



A Feature Based Approach for Number Plate Recognition of Indian Vehicles

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Abstract : The feature-based method for Indian car number plate recognition is presented in this study. The number plate formats are not rigorously adhered to in our nation. The characters and letters on the number plate are shown in a variety of typefaces, styles, and occasionally even languages. It is particularly challenging to distinguish the number plates on Indian automobiles because of these disparate representations of the plates, in addition to noisy and poor quality photographs taken in different lighting and weather situations. The three stages of number plate recognition are character recognition, character segmentation, and number plate localization. Based on a few distinguishing characteristics of the number plate The number plate of vehicles are localized and that is done using canny filter, morphological operation, horizontal and vertical projection analysis. Connected component analysis is used to segment the characters. We must introduce a novel feature-based method for character recognition that is based on certain distinctive character and number features.

IndexTerms - Number plate localization, canny filter, morphological operation, Character segmentation and Character recognition.

I. INTRODUCTION

A car's unique identifier is its number plate. By automatically reading car license plates, automatic number plate identification uses image processing and character recognition technologies to identify automobiles.

Advanced machine vision technology called automatic number plate recognition is utilized to identify cars by their number plates without the need for direct human intervention. One of the most significant uses of computer techniques in intelligent transportation systems (ITS) is automatic number plate recognition.

Because of its numerous uses, including border and custom security, parking management systems, highway toll collection, surveillance systems, security control of restricted areas, and traffic law enforcement, this field of study is crucial.

Around the world, there are differences in the complexity of automatic number plate recognition systems. It is simpler to localize and recognize the character on a standard number plate. Because there are differences in how the number plate is represented, the ANPR system in India is very challenging.

The primary objective of this study is to develop an effective technique for identifying license plates in Indian conditions. This is because license plates in Indian vehicles are standardized differently and contain additional information such as the owner's name, symbols, scripting language, and design. High recognition speed and accuracy are the fundamental problems in number plate recognition.

It is very challenging to locate the license plate accurately and efficiently due to a number of issues, including poor image quality, shadows on images, noisy images, other disturbance characters or reflections on vehicle surfaces, and color similarity between the number plate and background vehicle body.

The Automatic number plate recognition system is mainly classified in three categories, number plate localization, character segmentation and character recognition. The work flow of Automatic number plate recognition system is shown in figure (1).

Due to the small amount of the vehicle image that is occupied by the number plate area and the presence of numerous superfluous objects, number plate localization is an extremely challenging task.

II. IMAGE ACQUISITION AND PREPROCESSING

A high-resolution digital camera is utilized in this system to take pictures. Different backdrops, lighting settings, and camera-to-vehicle distances are used to capture images. resulting in an extremely low quality image being acquired. Enhance the image quality first by performing preprocessing.

Step 1: A grayscale image is used for every preprocessing step. Using the NTSC standard formula (1), the system will first transform input RGB images into gray level images.

$$\text{Gray} = 0.299 * \text{Red} + 0.587 * \text{Green} + 0.114 * \text{Blue} \quad (1)$$

Step 2: In this stage, binary images are created from grayscale photos.

Step 3: It is quite difficult to distinguish the number plate of Indian vehicles due to noisy and low quality photographs shot under different lighting and weather situations. Therefore, we must lower the image's noise and increase the pictures' contrast in this phase. Histogram equalization is used to improve photographs, while the median filter is used to eliminate noise.

Step 4: At this point, the extraneous objects are eliminated from the pictures using the morphological operation.

Step 5: Next, utilize the canny edge detection algorithm to identify the edges in the binary image displayed in Figure -2(c).

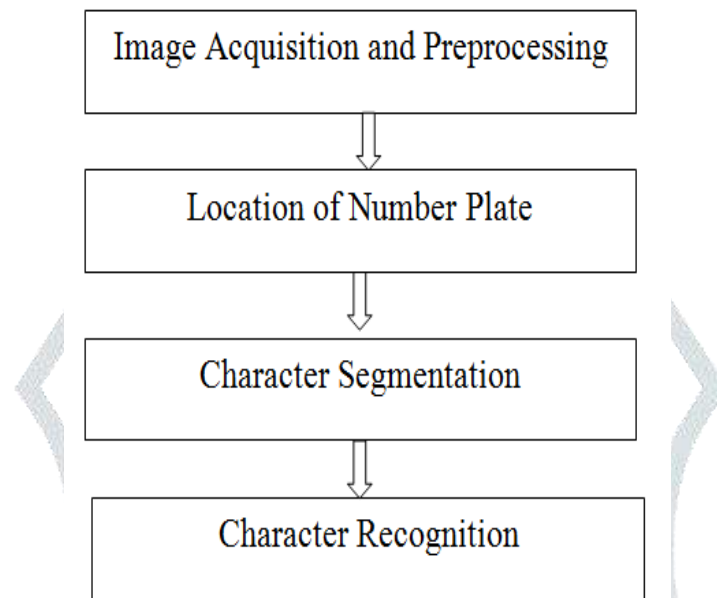


Figure-1 : Automatic Number Plate Recognition System Work flow

NUMBER PLATE LOCALIZATION

The crucial stage in the ANPR system is number plate localization, which has a big impact on the system's accuracy.

Given an input image, the objective of this phase is to generate several candidate regions that have a high likelihood of containing a number plate and verify that the regions contain a real number plate.

The letter and number are arranged in the same row, causing numerous variations in the horizontal intensity. As a result, determine in the first step how the horizontal intensity for each row changes from 1 to 0 and 0 to 1. Locate the region where the horizontal intensity varies the most in the second step. The black character on the white background creates the strongest transition at the letters [1][10].



(a)

(b)

(c)

Figure-2 : (a) Gray scale image (b) Binary image (c) Canny edge detection

Thus, we can conclude that the area where the number plate is located has the greatest changes in horizontal intensity.

Determine which row has the greatest changes, or amplitude. After that, scan the pictures from that reference line both up and down. And so on, until the initial local minimums are reached on both the upward and downward sides. The top and bottom lines on the number plate are these two lines. We must horizontally crop the image on the bases of the top and bottom boundaries; this is known as the candidate number plate area. A few instances are displayed in figure 3(a).



Figure-3: (a) Candidate number plate area (b) Canny edge detection (c) Original number plate

Once the candidate number plate area has been identified once more, we must use the clever edge detection algorithm to extract the edges from the horizontal crop images, as illustrated in figure 3(b). After that, photos are scanned vertically to determine how each column's values changed from 1 to 0 and 0 to 1. The column containing the character and letter with the largest vertical intensity

changes. Determine which column experiences the largest variations in vertical intensity. As a result, we must continuously scan the image from that column to the left and right until the changes stop. and determine the image's left and right boundaries. We must vertically crop the images based on the left and right boundaries. Finally, figure 3(c) shows where the original number plate is located.

CHARACTER SEGMENTATION

Every character is separated and segmented during the character segmentation phase. Given the picture of the license plate, the objective of this step is to segment every character without sacrificing any of their characteristics. The crucial stage in the ANPR system is character isolation from the number plate region, which has a big impact on character recognition accuracy.

Methods like connected component analysis and vertical projection analysis are used for the segmentation of the character number plate. Here, character segmentation is accomplished through the use of connected component analysis (CCA) [4]. A well-known method in image processing is called "connected component analysis," which involves scanning the image and classifying its pixels into components according to how connected or disconnected they are from one another. Similar pixel intensity values are shared by every pixel in a connected component. Following the determination of all the groups based on connectivity, each

pixel is labeled with the value associated with the assigned component. We must apply the CCA in our algorithm to binary images with eight connectivity scenarios.

CHARACTER RECOGNITION

Character recognition can now be done in a variety of ways [5–9][11]. While the original pixel value is used in the traditional template matching method to match, our algorithm extracts certain features from the original image to generate the vector's fix size [3][4]. In the character recognition phase, each character is identified based on a selection of salient characteristics.

The character recognition phase consists of two step

Step: 1 Character normalization

Step: 2 Feature extraction of the image

Character Normalization

First, the character image needs to have its noise removed. Images of segmented characters vary greatly in size. During this stage, every character is adjusted to a predetermined width (horizontal length) and height (vertical length) in pixels. Every character image is resized to a fixed size using normalization.

Feature Extraction of the Image

The goal of feature vector is to define distinguishing features of the characters.

The distance between the first pixel with value 1 and the left edge, as well as the distance between the last pixel with value 1 and the right edge, constitute the first type of feature. In this case, we address both the row and the column image. After that, we have the vector. It is referred to as vector A.

The second type of feature involves determining the value of a pixel in the character image that changes from 1 to 0 for each row and column. The same character appears twice with the same close number whose pixel value shifts from 1 to 0. Examples of close numbers where the pixel value changes from 1 to 0 are 8 and B, O and D, and 4 and A. This will result in an error during the recognition process. Two distinct characters can be identified by their different numbers, which cause the pixel values to shift from 1 to 0. Once we have the vector, we refer to it as vector B.

The image's third feature is obtained because the second feature is insufficient. Determining the total number of zeros (0) in the character image is the third type of feature. Vector C is the third vector, as it is known.

Here we will show some templates which have highly similarity.



Figure-4: templates images.

These three vectors can now be combined into a single vector.

Additionally, the target image's and the template image's vectors are available to us. Next, determine the Euclidean distance between the target image's vector and the template image's vector. Identify the template that has the least distance to our recognized character.



Figure-5: Target images.

CONCLUSIONS

In this paper we present the algorithm for number plate localization and the number plate recognition. On the basis of feature of number plate we present the algorithm for number plate localization that give good success rate with high accuracy and efficiently. Here we also present features based template matching method for Indian number plate recognition. Here we find out the prominent feature of segmented character image. On the basis of that feature vector we have to recognize the character and number. While the SVM approach works with numbers and characters separately, our algorithm works with both. While our

method only requires time to calculate distances, the SVM requires a large amount of time on the training set. The similar characters that our algorithm recognizes well are 8 and B, O and D, Q and O, and B and R. Our algorithm is more error-free, requires less processing time, and has a higher recognition rate when compared to the conventional method [2][11] and SVM method [2].

REFERENCES

- [1]Y. Yuan, W. Zou, Y. Zhao, X. Wang, X. Hu, N. Komodakis, A robust and efficient approach to license plate detection. *IEEE Trans. Image Process.* **26**(3), 1102–1114 (2016)
- [2]J. Shashirangana, H. Padmasiri, D. Meedeniya, C. Perera, Automated license plate recognition: a survey on methods and techniques. *IEEE Access* **9**, 11203–11225 (2020)
- [3] C. Nelson Kennady Babu, Siva Subramanian T and Kumar Parasuraman,” A Feature Based Approach for License Plate-Recognition of Indian Number Plates”, 978-1-4244-5967-4/10/\$26.00 ©2010 IEEE
- [4]M.A.H. Bakhtan, M. Abdullah, A. Abd Rahman, A review on license plate recognition system algorithms, In: 2016 International conference on information and communication technology (ICICTM) (IEEE), pp. 84–89 (2016)
- [5]T. Kumar, Vehicle license plate detection: A survey, (n.d.), **16**(10), 30–42 (2021)
- [6]J.I.Z. Chen, J.I. Zong, Automatic vehicle license plate detection using K-means clustering algorithm and CNN. *J. Electr. Eng. Automat.* **3**(1), 15–23 (2021)
- [7]Z. Selmi, M. Ben Halima, A. M. Alimi, Deep learning system for automatic license plate detection and recognition, In: *2017 14th IAPR International conference on document analysis and recognition (ICDAR) 1 (IEEE)*, Vol. 1, pp. 1132–1138 (2017)
- [8]B. Rajasekar, B. M. S. K. Roshan, B. C. Naidu and V. V. Kumar, "Automatic Number Plate Recognition Using Convolution Neural Network", pp. 381-386, 2021.
- [9]S. Yu, B. Li, Q. Zhang, C. Liu, and M. Q.-H. Meng, "A novel license plate location method based on wavelet transform and EMD analysis," *Pattern Recognition*, vol. 48, no. 1, pp. 114–125, 2015.
- [10]A. M. Al-Ghaili, S. Mashohor, A. R. Ramli, and A. Ismail, "Vertical-edge-based car-license-plate detection method," *IEEE Transactions on Vehicular Technology*, vol. 62, no. 1, pp. 26–38, 2013.
- [11]R. Antar, S. Alghamdi, J. Alotaibi, M. Alghamdi, Automatic number plate recognition of Saudi license car plates. *Eng., Technol. Appl. Sci. Res.* **12**(2), 8266–8272 (2022)