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Vehicle License Plate Recognition Based on Concentric Windows and Deep Neural Networks

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ABSTRACT: A license plate recognition (LPR) system employs image process techniques, to assist to spot the vehicles through their plates. License plate recognition may be a method, wherever 1st the license plate region is localized during a vehicle image so the characters on the plate are known by a character recognition system. the recognition will be exhausted 3 steps: Localization of the plate, extraction of the plate characters, and recognition of the characters employing a appropriate identification methodology. In our project we have a tendency to propose a replacement approach to research vehicle pictures which frequently contain blurred pictures of vehicle from that we have a tendency to extract license plate (LP). By victimizing the natural properties like finding vertical and horizontal edges. Initially, segmentation technique named as sliding concentric windows (SCW) is employed for detecting candidate region. Then the complete image is turned for correcting tilt by varied angle. Finally, a replacement algorithmic program supported artificial neural network (ANN) known as Deep Neural Network(DPP) is employed for recognition of plate characters. Numerous LP pictures of various vehicles are used with a range of conditions to check the projected methodology and results are conferred to prove its effectiveness.

I.INTRODUCTION

Automatic number Plate Recognition (ANPR) System today has became associate in nursing important system in our way of life ,as a result of the unlimited increase in cars, two-wheelers and transportation systems, that makes it tedious to manage fully and examined by humans. Some examples, like traffic observance, trailing taken cars, managing parking toll, red-light violation social control, border and customs checkpoints create use of LPR system. Yet, it's a really difficult drawback, because of the various sorts of plate formats, style, completely different scales, angles and non-uniform illumination conditions throughout image acquisition.Some of the sensible adoption of VLPR system are : In entrance gate, number plates are accustomed to determine the vehicles. Once a vehicle enters the entry gate, the number plate is mechanically detected and recognized so to hold on in information. The quantity that isn't recognized (i.e non-authorized or non-standard numbers), isn't given permission to enter. Once a vehicle later exits the place through gate, the number plate is recognized once more and matched with the number that is initial recognized and hold on within the information, and then it's taken a count and allowed to exit the place. Automatic number plate recognition systems are often utilized in access management. for instance, this technology is employed in several corporations to grant access solely to vehicles of licensed personnel. Our license plate detection approach has two major steps. First, we need to extract certain features using sliding concentric windows, as a result we get the extracted candidate region (i.e license plate region). Second, we need to develop a detector, which is a classifier in our case, to determine whether a certain region in the images or frames is license plate. Later recognition is done to determine the exact characters. In our approach artificial neural network (Deep neural network) is used for recognition. This system is experimented using Matlab.

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II. LITERATURE

[1] H.Erdinc Kocer , K.Kursat Cevik , A neural network for vehicle plate recognition is outlined by a group of input pictures which can be activated by providing pixels of the input image. When being weighted and remodeled by a function ,the activations of those pictures are then passed on to alternative method of recognition. This method is repeated till the characters within the image are expected. The characters together with letters and numbers inserting within the license plate were situated and determined by exploitation with canny edge detection operator and therefore the blob coloring technique. This method benefited in proving the accuracy of plate recognition on a whole range of inputs. The main disadvantages are :1) they can be hard to tune and therefore hard to debug; 2) they are computationally intensive to train, i.e you need a lot of preprocessing procedures and a distributed platform to train on very large datasets. As a result, 247 license plates in 259 vehicle image were recognized correctly by this method, so the overall recognition percentage of the system is 95.36%.[2] The paper implements an artificialneural networks based methodology for training the structural parameters of water harvesting structures(WHS) at the conceptual stage of design.This method reveals that,the structural parameters of the WHS predicted using ANN are closely related to the actual field parameters. A parametric sensitivity study is performed to assess the most significant design parameter.This system promotes in aiding the engineer incharge to conveniently focus on budget requirements and minimize the laborinvolved during the phases of analysis and design. When network failure or error occurred, it is evaluated in terms of mean squared error(MSE).The entire data comprising of 264 datasets was employed for judging the prediction ability of the neural network model. [3] weighted statistics technique is employed to create the plate within the image in a very additional outstanding position. At identical time, the thick grid feature extraction and momentum BP algorithmic rule is combined and accustomed to distinguish license. This technique improves the accuracy and speed of character recognition. Through the recognition nearly one hundred vehicles license plates, was accustomed to compare the momentum gradient descent law with the steepest descent law, and obtained error curves regarding the digital recognition. When analyzing the experiment, the momentum gradient descent law restrain quickly comparison with the steepest descent law. The momentum BP law must repeat 236 times to create error reach restraining, however the steepest descent technique must repeat 2088 times. As there are numerous varieties of plates, the paper solely studies the common background of the blue license, therefore the license for the opposite background is left for us to review within the future. [4] differential morphology closing profile is employed to extract the vehicle mechanically from the traffic image. During this technique certain further operations has been applied as a locality of the algorithmic rule to attain high detection and quality rate. Result shows that this technique has a wonderful detection and quality proportion. This system is compared with alternative ancient image process based mostly strategies and therefore the results prove that this planned method provides higher results than ancient strategies. Proposed algorithmic rule works for ninety six true vehicle detection rate. Experimental result shows the relevance and therefore the superiority of this algorithmic rule. Additional inventions are required to effectively cut back the misclassification supported linguistics and geometric properties of roads and vehicles.

[5] The standardization of analysis works on Optical Character Recognition in Persian language. It describes the formations of a regular written information, together with isolated digits, isolated signs, multi-digit numbers, numerical strings, and communicating codes. Here binary pictures of seventy two, 180 samples were extracted from the designed forms. These forms are filled by one hundred eighty writers chosen from completely different age, gender, and job. Additionally a changed framing feature was projected and applied for handwriting recognition supported completely different databases. In future, the information are often dilated by aggregating additional information entry forms, and adding additional sets like Persian dates and communicating codes.

[6] In this paper initially the foreground objects are extracted from the surveillance videos. Then the proposed hierarchical multi-SVMs method is used for vehicle classification. Along with this a voting based correction scheme is presented by tracking the classified vehicles for final precision. In order to prove that the presented scheme is effective, the proposed method is tested under extensive different scenes. The results of SVMs approach is compared with BP neural method, to analyze the effectives of both the methods. The experimental results demonstrate that this new method can achieve effective results. Based on the proposed approach, a practical system for robust vehicle classification in the complex scenes is constructed. [7] Proposed: In this paper the license plate recognition is done using the integrated segmentation approach.Harris corner algorithm is proposed which helps in changing motions and illuminated lightning weather conditions. Identifying license plate is done using the segmentation technique, which is done by analyzing Pixel count,Aspect ratio and Height of characters.The algorithm performs proficiently for a given

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input image file. License plate detection was performed successfully through combined component analysis method for a better result.

[8] Proposed: This paper explains about License plate detection using Ostu's thresholding method. Vertical and horizontal histogram isused for segmentation of characters. The recognition of character is done by Probabilistic Neural Networks. The characters obtained from the image are stored to the database and stored as a training set and this set is used to develop a neural network. The success in the rate of character recognition can boost further the success rate of plate recognition. Finally the simulated results are tabulated using both plate and character recognition.[9] This paper explains about a two-dimensional Gabor filter. The parameters of the filter such as the orientation and the wavelengths are fuzzified to optimize the filter. Fuzzification of the wavelength results in greater selectivity. It is one of the most efficient ways of detecting and extracting the license plate from an image. The use of the filters provides a satisfactory result. This algorithm is resistant to "poor capture images". The Gabor filter using fuzzy logic efficiently detects the license plate with satisfactory results.[10] explains about detecting the license plate in hazardous conditions such as an image having foggy weather conditions,low contrast images,tilted license plate and images similar to license plate in the background. For each of these conditions a new method is proposed in this paper.It uses a novel method-statistical binarization method-radon transform method to overcome the hazardous conditions. The overall detection percentage for these techniques is 94%.However the proposed system has few limitations and can be improved by using more filtering criteria.

Many techniques has been proposed for Automatic Vehicle License Plate Recognition. The literature survey covers a wide varieties of techniques to analyze the vehicle images. This summary focuses on the main methods and concepts which has been repeatedly used. The plate region is extracted and predicted using ANN. For extraction of plate region Segmentation technique is used using Sliding Concentric Windows. A different morphological operations is used to extract the vehicle plate. The license plate extraction is also done using integrated segmentation approach which uses Harris corner algorithm. Another paper explains about license plate detection using Ostu's thresholding method where vertical and horizontal histograms is used for segmentation of characters. A two dimensional Gabor filter can also be used. Some paper explains about detecting the license plate under hazardous conditions such as foggy weather, low contrast images, tilted license plate and images similar to license plate in the background.

Pre processing:

The vehicle license plate recognition (VLPR) task is kind of difficult task from vehicle pictures owing to the view purpose changes, once vehicle bodies and license plate (LP) have similar color, multi-style plate formats, and therefore the non uniform out of doors illumination conditions throughout image acquisition. In this module initially blurred image of vehicle with license plate is uploaded. Then it is converted into gray scale image to locate the license plate region. Later from this image the noisy datas are removed and finally converted to binary image.

Gray scale convertion of image

Typical color pictures are delineate as red (R), green (G) and blue (B) or RGB pictures, however a grey scale image contains solely the brightness data however not color data. So as to enhance image process speed, input vehicle image (RGB) is regenerated to gray-level image.

Remove noisy data

Digital pictures are susceptible to a range of sorts of noise. Noise is that the results of errors within the image acquisition method that end in pixel values that don't replicate actuality intensities of the real image. Here median filtering is adopted to get rid of the noise. At first the value of the output pixel is set to the average of the pixel values within the neighbourhood pixels, instead of the mean.

Binary convertion of image

The obtained denoised image is inturn converted to binary image for better usage of reduced values such as 0's and 1's. From binary image the edge values can be easily identified.

Segmentation:

In this module from the binary image candidate region is extracted. Later in future steps the extracted candidate region is decomposed using position histogram and normalized candidate region is obtained. From normalized candidate region equal sized alphanumeric character images are obtained. Using segmentation technique named as sliding

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concentric windows (SCW) a new approach is being proposed to analyze road images which often contain vehicles image and extract license plate from those images by finding vertical and horizontal edges from vehicle region. During this step, morphological process such as dilation and erosion are used to obtain isolated image. From this image the candidate region is detected.

Recognition:
In this module the equal sized alphanumeric characters are trained using deep neural network to find the precise plate characters. The last phase in LPR system is to acknowledge the isolated characters. Once rending the extracted license plate into individual character pictures, the character in every image may be identified. There are several strategies accustomed to acknowledge isolated characters. During this deep neural network is enforced for recognition.

License number recognition
The splitted alphanumeric characters are compared with the trained datasets for matching the correct pattern of the character. Several iterations are performed to get accurate results. Deep neural network method is adopted to recognize the plate characters.

LP number extraction
LP numbers are extracted from training datasets, random weight between each connection from input layer to output layer is taken. The normalization factor is multiplied by "weight adjust". This process is repeated for all candidate characters .A pre-calculation is made to find a different output neuron which has maximum value for each input character. Suppose, the first character output neuron four gives maximum output and the second character output neuron three gives maximum output. A record for each character is maintained and the output neuron gives maximum value. As a result, the license plate description is obtained.

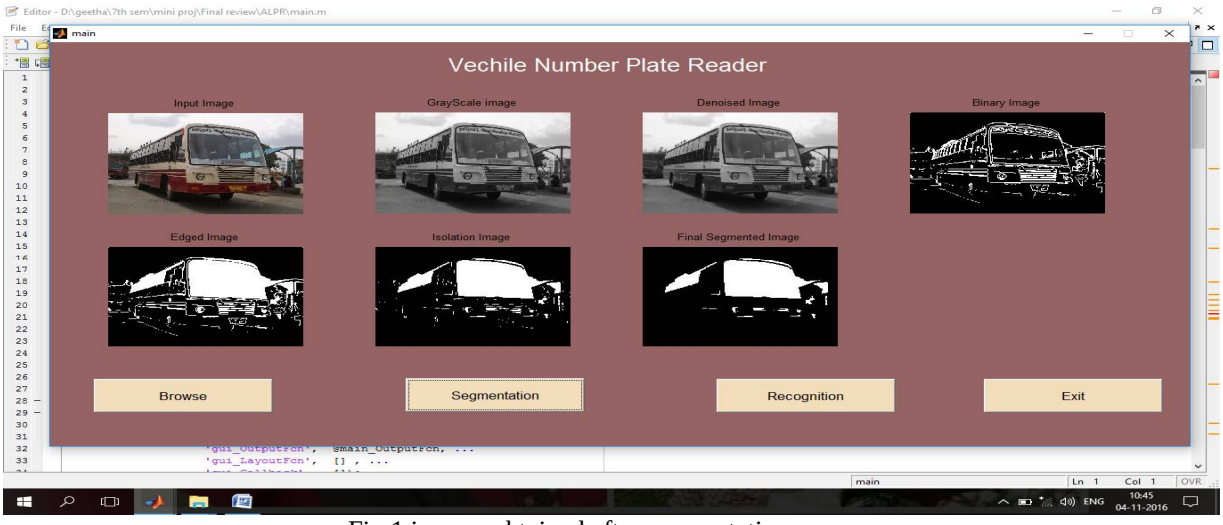

Fig 1 images obtained after segmentation process

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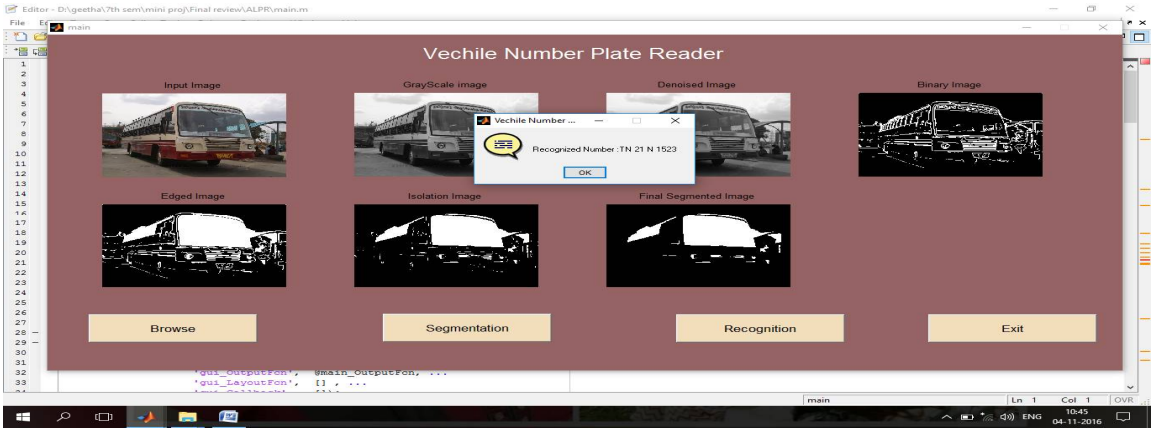

Fig 2 Extracting LP after recognition

III. DESIGN OF VEHICLE LICENSE PLATE RECOGNITION

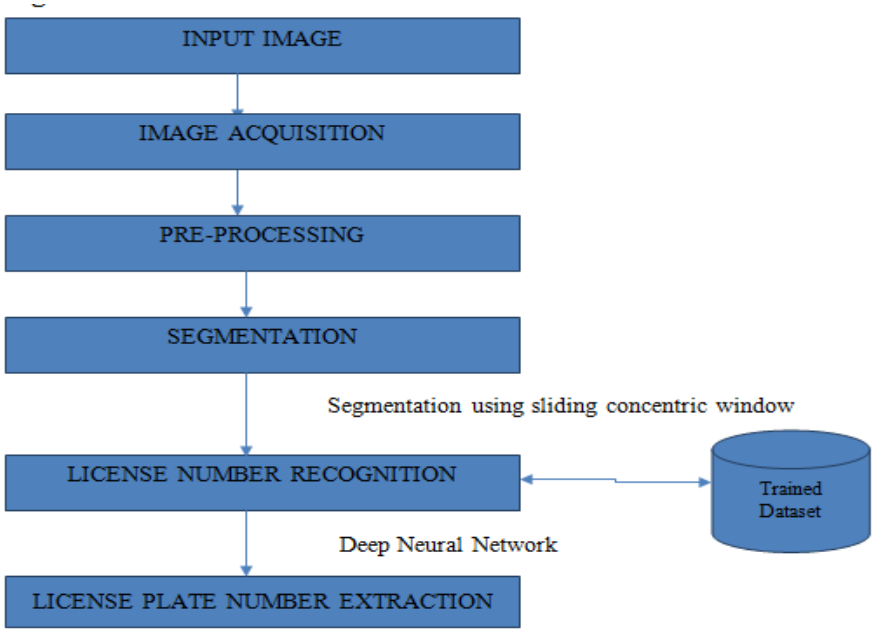

Fig 3 Proposed System

Segmentation Result:

Table 1 Time consumption for segmentation

Process	Average computation time(seconds)
Pre-processing	0.2
Gray-scale convertion	0.3
Binary convertion	0.3
Segmentation	0.5

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Table 2 Time consumption for segmentation

Process	Performance rate(%)
Pre-processing	99.2%
Gray-scale convertion	99%
Binary convertion	99%
Segmentation	96.5%

Table 3 Performance evaluation for segmentation

Table 4 Time consumption for recognition

Process	Average computation time(seconds)
Recognition of characters(DNN)	4.0
LP extraction	2.0

Table 5 Performance evaluation for recognition

Process	Performance rate(%)
Recognition of characters(DNN)	99%
LP extraction	98%

IV. CONCLUSION AND FUTURE WORK

An efficient less time consuming license plate recognition method is proposed which has been tested on various vehicle images and maximum accuracy on detecting license plate characters is obtained. In addition we also faced some difficulties during the experimenting such as License plate is broken,Too much complexity in image illumination,Number plate not within the legal specification., Characters with low resolution, Poor maintenance of the license plate and also It was difficult to recognize the characters namely, O and D; 5 and S; 8 and B, E; O and 0, etc. In future, the input image can be obtained from video and then used in our system to obtain the plate number. Also the input images can be captured from moving vehicle at varied speed using sensors and cameras. We can collect varied templates of characters from different language datasets. For example like Tamil character dataset, Telugu character dataset, Hindi character dataset , and so on. With the help of these varied datasets we can recognize the plate characters in different languages. We can also expand our system to identify the vehicle mode, type, and owner's information

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