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VEHICLE LICENSE PLATE DETECTION USING DIGITAL IMAGE PROCESSING

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1.ABSTRACT

License plate recognition (LPR) is an important research topic in intelligent transportation systems (ITS) and becomes more useful in many applications during the past decades. All vehicles around the world should have a license number as their principal identifier. With the rapid development of computer vision technology, more and more vision-based license plate recognition methods are applied in intelligent transport system such as electronic payment systems, traffic activity monitoring and automatic vehicle ticketing. Although significant progress of license plate recognition techniques has been made in the last decade and various commercial products are reliable under some ideal environments, it is still a challenging task to recognize license plates from complex images. A robust system should work effectively under a variety of conditions such as sunny day, night time or with different colors and complex backgrounds.

2.METHODOLOGY

LPR consists of three parts they are license plate detection (LPD), character segmentation, and character recognition. Accurate license plate localization and segmentation are crucial for the entire LPR system. There are two major methods for the localization of vehicle license plates: one method is based on color information and another is based on textures or edges of the license plates. Characters are segmented after license plate detection and propose to use grey-level quantization and morphology analysis to obtain candidate characters. The

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extracted license plate is rescaled to a template size in the template all the character positions. This method is incapable of dealing with any shift in the extracted license plates. In addition, the projection method is also applied when the extraction is not successful because of discontinuity and connectivity.

3.BLOCK DIAGRAM

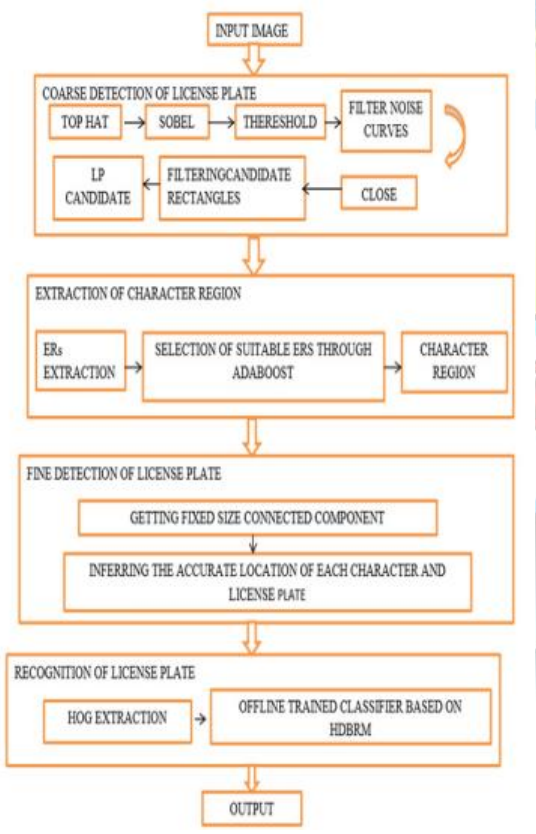

Figure 3.1 Block Diagram of Vechicle License Plate Detection

4.BLOCK DIAGRAM EXPLANATION

Input image

Input image is from a video cam and input image with noise is sent to the gray scale converter**.**

Figure 4.1 Input Image With Noise Filtered

RGB to Gray Scale Conversion

The vehicle images captured using different cameras are color images having different file formats for e.g. JPEG, BMP etc. Processing directly on RGB images will involve great deal of complexity because of large number of working levels. Hence retaining only the brightness information convert the original image to a Grayscale image.

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Top-Hat

Top-hat transformation in the gray image converted from the input image. Top-hat is a mathematical morphological transformation and is a non-linear filter . It has multiple functions such as restraining noises, extracting features, segmenting images, etc. The top-hat transformation equation is formulated in

$$Top\_hat(A)=A-(A\circ B).$$

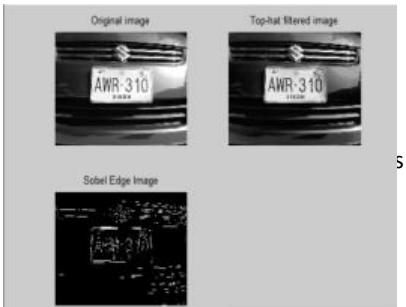
$A\circ B$ is defined as an open arithmetic in mathematical morphology,which helps to removesmall objects and to smooth edges of the input image. The open arithmetic equation is formulated as

$$A\circ B =(A\Theta B)\oplus B.$$

$A\Theta B$ and $A\oplus B$ are both morphological arithmetic, called erosion and dilation, respectively. Erosion is used to eliminate isolated noises Dilation is used to combine the object with the background points and its equation is shown in

$$X = A\Theta B = X : B + X \subset A$$

$$X = A\oplus B = X$$



$$:(-B + X)\cap A = \emptyset.$$

An efficient character region enhancement is crucial for the proposed character region-based license plate detection. Top- hat transformation could remove some noise for images with complex backgrounds and extract bright edges. In addition, top-hat not only enhances the image details especially the character regions in dim conditions but also enlarges the contrast between character regions and backgrounds. The result of top- hat transformation for a nighttime test image. The performance of top-hat transformation mostly depends on a square structuring element whose width is 3 pixels. [8] discussed about Automatic Number Plate Recognition (ANPR), Automatic Number Plate Recognition (ANPR) is a real time embedded system which automatically recognizes the license number of vehicles. In this paper, the task of recognizing number plate for Indian conditions is considered, where number plate standards are rarely followed.

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Figure 4.2 Output Image, Top Hat Image, Sobel Edge Image

Coarse Location of License Plates

After top-hat transformation, a character region with dense vertical edges is more likely to be a plate candidate. Hence, the Sobel filter is used to get vertical edges. A binary method with a global threshold cannot generate satisfactory results because the brightness distribution of a LP may vary due to lighting environment. In light of that, the adaptive local binary method is applied.The local Otsu method is used to obtain binary image and the result . But there are many short random noise and long bounding curves besides the license plate edges. the too long (back- ground curve) and too short (noise) edge length can be removed .Close operation, which is one morphological operation, is applied to connect text pixels into plate regions. Once extracting the bounding rectangles of external contours, a filtering method based on aspect ratio and area is applied to get regions that may contain license plates. The filtering method for coarse location is to set the thresholds of bounding rectangles, a bounding rectangles with area between 1000 and 16000, aspect ratio (width/height) between 1.5 and 8 and width above 70 is selected as a LP candidate .A high recall of license plates is essential to the whole LP recognitionsystem . As described above, coarse location method is robust to dim and bright light conditions . This method is also effective in highlight conditions with noises .Moreover, the precision of location is high corresponding to a high recall.

Contrast Enhancement

To allow the algorithm to detect the license plates correctly from the images captured during evening and low-light conditions, it is necessary to improve the overall contrast of the image. The condition whether to apply contrast enhancement or not is decided by using a suitable threshold based on statistical parameters of the input image that differentiate the low contrast and high contrast image.

Edge Detection

The license plate region is characterized by frequent intensity changes between characters and background. It consists of characters of almost equal shape and size placed at regularly spaced intervals

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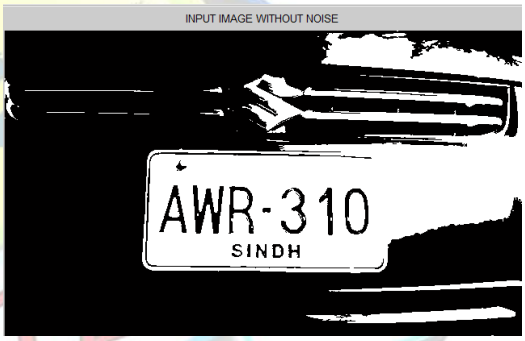
and oriented vertically. Edges define the boundaries between two regions with different gray levels. There are three different operators for detecting vertical edges present in the input image they are prewitt's operator it may miss the edges that represent the license plate region, while using Canny's operator results in large number of edges which will make further processing complex. Sobel's operator has an advantage of better noise suppression.

Edge Density Based Region Growing

The next step is to connect these edges together based on their density and compactness. This is achieved by moving a mask of pre- defined height and width over the entire image. For a given position of the mask the sum of the total number of edge pixels inside the masks is computed. This sum is then normalized by dividing it with total number of pixels in the window to give the density of the region.

Connected Component Analysis

After highlighting the regions using edge density based region growing, the next step is to retrieve each of these regions one by one and analyze some of their parameters to check whether they are license plates or not. This process assigns different labels to each of the regions based on specified connectivity. Labelled regions represented by five different colors. Each color in the indicates a different region. Based on coordinates of the rectangles extract the candidates one-by-one and analyze some of their parameters to filter out the non-license plate regions.



Component Filtering

The parameters has been decided considering the maximum and the minimum distance between camera and the vehicles, types of license plates, dimensions of license plates, etc. To implement this first , detect the edges in the LP-candidate once again. Then after a scan line is made to run from left to right boundary. After filtering out all the non-license plate candidates the left out

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candidates which clear all the filtering tests are returned as exact detected license plates.

Figure 4.3 Input Image Without Noise

LP Segmentation

Character Segmentation is an essential and important step in Automatic License Plate Recognition (ALPR) system, because the accuracy of the character recognition relies on the accuracy of the character segmentation. There are many difficulties in this step, such as different lighting condition,effect of image noise, poor contrast, rotation and so on, that degrades the accuracy of the character segmentation. Here we used character segmentation based on Connected Component Labeling (CCL) and reign property function.

Figure 4.4 Segmented Image

Fine Detection of License Plate

License Plate Recognition is the last step of the LPR system. This step is the main part of the recognition process which decides the accuracy and recognition rate of the system. This Recognition involves about to recognize the characters of the license plate numbers and character. Before the recognition the license plate characters are normalized. Normalization is to improve the characters into a block containing no added white spaces (pixels) in all the four sides of the characters. In this Stage, the license plate character images that are taken out from the license plate image have to be recognized. It is actually the process of the character recognition of the license plate characters. The character recognition of the license plate can be find out through Neural Network, Template matching, Hough Transform, Radial Basic Function.

Histrogram of Oriented Gradient (HOG)

HOG computes histogram of gradient orientation on a dense grid of uniformly spaced cells and uses local contrast normalization in overlapped blocks for improved accuracy. It can describe the

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local object appearance and shape effectively. Since the HOG descriptor computes histograms on localized cells, the method keeps nice invariance to geometric and photometric transformations.

Offline Trained Classifier Based on HDBRM

Due to technological advancements image acquisition process can be achieved at low cost. In the presence of obstacles such as vegetation, or terrain conditions the image faces difficulties hence reducing the efficiency of the output in such conditions. Thermal Infra-Red camera can be used to produce effective images for successful output.

License Plate Number Stored in Data Base

Target recognition needs to extract the features of the target.. The salient feature means what are advantageous to classifying objects. In mathematical expression, the salience feature represents the minimum probability of error in distinguishing a falsely object from the background. Therefore, the most salient feature corresponds to the largest probability in the extracting procedure. According to the prior information trained, in the actual recognition procedure, the system only extracts several salient features. This paper applies the minimum probability of error as the rule of feature selection.

Display

It is employed for the purpose of conversion of images of text into characters. Number plate recognition is now used to compare the each individual character against the complete alphanumeric database using template matching. The matching process moves the template image to all possible positions in a larger source image and computes a numerical index that indicates how well the template matches the image in that position. Matching is done on a pixel by pixel basis. Since the template size is fixed, it leads to accurate recognition.

5.CONCLUSION

An effective approach for vehicle license plate detection and recognition based on character specific regions is proposed in this paper. Firstly, a sequence of morphological operations is applied to find plate candidates with dense vertical edges. Then the character specific ERs are

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extracted and selected as character regions in colour space. The recognition step is achieved by an effective classifier named HDRBM. To our knowledge, HDRBM is the first to be integrated for license plate recognition. In addition, there is little literature dedicated to both license plate detection and recognition in wide view with high resolution The experimental results show that the proposed method can achieve outstanding performance in all day surveillance environment with various illumination conditions and complex backgrounds .The approach can be easily generalized to license plates from other countries as long as the character layouts are given. However, proposed method still has restrictions. For the recognition step, the recognition rate highly depends on accurate extractions of character regions. Some extracted or inferred character regions with low probabilities can be relocated and the extract features on raw pixel data by using deep architectures but have not got ideal results. A large scale of training data set for recognition task will be collected and the proposed framework will be generalized to license plates of other countries. In addition, deep architectures for location and recognition will be our future work. Character segmentation is based on Connected Component Labeling (CCL) and reign property function. Then the character recognition of the license plate can be find out through Neural Network, Template matching, Hough Transform, Radial Basic Function. Character segmentation is based on Connected Component Labeling (CCL) and reign property function. Then the character recognition of the license plate can be find out through Neural Network, Template matching, Hough Transform, Radial Basic Function.

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