captured picture.
2. Plate orientation and sizing – It compensates for the skew of the plate and also it adjusts the dimensions to the required size.
3. Normalization – It adjusted the brightness and contrast of the plate image.
4. Character segmentation – It finds the individual characters on the plates.
5. Optical character recognition.
6. Syntactical/Geometrical analysis – It check characters and positions according to rules specified by country.

The averaging of the recognized value over multiple fields/images to produce a more reliable or confident result. Especially since any image can contain a reflected light flare, be partially obscured or other temporary effect.

Difficulties

There were many difficulties that the software must be able to cope with. These include:

- Poor file resolution, if the plate is too far away but or because of the use of a low-quality camera.
- Blurry images, particularly due to motion blur.
- Poor lighting and low contrast due to overexposure, reflection or shadows.
- An object obscuring (part of) the plate, due to a tow bar, or dirt on the number plate.
- A different font sizes, shapes, figures popular for vanity plates (some countries do not allow such plates for eliminating the problem).
- Circumvention techniques.
- No coordination between countries or states.

Two cars from different countries or states have the same number but different design on the plate.

Some of these problems are corrected within the software, that's why the hardware side of the system is used to work out solutions to these difficulties. Height of the camera is increase to solve problems with objects such as other vehicles, obscuring the plate but it increases other problems, such as the adjusting for the increased skew of the plate.

III. NUMBER PLATE DETECTION

There are various number plate detection algorithms that are fall in more than one category based on different detection techniques. For detecting vehicle number plate following important factors must be considered:

- Size of Plate: a plate can be of different size in a vehicle image.
- Location of plate: a plate can be located anywhere in the vehicle.
- Background of plate: A plate can have different background colors based on vehicle type. For e.g. Vehicle number plate for government have different background color than other public vehicles number plates.
- Screw: A plate may have screw for fitting number plates on vehicle and that could be considered as a character.

3.1. Different Techniques for Number Plate Detection are

1. Image segmentation method.
2. Optical Character Recognition (OCR).
3. Radial Basis Function (RBF).
4. Probabilistic Neural Network (PNN) and Fuzzy system.
5. Morphological Edge Detection and Template Matching.

However, OCR was more preferable by researchers due to its high accuracy compared to other techniques [4].

3.1. Image Segmentation Method

In this method, a number plate is extracted by using image segmentation method. There are various image segmentation methods available in different literatures [2]. Image segmentation is broadly be categorized as semi-interactive approach and fully automatic approach and the algorithms developed lies in any of these approaches. Image segmentation is a crucial step as it directly influences the overall success to understand the image. Image segmentation is a processing technique used for analyzing the image and it can be defined as a processing technique which is used to classify or cluster an image into several disjoint parts by grouping the number of pixels to form a region of homogeneity based on the pixel characteristics like gray level, color, texture, intensity and other features. The main purpose of the segmentation process is to get more information in the region of interest in an image which helps in annotation of the object scene. Image segmentation aims at domain-independent partition of the image into a set of visually distinct and homogeneous regions with respect to certain properties. The main goal of segmentation is to clearly differentiate the object and the background in an image [3].

3.2. OCR

OCR is the acronym for Optical Character Recognition. In case of human beings, our eyes are optical mechanism. [10] Optical Character Recognition (OCR) is mainly used technology for converting scanned images of printed text or handwritten text characters into machine encoded text information such as ASCII code. It recognizes printed and handwritten characters but the performance is directly dependent from the quality of input documents. This conversion using OCR is performed offline [5].

3.3. Radial Basis Function (RBF)

Radial Basis Function (RBF) uses Neural Network (NN) which allows viewing a design as a curve fitting problem. The basic form of RBF NN comprises of three layers: an input layer of source nodes are connected to the environment, a hidden layer and an output layer with linear nodes (Wang, 2009). Hidden layers nodes represent clusters in the input space. Hidden units are known as radial centers and they are used for representing the same vector as that of input units. If the input units are closed to the radial centers then the output would be maximum and vice versa. The output layer gives the response of the NN.

The main advantage of RBFs over binary features is that, it creates approximate functions which smoothly vary and they are distinguishable. Moreover, some learning techniques for RBF NN modify the centers and widths of the characteristic. These nonlinear methods may more easily fit into the target function. The transformation from input space to hidden layer is nonlinear while from hidden to outer layer is linear. Thus, RBF NN is a mapping function which is used for mapping from non-linearly separable space to linearly separable space. Due to these benefits RBF was used not only for recognition but also for detection purposes [6].

3.4. Morphological Edge Detection and Template Matching

It is a correlation based character recognition system which provides result with significant accuracy and it is very simple to implement. This type of system is tested on MATLAB environment which provides satisfactory results. But most of the time the input image is taken from low-resolution mobile camera which does not have very good quality image output. If better device is given its results can be increased with significant accuracy [7].

3.5. Number Plate Extraction from Vehicles Image under Image Processing

This is an efficient approach which is mainly used for the extraction of number plate from the vehicle image based on morphological operations (opening, closing, dilation, and erosion), image subtraction, thresholding, sobel edge detection and the connected component analysis. Firstly the input image is preprocessed by iterative bilateral filter and adaptive histogram equalization [8].

In this technique, firstly the car image is captured. Then, it extracts the number plate of the car alone for the segmentation of character purpose. This plate localization algorithm is based on combining morphological operations which is sensitive to specific shapes in the input image with a good threshold value by which the license plate is located. Components of algorithms that adjust for the angular skew of the license plate image is accurately sample, correct, and proportionally recalculate to an optimal size. The recognized image will be converted in binary format. After this processing it is further used for template matching approach [9].

IV. CONCLUSION

According to survey, crimes reported in Delhi, motor vehicle thefts constitute almost one-fifth of the total IPC (Indian Penal Code). An average of 80 vehicles is stolen from the capital daily. This year, the count of stolen vehicles already crossed 16,000 in the first seven months. Last year, this figure stood at 23,000.

The crime, police say, is getting more organized every day and around half-a-dozen gangs are on the prowl in different areas every night. Within 2-3 hours, vehicles reach workshops in UP and Haryana dens where they are reduced to scrap in less than an hour. The chances of recovery is extremely less unless the cars are being used in committing other crime and aren't taken apart.

Out of the 80 vehicles going missing daily, around 20 are cars and 45 bikes, police data suggests. According to a rough estimate, police are able to recover only eight of the 80 stolen vehicles. A total of 22,223 vehicles were stolen last year and a break-up reveals that 6,019 were cars and 15,237 were bikes. Around 994 were other vehicles including commercial tempos. The number of stolen vehicles in 2013 was 26,330. It was 24,231 in 2012 and 26,729 in 2011. So to reduce stolen vehicle as well as for the other applications, number plates detection are very important.

In this paper, we presented different techniques used for a detecting the position of vehicles and the localization of their numbers plates. Image segmentation is broadly categorized as semi-interactive approach and fully automatic approach and the algorithms developed lies in either of this approaches. The main goal of segmentation is to clearly differentiate the object and the background in an image. Optical Character Recognition (OCR) is widely used technology which is used for converting scanned images of printed text or handwritten text characters into machine encoded text information such as ASCII. Radial Basis Function (RBF) is an approach of Neural Network. In Morphological Edge Detection and Template Matching, a correlation based character recognition system provides result with significant accuracy, which is very simple to implement.

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