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Recognition of Vehicle by Number Plate by Automatic Number Plate Recognition System

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Abstract: ***Pattern recognition is a process of design a automation tool for recognizing images or Pictures. Number plate recognition is one such Problem where the vehicle can be recognized based on the unique id given to them by Transport department. The Number plate recognition is done using various algorithms. The dataset used for designing the algorithm is also a major criterion in decision making. In the present problem studied we have implemented Image segmentation tool for recognizing the tool. One such case study is Automatic Number Plate Recognition (ANPR) is an image processing technology which uses number plate to identify the vehicle. The paper presents a design for efficient automatic authorized vehicle identification system by using the vehicle number plate. The Process involves collecting the Video of the Vehicle movement. The Vehicle number plate is extracted from the Video by using Image segmentation. The Pre-processing of Optical character recognition is used for character recognition from the Image captured. The outcome is compared with the database present as records in Regional Transport Office. The Algorithm is designed using Matlab.***

Keywords: Automatic Number Plate Recognition, Optical Character Recognition, Licence Plate (LP), Binary Image, Segmentation, correlation coefficient

1. Introduction

The ANPR system has various applications in toll payments, parking management, road-traffic monitoring, security etc. Manual monitoring of vehicles is cumbersome and error prone because of weak and unreliable human memory. Thus, there is a need of robust mechanism such as ANPR to handle task efficiently. Each vehicle is uniquely identified from its number plate. An Indian number plate has ten characters - state code is a set of two alphabets followed by two digits and alphabets for district information and at last a four digit actual registration number.

Figure 1: Number plate of a vehicle registered in Bangalore RTO office

The ANPR system has three basic modules: image pre-processing, region extraction and object recognition. In pre-processing the image is loaded and converted to gray and binary. In region extraction detection of number plate is performed by segmentation of characters. In object recognition matching algorithm is done. The Template matching and retrieval of characters is performed for training set. In present work, we have implemented correlation function to comparing similarities of objects. The simulation and implementation is done by using MATLAB [1].

2. Background

2.1 Licence plate localization techniques:

Localization is a process of capturing the information from the image. Number plate localization is a difficult task as vehicle may have different Shape, Design and Pattern. The various conditions may be the plate may be embedded with noise such as dirt and so on. The variation in weather, light condition will also create difficulties/challenges. The efficiency of LP localization is dependent on all this factors. The complexity increases when the unwanted areas are displayed in images which increase the intensity values which increasing the detection rate of matching algorithm [2, 3].

There are other algorithms for number plate localization technique such as using Adaptive Threshold. This algorithm uses direction sensitive window filtering, etc. The accuracy can be increased by computation. Localization of number plate using morphological operations provides very accurate and efficient solution. The localization technique can also extract useful region shapes such as skeletons, boundaries and convex hull. Operators such as dilation and erosion can be hybridized for computation and identification of various shapes in the image [4,5].

2.2 OCR methodologies

This method uses novel OCR technique which claims 100 percent accuracy for digitized fonts. It involves partial segmentation of character using features and correlating segment set withthe ASCII characters. OCR based on matrix matching is proposed using non determined solution using fuzzy set and fuzzy equations. OCR uses low resolution character image or low quality images using structural analysis.

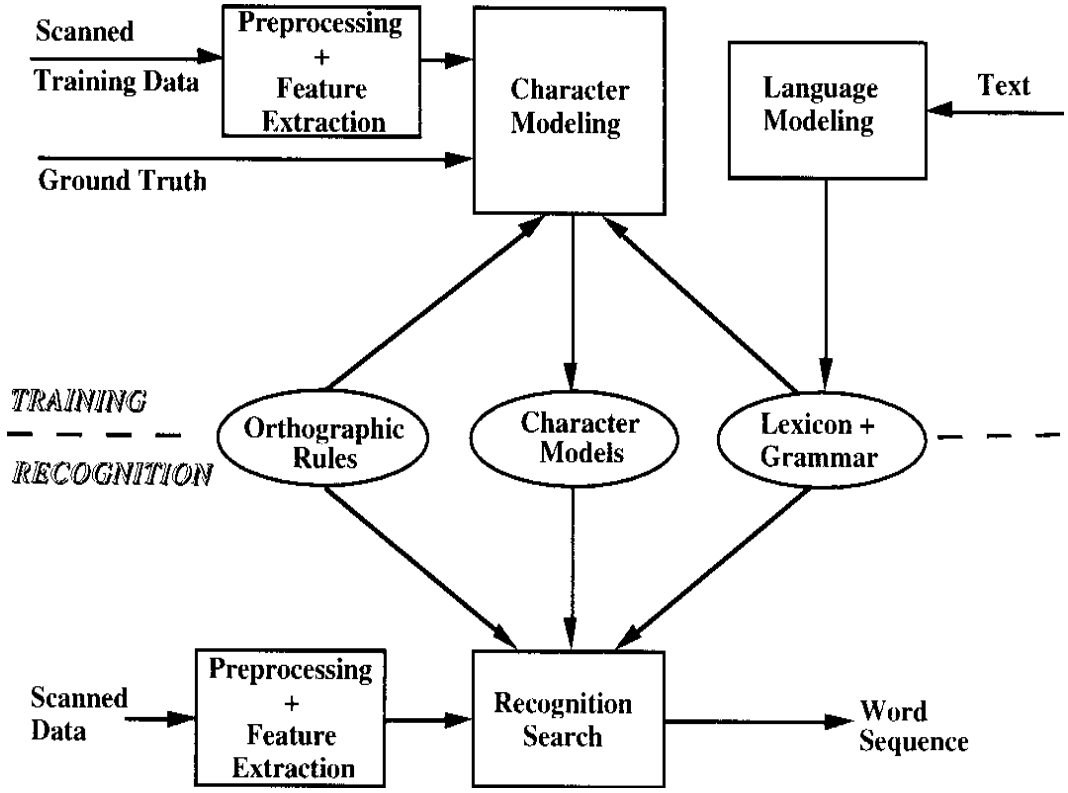

Figure 2: OCR Methodology

3. Experimentation

For better performance the image parameter namely intensity is varied. Color image is resized to 300*400 and then converted to gray image further into binary image which is 2D in nature. Optical Character Recognition takes an image of letters or typed text and converts it into data that automation can be performed.

The documents can be easily converted into editable form. OCR is widely used in the field of pattern recognition and artificial intelligence. Thus, the process is presented in next section.

3.1 Converting to Gray image.

rgb2gray: converts the true color image RGB to the grayscale image. The process eliminates the hue and saturation information while retaining the luminance. *picture=rgb2gray(picture); rgb2gray* converts the RGB values to grayscale values by forming a weighted sum of the R, G and B components. The calculations are done using following formula:

$$0.2989 * R + 0.5870 * G + 0.1140 * B$$

The RGB and Binary image of sample input.

3.2 Converting to Binary image.

imbinarize(): creates a binary image from a 2D or 3D grayscale image by replacing all values greater than threshold to a globally determined or adaptive threshold values with 1s and all other values to 0s.

To obtain the threshold values, we use a function of matlab which is *graythresh().* It computes a global threshold from gray scale using Otsu's method. Otsu's method chooses a threshold which minimizes the intraclass variance of the thresholded black and white pixels.

threshold = graythresh(picture); The global *threshold* can be used by *imbinarize* to convert garyscale image to binary image. The inverse sign will be used for changing background black and foreground white.

picture =~imbinarize(picture,threshold);

3.3 Number plate extraction

Further, the number plate is extracted by considering the intensity in pixels of the image. The matlab command which we use to perform this is *bwareaopen().* The *bwareaopen()* removes all connected components that have lesser pixels from the binary image, producing another binary image. The process is called as area opening.

picture1=bwareaopen(picture,3500); The *picture1* stores those things that have less than 3500 pixels that is removed excluding number plate.

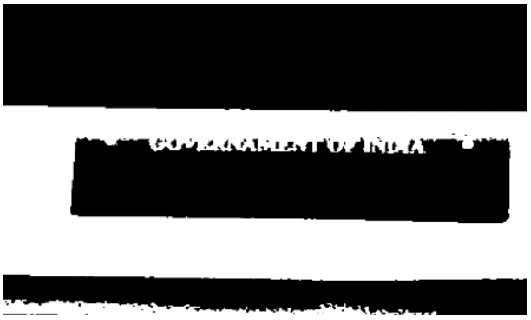

Figure 3: The image with 3500 pixel or more

picture2=picture-picture1; Here *picture2* stores only the number plate where the background from the original image is subtracted.
picture2=bwareaopen(picture2,200); This code gives us the text in the number plate i.e, the part which has less than 200 pixels.

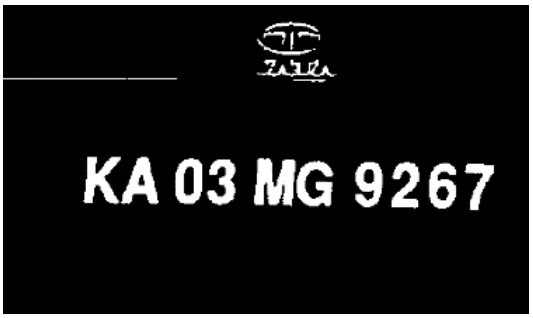

Figure 4: The image with localized number plate

4. Segmentation

In this stage number plate characters are extracted from number plate. These sub-segmented constituent parts are obtaining the characters individually. Here, we have applied bounding box to the characters in order to obtain the individual characters.

Measure Properties of image region: The matlab command *regionprops()* returns measurements of the set of properties for each 8-connected components in the binary image. This can be used in both contiguous and discontiguous regions.

propied = regionprops(L,'BoundingBox'): The function measures a set of properties for each labeled region in label image L.

Apply Bounding box: Command rectangle() creates a rectangle in 2D coordinates. *rectangle('Position',propied(n).BoundingBox,'EdgeColor','g','LineWidth',2);* This applies a bounding box to the *n* propied properties of object and the bounding box is of color green and of width 2cm.

Figure 5: The number plate with bounding box

5. Decision Making

To perform decision making function, the correlation function and the matlab command available is *corr2().* This function returns the 2D correlation coefficient R between arrays.

y = corr2(imgfile{1,k},n1); Here the file *imgfile* consists of the training dataset and *n1* represents the individual segmented objects. Both these inputs are in array format. Variable *y* stores a numeric scalar output returned from the function *corr2().*

6. Results and Discussion

The experimentation has been done by checking approximately 15 odd Indian vehicle images which were filmed by clicking at different viewing angles; and environmental conditions and the algorithm has given an accuracy of 70%. The table 1, Illustrates the execution time of the commands used during the recognition process. Further, total execution time of algorithm for the given input image which is 18secs.

Table 1: Illustrates the Execution time of Commands

S. No.	Commands	Execution Time (Secs)
1	uigetfile	4.214
2	graythresh	0.381
3	imresize	0.350
4	imread	0.229
5	corr2	0.193
6	regionprops	0.172
7	winopen	0.213

7. Conclusion

The proposed algorithm can be used to compare and extract the number plate information for Indian vehicles. In the present work, we have used the matlab. The Threshold and complexity of image extraction can be considered as a tool to increase the accuracy of the system. The correlation coefficient compares the similarities between the information present in the number plate and thus, increasing accuracy and speed of the system.

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