Character Recognition of High Security Number Plates Using Morphological Operator

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Abstract— Character recognition techniques associate a symbolic identity with the image of character. Character recognition software recognizes text characters in electronic files, usually scanned documents that are saved as images and are not immediately text-searchable. Character recognition software is also known as optical character recognition or OCR, because it uses to optical properties of text to identify the characters and it deals with the recognition of optically processed characters. In this paper, a smart, simple and efficient algorithm is presented, which is mainly designed to identify the region from High Security Number Plates. It is used to identify three regions from vehicle number plates i.e. "Punjab", "Chandigarh", and "Haryana". The proposed algorithm consists of three major parts: Extraction of image, segmentation of characters and the recognition of characters from vehicle number plate. For recognition of characters three features of characters: holes, junction and end points are used. The recognition is based on the number and position of these features.

Keywords - Morphological Operators, Thinning, Binary Images, Character Recognition, Segmentation.

I. INTRODUCTION

Every country uses specific vehicle identification system for the control of traffic, traffic surveillance, monitoring against illegal activities, security control of restricted areas, traffic law enforcements, toll collection and parking management etc and as such India also has its own system of assigning unique numbers to vehicles. These unique numbers plates are assigned to the vehicles by RTO (Regional Transport Office).These plates in general are easily readable by the human beings because of very high level of intelligence but when it comes to do the same using machines, many effects such as illumination, blur, background and foreground color etc. pose a problem. Also the License plate recognition (LPR) in India is difficult in the sense that the traffic rules are hardly followed. Since number plate standards are not strictly practiced in India, a large amount of variations are obtained in parameters like, size of number plate and characters, location of number plate, type of font used (standard font is Arial Black), background (white for non commercial vehicles and yellow for commercial vehicles) and foreground color (black for commercial and non commercial vehicles), etc. which makes the task of number plate localization all the more difficult. Rani et al. [1] presented a character recognition system by using morphological operators on binary images. They stated that this recognition system is merely feature-based, with no need of a learning phase or any kind of memory. They stated that the proposed algorithm has high degree of accuracy on different type of Punjabi fonts and sizes. Pandya & Singh [2] used simple operations for localization of Indian number plates. For effective segmentation of characters, the skew correction of the number plate is done. Unwanted conditions which create problem for localization are taken in it. Nagare [3] used, still pictures of vehicles to develop license plate character recognition system. He stated that the character recognition results obtained using Learning Vector Quantization Neural Network is better than the character recognition results obtained by using Back Propagation. Kumar P & Kumar P.V. [4] designed a simple algorithm for Indian license Plate Recognition. It deals with Extraction of plate region, segmentation of characters and recognition of plate characters. They stated that the performance of the proposed algorithm has been tested on real images and satisfactory results are formed. Anishiya and Joans [5] proposed a number plate localization and recognition system for vehicles in Tamil Nadu. The proposed algorithm is based on a combination of morphological operation with area criteria tests for number plate localization. Edge detectors, labeling and fill hole approach was used for segmentation of plate recognition. The process of Template matching is used for character recognition with the aid of optical characters.

Main aim of this research paper is to implement a method efficient in recognizing the region from vehicle number plates in Indian conditions. Our work is not restricted to car but, it can also be implemented to the number plates other than cars like bikes, motor cycles.

Our algorithm is feature analysis based. As a consequence, it shows great generalization capabilities. Moreover, all needed features can be extracted by using Morphological Operators.

Morphology is the branch of biology that deals with the form and structure of animals and plants. Similarly mathematical morphology is a tool for extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons and the convex hull. In this technique we use Morphological operator's skeleton, end points and thinning of binary images.

*A. Thinning***:**

Thinning means reducing binary objects or shapes in an image to strokes that are a single pixel wide.

B. Skeletonization:

It is another process that reduce binary image object to a set of thin stroke that retain important information about the shape of the original objects.

II. FEATURE EXTRACTION

For the better generalization capability and low computational cost, we considered only three features of characters: holes, junctions and ends. The recognition is based on the number and position of these features.

A. Holes

The first feature we considered is the number of holes existing in the characters. In order to obtain an image in which every hole is represented as a point.

Subtract the filled holed image from input image and shrink it, you will get the final image.

Figure 1 Hole detection

B. Junctions

Junction is also known as branch points. It's a point where two points meet. For example

0 0 1 0 0 becomes 0 0 0 0 0
1 1 1 1 1 0 0 1 0 0
0 0 1 0 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0 0

From Input Image, it will give the Output Image.

Count the number and position of junctions in the character, just by counting the number of black pixels.

C. Ends

An endpoint is a mark of termination or completion. Every character has a number of end points which play a significant role to recognize a character.

1 0 0 0 1 0 0 0
0 1 0 0 becomes 0 0 0 0
0 0 1 0 0 0 1 0
0 0 0 0 0 0 0 0

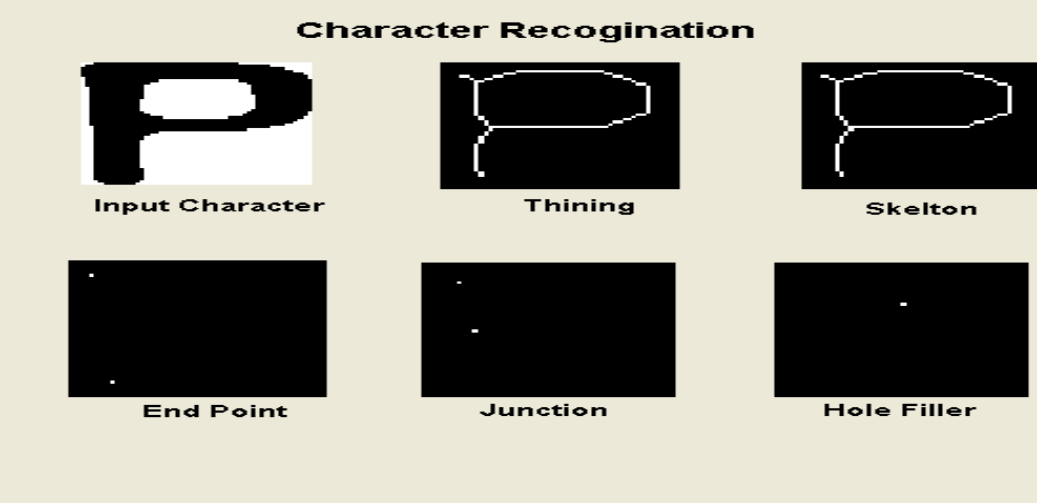

Figure 2 Morphological operations

III. CLASSIFICATION

Hole detection is done by filling the holes in input image and taking logical difference with original image and shrink it. Then after thinning of image the Skeletonization applied to the image and the result will be used for both junction detection and for ends detection. A first rough classification can be obtained just by counting the number of holes, junctions, and ends.

TABLE 1. Decision Table

English Characters	End Point	Junction	Hole
P	2	2	1
C	2	0	0
H	4	2	0

IV. PROPOSED ALGORITHM

- Firstly, already segmented gray scale image will be loaded; it is a number plate of a particular vehicle which is already segmented.
- After filtering, to extract the number from number plate. Characters will be segmented from the plate.
- The character will be recognized by taking an input character from the number plate Image.
- After recognition, the morphological operations character thinning and skeleton is applied. Then, find out the end point, junction and hole filler from the input character.
- After going through all these operation the number will be extracted from number plate and the location of a particular vehicle will be recognized. Location name can be ‘Punjab’, ‘Chandigarh’, and ‘Haryana’.
- If recognized character is ‘P’ then location will be ‘Punjab’. If recognized character is ‘H’ then location will be ‘Haryana’. If recognized character is ‘C’ then location will be ‘Chandigarh’.

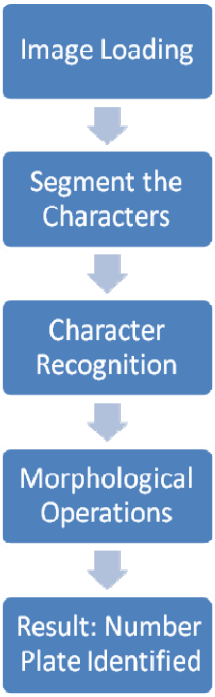

Figure 3 Steps for identifying number plates

V. EXPERIMENT AND RESULTS

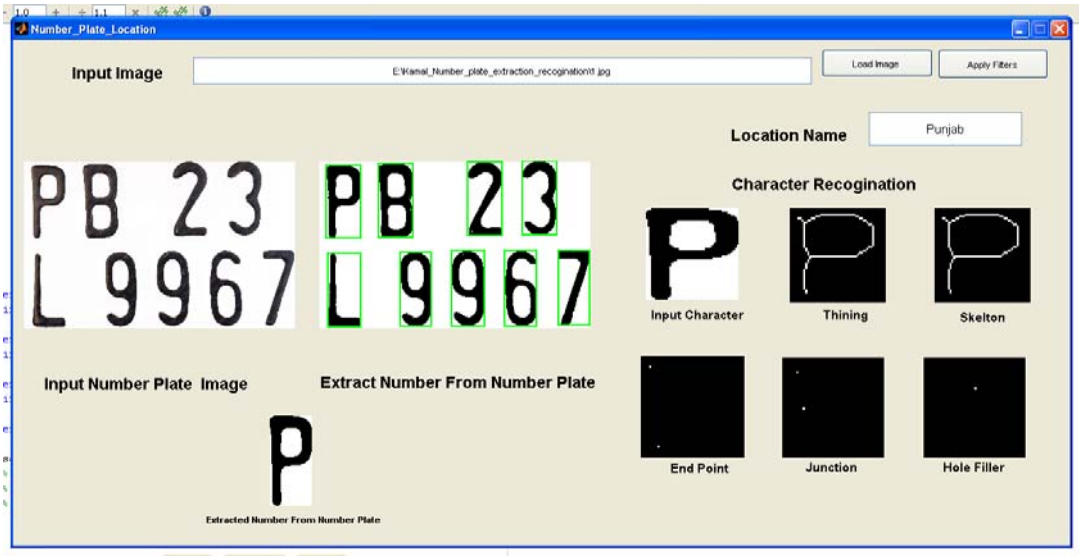

Figure 4: Application to conduct Experiment

The method has been tested by using the above algorithm for identifying the region from the high security number plates over a large number of images with JPEG format. This system has good performance. It will give the accuracy of **100%**.

VI. CONCLUSION AND FUTURE WORK

In this paper, an efficient algorithm is used to identify the region from high security number plates. A method for character recognition is developed based on the morphological operators. The proposed algorithm consists of three major parts: Extraction of image, segmentation of characters and the recognition of characters from vehicle number plate. For recognition of characters three features of characters: holes, junction and end points are used.

This method is only used to identify the region of particular vehicle by recognizing the first character from specific region. In future, it can be implemented on complete number plate and also recognize other regions from vehicle number plates other than PUNJAB, CHANDIGARH and HARYANA.

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