

Vehicle Number Plate Detection & Recognition of Characters in ANPR

Nitesh Shukla¹ Divyanshu Rao²

^{1,2}Department of Electronics & Communication Engineering

^{1,2}Shri Ram Institute of Technology, Jabalpur, MP, Pin- 482001, India

Abstract— This is the age of “digital India”. In modern India the technologies play an important role in the race of globalization. I would like to participate in this race as an Indian, so that I have decided to introduce my research in the field of Indian security. The main goal of my research is to provide secure and efficient way for the traffic police to recognize the number plate of a vehicle on the spot in field of either an accident or the crime. Presently the vehicle number is captured by the image camera and the image is transmitted to the traffic police central office. It requires more bandwidth to carry the poor image and more power. I want to make an idea by which the information of the owner of the vehicle is directly transmitted to the traffic police central office. This would be an automatic system which can help to reduce the man power and the faster information way to avoid more crimes or to catch the criminals. It also helps to find out the stolen vehicles. I want to use some techniques for better resolution for the poor image of the number plate and the faster and efficient way to transmit this data to the traffic police central office.

Key words: Resolution, Digital Systems, Bandwidth

I. INTRODUCTION

There are many global feature extraction technique used in image analysis, computer vision, and digital image processing. The main purpose of the technique is to find the primary lines of objects within a certain class of shapes. Firstly I will introduce a method for reorganization the numbers drawn on the number plate then I will test it on Indian license plate system, having font of UK standard and UK standard 3D, which has ten slots for characters and numbers. Surveillance cameras aren't just the bane of hard core civil libertarians. The idea of submitting to constant monitoring feels wrong to most of us. Cameras in the sky are the ultimate manifestation of Big Brother a way for the government to watch you all the time, everywhere. In addition to normalizing surveillance turning every public place into a venue for criminal investigation, there's also the potential for abuse. Once a city is routinely shrivelled, the government can turn every indiscretion into a criminal matter. You used to be able to speed down the street when you were in a hurry.

II. IMAGE DETECTION & RECOGNITION

An input image taken is cropped and the significant blocks of information in the number plate are thus obtained. This image is then fed to a transform mechanism which will be able to extract the information related to the owner. Now this information is used for the recognition purposes. The vehicle is moving via the areas, all are identifying. It gives us the information that the vehicle is coming from which area and going towards which area.

III. AUTOMATIC NUMBER PLATE RECOGNITION

Automatic number plate recognition (ANPR) is a mass surveillance method that uses character recognition on images to read vehicle registration plates [1]. They can use existing closed-circuit television or road rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces and as a method of electronic toll collection on pay per use roads and cataloguing the movements of traffic or individuals and also for traffic law enforcement. ANPR can be used to store the images captured by the cameras as well as the text from the license plate. ANPR technology tends to be region specific, owing to plate variation from place to place. Concerns about these systems have centred on privacy fears of government tracking citizens' movements, mis-identification, high error rates, and increased government spending.

A. Constraints

The variations of the plate types or environments cause challenges in the detection and recognition of license plates [3]. They are summarized as follows.

1) Plate Variations

- Location
Plates exist in different locations of an image;
- Quantity
An image may contain no or many plates;
- Size
Plates may have different sizes due to the camera distance and the zoom factor;
- Colour
Plates may have various characters and background color due to different plate types or capturing devices;
- Font
Plates of different nations may be written in different fonts and language;
- Standard versus vanity
For example, the standard license plate in Alberta, Canada, has three and recently (in 2010) four letters to the left and three numbers to the right.
- Occlusion
Plates may be obscured by dirt;
- Inclination
Plates may be tilted;
- Other
In addition to characters, a plate may contain frames and screws.

2) Environment Variations

a) Illumination

Input images may have different types of illumination, mainly due to environmental lighting and vehicle headlights;

b) Background

The image background may contain patterns similar to plates, such as numbers stamped on a vehicle, bumper with vertical patterns, and textured floors.

IV. PROPOSED WORK

ANPR systems are generally deployed in one of two basic approaches: one allows for the entire process to be performed at the lane location in real-time, and the other transmits all the images from many lanes to a remote computer location and performs the recognition process.

When done at the lane site, the information captured of the plate alphanumeric, date-time, lane identification, and any other information required is completed in roughly milliseconds. This information can easily be transmitted to a remote computer for further processing if necessary, or stored at the lane for later retrieval. In the other arrangement, there are typically large numbers of PCs used in a server farm to handle high workloads. Often in such systems, there is a requirement to forward images to the remote server, and this can require larger bandwidth transmission media.

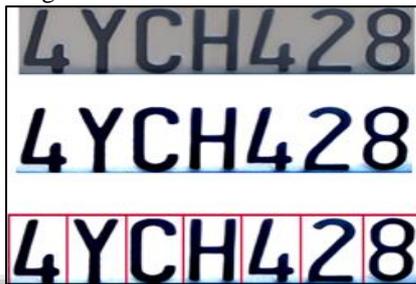


Fig. 1: Acquisition, Filtering & Segmentation of Plate

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

- 1) Plate localization – responsible for finding and isolating the plate on the picture.
- 2) Plate orientation and sizing – compensates for the skew of the plate and adjusts the dimensions to the required size.
- 3) Normalization – adjusts the brightness and contrast of the image.
- 4) Character segmentation – finds the individual characters on the plates.
- 5) Character recognition.
- 6) Syntactical / Geometrical analysis – check characters and positions against country-specific rules.

V. PROPOSED METHODOLOGY

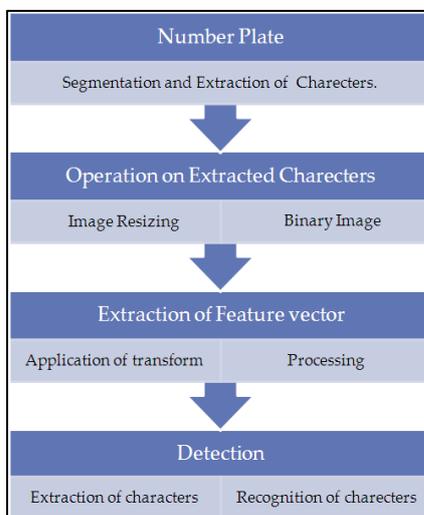


Fig. 2: Proposed Detection Algorithm

The proposed technique hereby uses image cropping and image resizing on the original input RGB image and thus, obtaining the significant blocks of the input image needed for detection. As instead of whole image, significant blocks are used, the database management becomes compact and the technique becomes flexible, until same fonts are used. Further, conversion of these RGB sub images to binary images is done and then is fed to the algorithm to give the information.

A. Acquisition of License Plates Images

Since the quality of detection result dominantly depend on the quality of the acquisition process, the choice of acquisition system must be done carefully. Normally image acquisition by means of 2D sensors needs image processing technique. In our experimental work, online facility of generation of any license plate of standard font and size is used. The font used is standard UK, with actual plate size of 520mm X 111mm (20.5 in X 4.375 in). The size of the image used is 2018 X 503 pixels.



(a)



(b)

Fig. 3: Indian License Plates (a) Standard UK font (b) standard UK 3D font

B. Extraction of Characters by Segmentation

The input License plate according to the Indian convention has 10 slots to convey the information regarding the details of the registration [2]. The current format of the registration index consists of 3 parts. They are-

- The first two letters indicate the state to which the vehicle is registered.
- The next two digit numbers are the sequential number of a district. Due to heavy volume of vehicle registration, the numbers were given to the RTO offices of registration as well.
- The third part is a 4 digit number unique to each plate. A letter(s) is prefixed when the 4 digit number runs out and then two letters and so on.

The input image is a RGB image, with ten slots for the character and alphanumeric characters. Now the input image is then cropped to get these characters and numbers which are considered to be significant blocks of the image. The format of the characters and numbers used in license plate are standard UK format, database is maintained accordingly. Since the proposed method is basically feature dependent, same database for different font is not acceptable, hence for other formats the database should be upgraded accordingly.

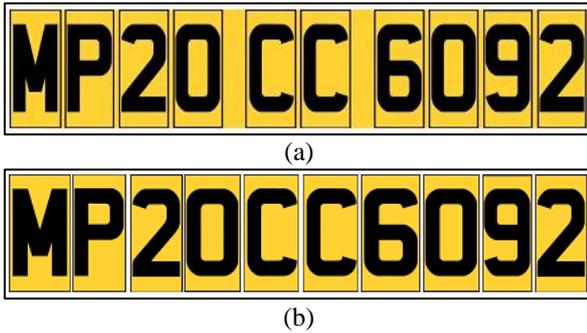


Fig. 4: Segmented & Cropped Images

C. Image Resizing & Binary Conversion

Image scaling is the process of resizing a digital image. Finally, the cropped images were resized to 250 X 250 and further converted to monochrome bitmap format to obtain the bit depth of “1”. The resized and binary images are show in figure. The binary image of the localized number plate contains the character with noise and special characters. The binary image is passed through a special reorganization function that calculates the features of the binary image. This algorithm uses the fact that every character has unique set of features such as corners, ending and bifurcations. Inheriting these features makes the algorithm fast and less complicated. The input character is converted to edge image and the features are extracted from it in iterative process. These features are then stored in the feature vector with the number, direction and state of the features.

ALPHABET	TRIANGLE	SQUARE	CORNER	PORE	END	POSITION OF ENDS
0	0	0	0	1	0	0
1	1	0	1	0	3	LEFT, LEFT, RIGHT
2	0	0	1	0	2	LEFT, RIGHT
3	1	0	0	0	3	LEFT, LEFT, LEFT
4	0	1	2	1	2	RIGHT, BOTTOM
5	0	0	2	0	2	LEFT, RIGHT
6	0	0	0	1	1	RIGHT
7	0	0	1	0	2	LEFT, BOTTOM
8	0	1	0	2	0	0
9	0	0	0	1	1	LEFT
A	2	0	1	1	2	BOTTOM, BOTTOM
B	2	0	2	2	0	0
C	0	0	0	0	2	RIGHT, RIGHT
D	0	0	2	1	0	0
E	1	0	2	0	3	RIGHT, RIGHT, RIGHT
F	1	0	1	0	3	RIGHT, RIGHT, BOTTOM
G	0	0	2	0	2	LEFT, RIGHT, BOTTOM
H	2	0	0	0	4	TOP, TOP, BOTTOM, BOTTOM
I	2	0	0	0	4	LEFT, LEFT, RIGHT, RIGHT
J	0	0	1	0	2	LEFT, LEFT
K	0	1	0	0	4	TOP, TOP, BOTTOM, BOTTOM
L	0	0	1	0	2	TOP, RIGHT
M	0	0	3	0	2	BOTTOM, BOTTOM
N	0	0	2	0	2	TOP, BOTTOM
O	0	0	0	1	0	0
P	1	0	1	1	1	BOTTOM
Q	1	0	0	1	1	BOTTOM
R	2	0	1	1	2	BOTTOM, BOTTOM
S	0	0	0	0	2	LEFT, RIGHT
T	1	0	0	0	3	LEFT, RIGHT, BOTTOM
U	0	0	0	0	2	TOP, TOP
V	0	0	1	0	2	TOP, TOP
W	0	0	3	0	2	TOP, TOP
X	0	1	0	0	4	TOP, TOP, BOTTOM, BOTTOM
Y	1	0	0	0	3	TOP, TOP, BOTTOM
Z	0	0	2	0	2	LEFT, RIGHT

Table 1: Recognition of Alphabets or Numeric Digits from Image



Fig. 5: Resized & Converted Binary Image

VI. CONCLUSIONS & FUTURE WORKS

In this work, existing methodologies and algorithms proposed in literature for Vehicle Number Plate recognition were reviewed. Due to the requirement of bandwidth for ANPR system, it is my endeavor to customize an ANPR system for future applications. Template matching will be conducted automatically in the police central office accurately and with fast rate. The result of localization gave accuracy of 96.7% whereas the character recognition technique 92.2% accuracy given in IEEE paper by Bhavin V Kakani. This accuracy can be improved greatly by the proposed method. In the near future I will use some effective coding method rather than ASCII code to provide more security and less memory space.

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