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Number Plate Recognition

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Abstract - With India growing it has made the ownership of vehicles a necessity. This has resulted in an civic problem. Parking areas have become congested due to the growing numbers of vehicles. The Number Plate Recognition System (NPR) plays an important role in different application as it is from parking to monitoring urban traffic and tracking automobile thefts. There are various NPR systems available today which work with different methodologies. In this paper, we attempt to review the various techniques and their usage. The NPR system has been implemented using template Matching and its accuracy was found to be 90.2% for number plates

Keywords- *Number Plate Recognition, Template Matching*

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I. Introduction

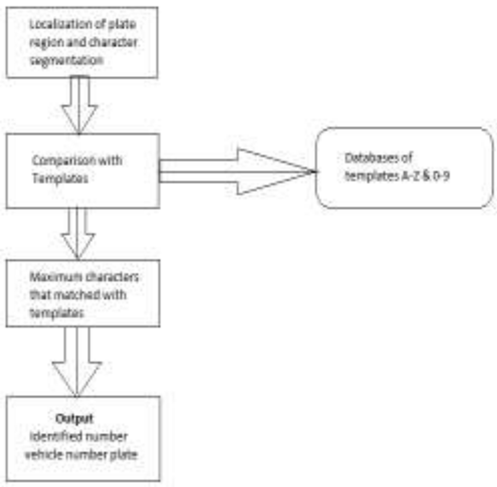
Number plate recognition is a form of vehicle identification. A number plate is unique for every vehicle. Automatic number plate recognition is an image processing technology used to identify vehicles by their own number plates. In Real time number plate recognition plays an important role in maintaining traffic rules. Most of the car parks are managed manually by security guards who do not keep a track of the number of vehicles entering and exiting the premises. Hence, the vehicle driver have to keep searching the car park in order to find a vacant slot leading to a wastage of time. The absence of the security guards may also lead to vehicle thefts.
The goal of the system is recognition of vehicle number plate using Template Matching.

II. Existing Methodologies

There are two algorithms for license plate Computer vision and character recognition. These algorithms play an important role in analysing number plate image. Therefore they are the core modules of any Number plate recognition system. The system recognizing the number plate includes a camera, a frame grabber, a computer, and custom designed software for image processing, analysis and recognition .Automatic number plate recognition has three major parts: First extract features of input image using principal component analysis and detected number plate is pre-processed to remove the noise and then the result is passed to segment the individual characters from the extracted number plate. The segmented characters are normalized and passed to an OCR algorithm. At last the optical character information will be converted into encoded text. The characters are recognized using Template matching. The final output must be in the form of string of characters.

III. Preprocessing of License Plate

License plate preprocessing is important in number plate recognition, which includes plate detection, correction, and segmentation .The goal of preprocessing a plate is to locate regions of interest that are similar to the license plate.



Due to the angle of orientation, the image may have a slant and distortion; thus, transformation or correction of image is an important step before the character segmentation.

IV. Localization of number plate region and Character Segmentation

Preprocessing is done for the selected image by passing it over gray scale filter and to isolate the region of interest edge detection is applied, which is the number plate itself. A gray scale digital image is an image in which each pixel is quantized exclusively the shades of neutral gray, varying from black at the weakest intensity to white at the strongest intensity. The obtained gray image is then binarized, that is, it is converted to logical matrix by giving the pixel values of 1 for white shade and 0 for black shade . The best possible number plate location is found out by comparing width by height factor of actual Indian number plates to the same factor of plate like areas found by this method. Maximum efficiency is shown by the system when the width by height factor is set between 3 and 7 .

The gray level plate images are enhanced by applying contrast extension and median filtering techniques . So, the contrast differences between images and the noises such as dirty regions in white background of the plate can be eliminated.

3.1 Contrast Extension

To extend the contrast of an image means equalization of the histogram of that image will be used. In other words, the contrast extension makes the image sharpen. The gray-level histogram of an image is the distribution of the gray level values in an image. The histogram equalization is a popular technique to improve the appearance of a poor contrasted image. The process of equalizing the histogram of an image consists of 4 steps: (i) Find the sum of the histogram values. (ii) Normalize the values dividing by the total number of pixels. (iii) Multiply the normalized values by the maximum gray-level value. (iv) Map the new gray level values.

3.2 Median Filtering

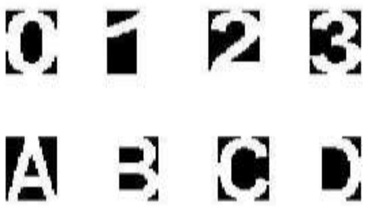
Median filter is used for eliminating the unwanted noisy regions. In this filtering method, the 3x3 matrices is passed around the image. The dimension of these matrices can be adjusted according to the noise level. The process of working is (i) one pixel is chosen as Centre pixel of the 3x3 matrices, (ii) the surrounding pixels are assigned as neighborhood pixels, (iii) the sorting process are employed between these nine pixels from smaller to the bigger, (iv) the fifth element is assigned as median element, (v) these procedures are implemented to the all pixels in plate image.

3.3 Character Segmentation

The characters of the number plate region identified are segmented using MATLAB function called as region prop to obtain bounding boxes for each of the characters. Region props function returns the smallest bounding box that contains a character. This method is used to obtain the bounding boxes of all characters in the number plate.

V. OCR using Template Matching

Template matching is one of the important techniques used for Character Recognition . It is the process of finding the location of a sub-image called a template, inside an image. Template matching involves determining similarities between a given template and windows of the same size in an image and identifying the window that produces the highest similarity measure. It works by comparing each pixel by pixel of the image and the template for each possible displacement of the template. This process involves the use of a database of characters or templates. There exists a template for all possible input characters. Templates are created for each of the alphanumeric characters (from A-Z and 0-9) using 'Regular' font style. Below are the few templates of the alphanumeric characters.



For recognition to occur, the current input character is compared to each template to find either an exact match, or the template with the closest representation of the input character. It can capture the best position by moving standard template, thereby carry out the exact match. Moving template matching method is based on the template of target character, using the template of standard character to match the target character from eight directions of up, down, left, right, upper left, lower left, upper right, lower right. The results of template matching for character recognition on some of the number plates taken from static images are shown in Table 1. The images of number plates used for template matching are shown below.

Table 1: Results of Template Matching

Actual Plate	Predicted Plate	Mismatched characters	Accuracy (%)
KPT-295	KPT295	0	100%
AED-632	AED632	0	100%
KZ66 ZYT	KZ66ZYT	0	100%
DAZ 2427	DAZ2427	0	100%

VI. Results

VII. Conclusion and future Work

In this work, existing methodologies and algorithms proposed in literature for Vehicle and Number Plate recognition were reviewed. Due to the unavailability of such an NPR system off the shelf in tune with our requirements, it is our endeavor to customize an NPR system for educational institution.

Template matching was implemented on number plates obtained from static images and an average accuracy of 90.2% was obtained. This accuracy can be improved greatly by positioning the camera suitably to capture the best frame and using two layers of neural networks. The implementation of the proposed system can be extended for the recognition of number plates of multiple vehicles in a single image frame by using multi-level genetic algorithms.

Also, a more sophisticated version of this system can be implemented by taking inputs from live video feed an selecting the best vehicle frame for classification of vehicle types and recognizing the number plates using neural networks.

VIII. Acknowledgements

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