Automatic Vehicle Number Plate Recognition Using Zonal Features

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Abstract: Usually vehicles are generally in motion so number plate recognition from vehicles becomes very complicated problem due to acquisition of images, along with that number plate may contain other designs and some extra stickers also. In this paper, we testing our method for number plate recognition which includes many steps, the images of the vehicle's number plate are collected from the car parking areas and from the web. First, pre-processing of input sampled images are done then feature extraction of those pre-processed images by applying Gabor convolves and Zonal based algorithm. Then morphological operations are applied to detect the characters and also for segmentation of images, each individual character is segmented horizontal processing histogram. The features of each character are calculated using zonal based approach. These features are used as input to the neural networks for character recognition.

Keywords: Number plate recognition, Gabor convolves and Zonal based algorithm.

I. INTRODUCTION

The vehicle number plate recognition automatically controls access to a secured area for authorized members. Number plate recognition system recognizes the number of vehicle from still image of vehicle's number plate. There is importance for the improvement of road safety in various areas like the automatic-toll tax collection, rush hour law enforcement, parking transport access control, road traffic supervision and with the crime prevention. It is executed with the synthesis of five main procedure flow one after other in vehicle number plate recognition method that are the pre-processing of the query image, cropping the pre-processed image then the edge extraction applied on the cropped image that follows the character segmentation and finally, the character recognition. Among this, Segmentation is the most important part in the method because it affect the system accuracy. There are many issues to be fixed in order to recognise a number plate successfully. Usually vehicles are generally in motion so number plate recognition from vehicles becomes very complicated problem due to acquisition of images, along with that number plate may contain other designs and some extra stickers also. Their main limitation is

that number plate variations due to plate types are the location, quantity, colour, and occlusion, standard versus vanity, inclination and fonts.

Number Plate Recognition is a computer vision method in which vehicles are identified by their license plates. During past few years, Number Plate Recognition have been widely used as a core technology for security or traffic applications such as in traffic surveillance, parking lot access control, and information management. In this method the images of the vehicle's number plate are collected from the car parking areas and from the web. First, the image is converted into gray scale image and then pre-processed that includes removing noise, dilation and making the image suitable for further processing or analysis as per the requirements. Then each individual character is segmented and recognized by morphological operations.

II. LITERATURE SURVEY

Prof. S. Mary Joans et al. [1] a combination of morphological operation is used for number plate localization. The application of edge detectors, labeling and fill hole

approach is used to segment the characters. The character was recognised with the aid of optical characters by the process of Template matching. The system was experimented with Sobel, Canny, Prewitt, LOG edge detectors. First the image is converted into the grayscale image and noise removing techniques are applied to remove speckle noise, salt and pepper noise. Ocr and icr techniques are used to recognize characters. In this , the topological features of the image are calculated and compared with pre-stored character template, the character template that best matches the input character are displayed. The experiment performed on images obtained from highways, parking under different lightning conditions. The success rate was 96%. Deepak Ghimire Et al. [2] has proposed a method to enhance the colour images with the non-linear transfer function by retrieving the neighbouring pixels. In this method, the enhancement is applied on the image where 'V' is the value of the luminance. The components are unchanged to restrict colour balance of the degradation between the HSV components. The objective and subjective achievement evaluation shows that the enhancement method that proposed and thus, yields results positively when compared with conventional methods. Lisheng Jin et al. [3] proposed approach presented a solution for the license plate recognition problem in China's number plate. Number plate images were pre-processed through gradation, edge detection and middle value filters. A character classifier was recognized using a fuzzy recognition method which was proposed based on the fuzzy decision-making method. Experiments showed that the recognition accuracy rate was up to 92%. Kumar Parasuraman Et.al [4] has proposed presented a new algorithm for recognize number plate system using SVM classifier which is called Support vector machine (SVM). The algorithm divided into two parts, one is character segmentation and other is recognition. This algorithm employed an SVM to recognize numbers and provided a good direction for automatic number plate recognition.

III. METHODOLOGY

Figure1 represent the overall representation of proposed system. The system consists of two phases they are training phase and testing phase.

In training phase we consider characters and digits sampled images as input images, sample images which we are using as input sample are taken from the vehicles images from parking and web, which we are testing and later those images are pre processed from color images to gray scale images and also these images are resized. To extract features from pre-processed images will apply Gabor convolves and Zonal based algorithm accurately and efficiently, result from feature extraction are trained by SVM training and will dumped to knowledge base as a result database. In this phase we train the SVM trainer to recognise the characters and digits present in the vehicle number plate, SVM classifiers compares the images in knowledge base with the query image to set the result. In testing phase will consider query images as input and these images are pre-processed then by applying morphological operations for character detection and segmentation, to extract features from pre-processed images

will apply Gabor convolves and Zonal based algorithm accurately and efficiently, and SVM classifier will recognise the number plate character from the images.
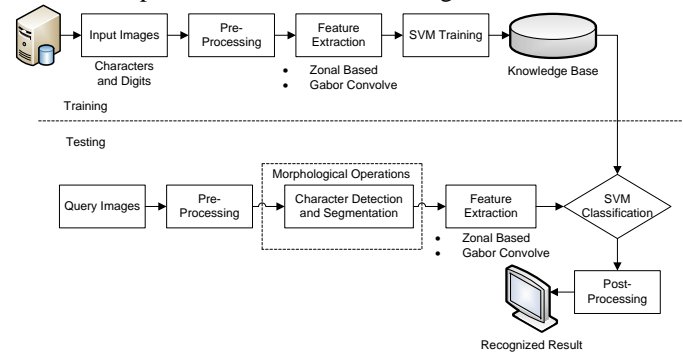

Figure 1: Block Diagram of proposed system

A. PRE PROCESSING

Pre-processing is used to convert the character image into gray scale image and to adjust the size of the image. Pre-processing is any form of signal processing for which the output is an image or video, the output can be either an image or a set of characteristics or parameters related to image or videos to improve or change some quality of the input. This process will help to improve the video or image such that it increases the chance for success of other processes. In this paper we considered image as input and these images are subjected to pre-processing this will resulting in gray scale conversion and resizing.

B. ZONAL BASED FEATURE EXTRACTION

The most important aspect of number plate character recognition is to select the good feature set. This feature set helps for good recognition and implementation. Initially, we will perform the centroid of image (numeral/character). This image is further divided into 50*50 equal zones where size of each zone is (5*5). Then we have computed the average distance from image centroid to each pixel present in the zones/block. We have got 100 feature vector of each image. Then perform the average distance from the zone centroid to each pixel present in zones. There could be some zones that are empty then the value of that particular zone is assumed to be zero. We repeat this procedure for all zones present in image (numeral/character). We have used efficient zone based feature extraction algorithm for handwritten numeral recognition Zonal based feature extraction algorithm is explained below

Algorithm: Zone Centroid Zone (ZCZ) based feature extraction system.

START

STEP 1: Input image is divided into 'n' equal zones.

STEP 2: For all 'n' equal zones, perform centroid.

STEP 3: Compute the distance between the zone centroid to each pixel present in the zone.

STEP 4: Repeat step 3 for the entire pixel present in the zone.

STEP 5: computed of average distance is between these points present in image.

STEP 6: This procedure are sequentially repeated for the entire zone.

STEP 7: obtaining 'n' such features for classification and recognition.

ENDS.

C. GABOR CONVOLVES FEATURE EXTRACTION

The Gabor wavelet transform is used for feature extraction in this architecture; it has some attractive mathematical and biological properties and has been used frequently on researches of image processing. Gabor functions provide the optimal resolution in both the time and frequency domains, and the Gabor wavelet transform seems to be the optimal basis to extract local features for several reasons, they are Biological motivation and Mathematical and empirical motivation.   F.

Gabor wavelet is given as

$$\varphi(x, y) = \frac{f^2}{\pi\gamma\eta} \exp\left(-\left(\frac{f^2}{\gamma^2}x_r^2 + \frac{f^2}{\eta^2}y_r^2\right)\right)(\exp(j2\pi x_r) - k \quad (1)$$

where K is an offset parameter.

Gabor wavelet is used as the discrete wavelet transform with either continuous or discrete input signal. The non-orthonormal wavelets could provide a complete representation only when they form a frame only if the Gabor wavelets are used for feature extractions. When extracting features for pattern recognition, retrieval, or computer vision purpose, the transformed coefficients are used for distance measure or compressed representation but not for reconstruction, so the orthogonal constraint could be omitted.

D. THE EDGE EXTRACTION USING MORPHOLOGICAL OPERATIONS

First, the query image C(x, y) should be converted to the binary image consists of only 1's and 0's (for black and white). The edge of the image which is directly extracted by the morphological basic operations gives the E(x, y) from the query image C(x, y). By using dilation and erosion morphological operation are done in this method.

These two methods are based on the fundamental morphological operations by giving the limits 1.1 and the image terminals by selecting different size and extensions converted to images of grey levels and then remove the entire unwanted region. This process, first gives the number of pixels connected together in a sequence to form a group of connected objects. Then, it counts the query characters and number of the connected region from number plate and matches this characters and number from the dataset of the template library which is created to call the objects.

After the edges of the number plates are determined as E(x, y), next the character segmentation isdone for the identification module. Each character of the query number plate need to be split and the acquired image is the resultant image S(x, y).

The final recognition stage is performed by the correlation matching algorithm implementation and the accuracy rate is the approximation of value 1 in the F(x, y) image. This final resultant recognized objects of the vehicle

implements correlation for the pattern recognition by the following steps:

✓ It sequentially multiplies every segmented objects S(x, y) over the entire reference image set from the template library,
✓ Next, for each multiplication it calculates the correlation plane.
✓ For each segmented character S(x, y) it identifies the maximum peak value as max (out) to the correlation,
✓ It sorts the maximum peak correlation values from each correlation plane to found the reference image brings about the highest correlation peak value, i.e., with the reference image S(x, y) have the best match with unknown input image I(x, y).

E. SVM CLASSIFIER

SVM stands for Function Support Vector Machines. SVM first maps the input vector into a higher dimensional feature space in order to achieve the optimal separating hyper-plane in the higher dimensional feature space,

The kernel function on two samples X and X', represented as feature vectors in some input space, is defined as

$$K(X, X') = \exp\left(\frac{\|X-X'\|^2}{2\sigma^2}\right) \quad (2)$$

$\|X - X'\|^2$ Represent the squared Euclidean distance between the two feature vectors. σ is a free parameter.

Furthermore, a decision boundary, i.e. the separating hyper-plane, is determined by support vectors rather than the whole training samples and thus is extremely robust to outliers. Exactly an SVM classifier is designed for binary classification. That is, to separate a set of training vectors which belong to two different classes. Note that a decision boundary similar to the support vector i.e. training samples. To provide the required mapping to ice-water labels a soft-margin SVM classifier is used. An SVM works by computing a linear decision boundary in a high dimensional space using the subset of labeled training samples near the decision boundary (called the support vectors). The SVM decision boundary equation is

$$f(x) = \sum_{vi} y_i \, \alpha_i K(x_i, x) \quad (3)$$

Where $K(x_i, x)$ Kernel function is defined by

$$K(x_i, x) = \exp(-\gamma|x_i - x|^2) \quad (4)$$

Then according to the result which we stored in the knowledge base at training phase SVM classifier will classify the characters by comparing it with SVM trained knowledge base database.

IV. EXPERIMENTAL RESULT

The experimental result for the above discussed methodology is discussed in this section. Figure 2 represents the overall experimental results. Figure 2 (a) represents input image this image is preprocessed and will get Figure 2(b) and 2(c) i.e. gray scale image and binary image respectively. Next will apply Zonal algorithm for feature extraction from that noise removed image we will get that is as shown in Figure 2(d), next will perform segmentation by morphological operations for segmentation and recognition of separated

characters as shown in Figure 2(e), after segmenting each letter from the query image will get the effective result of number plate as shown in Figure 2(f).
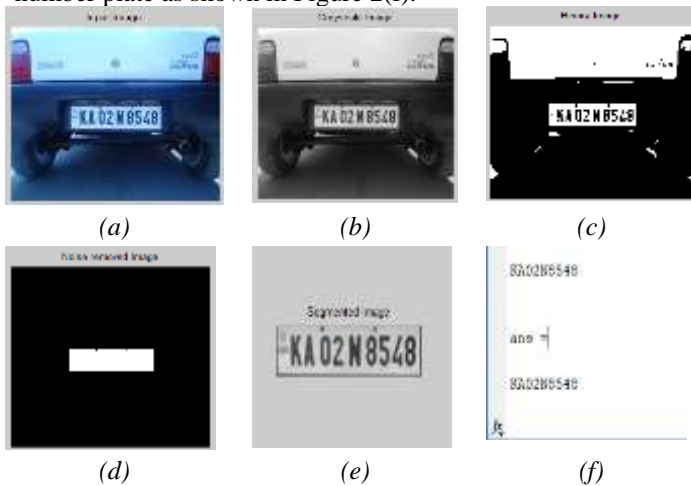

(a) *(b)* *(c)*

(d) *(e)* *(f)*

Figure 2: (a) Input image; (b) Gray scale Image; (c) Binary converted Image; (d) Noise Removed Image; (e) Segmented Image; (f) Result

V. CONCLUSION

In this paper we demonstrated a system on the vehicle number plate recognition through the Zonal and Gabor convolves method for feature extraction. This algorithm has shown a notable improvement for recognizing number plate of a vehicle. The approximate results show that this approach gives the potential of the morphological edge detection and segmentation for vehicle number plate classification that has been assessed. The purpose to apply segmentation is to eliminate the unwanted region from the vehicle number plate and detect the prominent edges which are required for the recognition of the characters and numbers from the vehicle number plates. Hence, the recognition accuracy is high. The method is quite simple that can be put into practise and also has a good application prospect. Our Experimental Results proved that Zonal based method provide better recognition accuracy than compare to other conventional methods.

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