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Number Plate Recognition Using Neural Network Classifier and KMEAN

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Abstract— Vehicle License Plate Recognition(VLPR) is a vital component in Intelligent Transportation Systems. A system that can identify any vehicle by reading its license plate number can be helpful for any organization.These systems has the process of recognizing the license number of vehicles, making it time efficient, fast and cost-effective. There are many challenges in developing a reliable, efficient automatic vehicle license plate recognition system(VLPRS). In this research paper , VLPR system is proposed. The research paper presents the technique of recognition of number or characters from vehicle number by feature extraction and contrasting recognition with two classifiers. The research work focuses mainly on two parts, first is feature extraction and second is classification means recognition of text and numeral objects embedded on number plates. For database, 24 images of different vehicles have been captured. The effects are made to create a real time database which contain no. of characters of different size, font and styles. The work begins by the Pre-processing, image extraction, segmentation of an image and finally recognition of image by the Back Propagation Neural Network and KMean classifiers.

Keywords- Image processing, License plate recognition, Neural Network, K mean, Feature Extraction

I. INTRODUCTION

During the past few years, intelligent transportation systems (ITSs) have had a wide impact in people's life as their scope is to improve transportation safety and mobility and to enhance productivity through the use of advanced technologies. ITSs are made up of 16 types of technology based systems. These systems are categorized into intelligent infrastructure systems and intelligent vehicle systems [1]. In this paper, a computer vision and character recognition algorithm for a license plate recognition (VLPR) is presented to be used as a core for intelligent infrastructure like electronic payment systems (automatic toll collection , parking fee collection), freeway, and arterial management systems for traffic surveillance. As the high security awareness has made the need of vehicle based authentication technologies extremely significant, the proposed system may be used as access control system for monitoring of unauthorized vehicles entering private areas. The license plate is the unique identifier for the vehicle despite the fact that it can be deliberately altered in fraud situations or replaced (e.g., with a stolen plate). Therefore, ITSs rely heavily on robust VLPR systems. The focus of this paper is on the integration of a novel segmentation technique.

The paper is organized as follow. The next section constitutes a review of similar researches that have been reported in the literature. In Section III, the recognition and segmentation method is described, followed by the complete description of the proposed algorithm. Experimental results and sample set formation are presented in Section IV. In Section V,finally, conclusion and future scope are presented.

II. LITERATURE SURVEY

In **[1],** for faster detection of region of interest (ROI) a technique called sliding concentric window (SCW) is developed. It is a two step method having two concentric windows moving from upper left corner of the image. Then the statistical measurements in both windows were calculated based on the segmentation rule which tells that if the ratio of the mean or median.

Another SCW based system is presented in **[2]** for locating Korean number plate. After applying SCW on vehicle image authors used HSI color model for color verification and then tilt was corrected by using least square fitting with perpendicular offsets (LSFPO).

To locate Chinese number plate Hui Wu and Bing Li **[3]** proposed a method to find horizontal and vertical difference to find exact rectangle with vehicle number. The Authors converted vehicle image into gray scale and then applied automatic binarization using MATLAB. Any further detail regarding number plate detection algorithm is not mentioned in this paper. The authors claim to have average recognition rate of 0.8s.

In **[4],** canny edge detector operator was applied to find out the transition points. As per H.Erdinc Kocer et al a license plate contains white background and black character normally. The Canny edge detector uses a filter, which is then based on Gaussian smoothing's first derivative to eliminate the noise. Then in the next step, the edge strength is calculated by considering the gradient of the image. The canny edge detector operator used 3 X 3 matrix to accomplish this task. Based on this information transition points region is determined.

In **[5],** global edge features and local Haar-like features are proposed for real-time traffic video. License plate detection is accomplished by moving a scanning window around the vehicle image. The scanning windows is categorized a license plate region and non license plate region based on the pre-defined classifier.

In **[6],** a fuzzy discipline based approach is proposed for number plate segmentation. In license plate locating module, the authors considered number plates having colors white, black, red and green. The edge detector algorithm is sensitive to only black-white, red-white and green-white edges.

III. PROPOSED WORK

The following are the major steps of the research task:-

A. Input Image

Firstly image acquisition is done using camera of 5 megapixel. Image acquisition is very important step in the recognition of number plate recognition, The database used for the proposed work is real time database.

As the image has great effect of capturing angle, colour or font and style of number plate.

B. Color To Gray –Scale conversion

The algorithm described here is independent of the type of colors in image and based mainly on the gray level of an image for processing and extracting the required information. The primary Color components like Red, Green and Blue value are not used in this algorithm.The coloured image is converted into gray scale image using MATLAB command rgb2gray and histogram of that image is drawn.

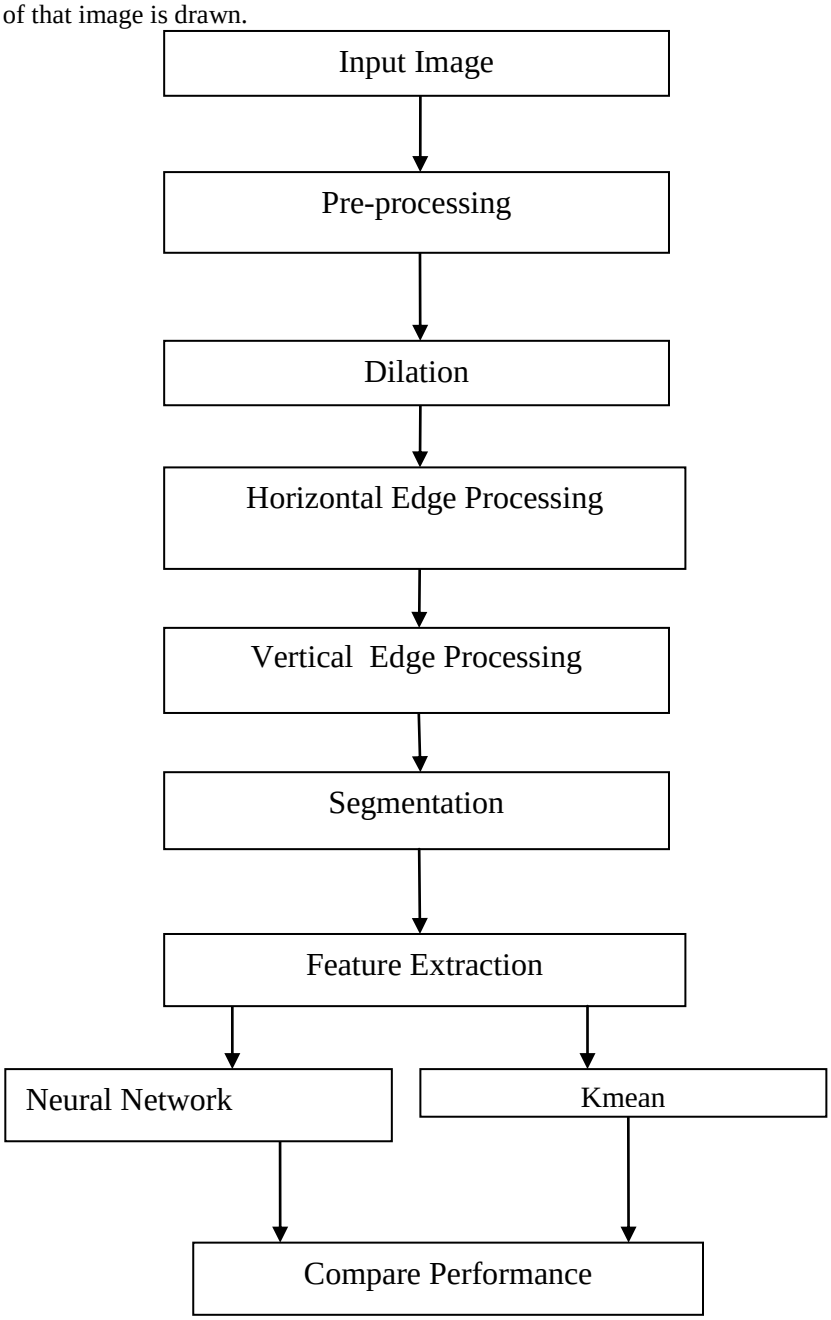

Fig. 1 Proposed Model

Fig. 2 Coloured Image

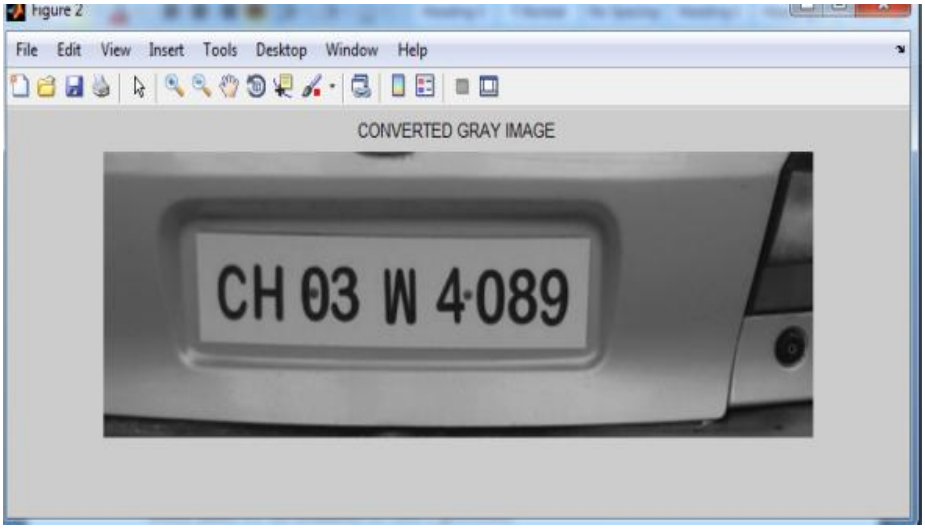

Fig. 3 Gray Scale Image

C. Dilation of image

Dilation is a process of improving the structure of the given image by filling holes ,sharpening the edges of objects in an image by adding the pixels to the boundary of the objects , by joining the broken lines and increasing the brightness of an image. Using dilation, the noise from an image can also be removed. By making the edges sharper, as the difference of gray value between neighboring pixels at the edge of an object increases, it enhances the edge detection. For Number Plate Detection, the image of a car number plate may not always contain the same brightness and shades. So, firstly the given image has to be converted from RGB to gray scale form. During this conversion, some important parameters like color difference, light edges of object, etc. may get lost. The process of dilation will help to prevent such losses .Image is filled by the command and holes, unnecessary lines are filled.

D. Segmentation

The segmentation process is carried out by thresholding and Connected Component Analysis (CCA). In binary image processing, CCA is a technique that scans and labels the pixels of a binarized image as components based on pixel connectivity. Pixel has given a value depending on the component to which it was assigned. Then the connected components are analyzed to filter out.

Once the histograms are generated , a filter is used to remove unwanted region from an image. Histogram is a graphical representation of the distribution of pixel values of over a given range of an image. The unwanted regions are the rows and columns with low histogram values. A low histogram value gives indication that the part of image contains very little variations among neighboring pixels. So, if a region with a license plate contains a plain background with alphanumeric characters , then the difference among the neighboring pixels, mainly at the edges of characters and number plate, will be very high. This gives a high histogram value for such part of an image. So, a region with probable license plate has a high horizontal and vertical histogram values and areas with less values are required nomore.. Such areas are discarded from an image by applying a dynamic threshold. Here, the dynamic threshold refers the average value of a histogram. Both horizontal histogram and vertical histogram are passed through a filter with the dynamic threshold. This process

outputs histogram having regions with high probability of containing a number plate The next step is to find all the regions in an image that has high probability of containing a license plate. The Co-ordinates of all such probable regions are stored in an array.

E. Horizontal and Vertical Processing of Image

For Number Plate Detection algorithm, horizontal and vertical histogram are used, which represents the column-wise and row-wise histogram respectively. These histograms gives the sum of differences of gray values between neighboring pixels of an image by column-wise and row-wise. In this step, the horizontal histogram is calculated first. To find a horizontal histogram, the algorithm goes through each and every column of image. In each column, the algorithm starts with the second pixel from the top. Then the difference between second and first pixel is calculated. If the difference crosses certain threshold then that difference is added to total sum of differences. Then, algorithm goes downwards to calculate the difference between the third and second pixels and so on, it moves until the end of a column and calculate the total sum of differences between neighboring pixels. At the end, an array having the column-wise sum is created. The same criteria is carried out to find the vertical histogram and rows are processed instead of columns and same procedure is carried out on all the pixels of rows until the end of row and total sum of differences between neighboring is calculated and an array having row-wise sum is created.

F. Passing Histograms to Low Pass Filters

To secure important information in further steps, it is advisable to smooth out such drastic changes in values of histogram. For this reason, the histogram is passed through a low-pass digital filter. During performing this step, each histogram value is averaged out assuming the values on it right-hand side and left-hand side. This step is performed on both histograms, horizontal as well as vertical histogram.

G. Feature Extraction

In proposed work, we have extracted the 12 features of each alphabet and numeric and stored those features. These features help to train the neural network. The extracted features are: area, perimeter, orientation, solidity, eccentricity, extent, eulernumber, equivdiameter, convexarea, filled area, bounding box ,centroid.

1. Area
   To find the area, count the number of pixels in that region. A = Number of pixels in the smallest rectangle that cover the digit.
2. Bounding Box
   Bounding box feature provide 4 outputs. One is the top left x-coordinate of the smallest rectangle that cover the digit. Second is the top left y-coordinate of the smallest rectangle that cover the digit. Third is lower right x-coordinate of the smallest rectangle that covers the digit. Fourth is downright y-coordinate of the smallest rectangle that covers the digit.
3. Centroid
   Centroid is the center of mass of the region. It provides two outputs first is the horizontal coordinate of the center of mass and second is the vertical coordinate of the center of mass.
4. Convex Area
   Convex area specifies the number of pixels in convex image.
5. Eccentricity
   The eccentricity is the ratio of the distance between the foci of the ellipse and its major axis length. The value is between 0 and 1. An ellipse whose eccentricity is 0 is actually a circle, while an ellipse whose eccentricity is 1 is a line segment.
6. Equivdiameter
   The diameter of a circle with the same area as the region. Equivdiameter computed as
   Equiv-diameter = $\sqrt{(4\times\text{Area})/\pi}$
7. Euler Number
   Euler number tells the number of objects in the region minus the number of holes in those objects. regionprops uses 8-connectivity to compute the EulerNumber measurement.
8. Extent
   Extent is the ratio of pixels in the region to pixels in the total bounding box. It is calculated by the Area divided by the area of the bounding box.
9. Filled Area
   This feature describes the number of on pixels in filled image.
10. Orientation
    It is the angle (in degrees from -90 to 90 degrees) between the *x*-axis and the major axis of the ellipse that has the same second-moments as the region. The orientation is the angle between the horizontal line (x-axis) and the major axis.
11. Perimeter
    Perimeter is the distance around the boundary of the region. The perimeter is calculated by the distance between each adjoining pair of pixels around the border of the region. If the image contains discontinuted regions, regionprops returns unexpected results.

12. Solidity
    Solidity is the proportion of the pixels in the convex hull that are also in the region. It is Computed as Area/ConvexArea.
    These features help in recognition process to recognize the characters and numbers.

H. Classification

The final step in the recognition process is the classification. For classification, two classifier are introduced.

- Neural Network
- Kmean

1. Neural Network

Neural network is the set of input neurons which are activated by the pixels of an image. The use of artificial neural network (ANN) in OCR applications can simplify the code ,easy to use and improve quality of recognition while attaining good performance. The other benefit of using neural network in OCR is extensibility of the system means ability to recognize more character sets than initially defined. The character recognition is done by the neural network.

2. K Mean

After the recognition of text is done by Neural Network, It is again recognized using K- mean. K-mean loop on entire word patterns, each consisting of a temporal sequence of vectors rather than single vector

IV. RESULTS AND EXPERIMENTS

a) Upload ORIGINAL IMAGE PICTURE, EXTRACTED IMAGE PICTURE of the database to show the experiments.
b) Pre-processing, Segmentation
c) Feature Extraction
d) Classiication
e) Results

Table no.1

Classifier	Accuracy
Neural Network	95.6%
K-Means	83. 8%

V. CONCLUSION

This paper introduces a neural network and K Mean approach for automatic identification of vehicle License plate. Recognition of character by neural network is better than K Mean method The accuracy given by the neural network is 95.6% and by kmean,the accuracy provided ,is 83.8%. The given approach of license plate recognition can be implemented by traffic police to reduce traffic violations, to detect the speed violators, parking fee collection, on highways, bridges or for toll fee collection etc.

VI. FUTURE SCOPE

In future this system can be used for security purpose as it can be developed to recognize high security number plates. The research work is done on the stationary vehicles with white background of plate. The future scope can be done:

- On moving vehicles .
- With coloured background of number plates.
- Recognition can be performed on Darkest number plate means number plate in darker mode

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