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Comparative Study of Work Done in License Plate Recognition

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Abstract—*The Licence Plate Recognition system is plays a very important role in keeping a check on the criminal activities like vehicle theft, over speeding of vehicles, etc. LPR system is very beneficial in supporting for exposing, prevention and breaching culpability at a local, regional and national level. This also includes keeping a track on travelling criminals, organised crime groups, terrorists or any other kind of nuisance creating person or group. LPR system is also helpful in providing lines of enquiry and evidence in the criminal investigation and is used by law enforcement agencies throughout England, Wales, Scotland and Northern Ireland.*

Keywords*: License Plate Recognition, Optical Character Recognition, Image Processing*

1. INTRODUCTION

As a vehicle passes an ANPR camera, its registration number is read and instantly checked against database records of vehicles of interest. Police officers can intercept and stop a vehicle, check it for evidence and, where necessary, make arrests. A record for all vehicles passing by a camera is stored, including those for vehicles that are not known to be of interest at the time of the read that may in appropriate circumstances be accessed for investigative purposes. The use of ANPR in this way has proved to be important in the detection of many offences, including locating stolen vehicles, tackling uninsured vehicle use and solving cases of terrorism, major and organised crime. It also allows officers' attention to be drawn to offending vehicles whilst allowing law abiding drivers to go about their business unhindered.

2. LITERATURE REVIEW

1. Author-Chittode J S.Details- developed algorithm which is applied on the car park systems to monitor and manage parking services. Algorithm is developed on the basis of morphological operations and used for number plate recognition. Optical characters are used for the recognition of characters in number plate.
2. Author-Lekhana G.C. Details- developed an efficient real time on-line Number plate recognition system. NPR algorithm works in different steps firstly image acquisition, using fusion of spectral analysis characters are segmented and characters are recognized.
3. Author-Paunwala C.N. Details- proposed a methodology which finds ROI using morphological processing and directional segmentation. The ROI is the area which includes the number plate from which the alphanumeric characters are recognized. This method is tested on different databases which contain images.
4. Author-Singh M Details- developed an efficient approach works on opening and closing of morphological operations. Firstly localization of plate in image has been done then skew correction is been done for segmentation process of alphanumeric characters. Recognition is done on the basis of template matching.

3. VARIOUS TECHNIQUES USED FOR LICENSE PLATE DETECTION

1) This technique is a combination of an Image Segmentation technique of Sliding Windows and Character Recognition technique of neural network. It is responsible for the rapid discovery of the ROI. The setup was done in such a manner that the point of concentration of the camera was the number plate, which remained constant whereas the angle of view and the distance between the vehicle and the camera was variable.This procedure consists of two steps that include two concentric windows moving from the upper left corner of the image. In the next step, statistical measurements such as Standard Deviation and Mean Value are computed in both windows based on the Segmentation rule which states that, "if the ratio of the statistical measurements in two windows exceeds a threshold set by the user, then the central pixel of the windows is considered to belong to an ROI."The value of threshold is determined on the basis of trial and error method. The two concentric windows cease to slide after the whole image is scanned. The algorithm consists of following steps:
   - Two concentric windows namely A of size $(2X_1)$ x $(2Y_1)$ pixels and B of size $(2X_2)$ x $(2Y_2)$ pixels. For the first pixel of *the image in the upper left corner of the windows.*

- Then in the next step, image statistics are computed.

$$in\ I_1(x,y) \Rightarrow \begin{cases} I_{AND}(x,y)=0, & if\ \dfrac{M_B}{M_A} \le T \\ I_{AND}(x,y)=1, & if\ \dfrac{M_B}{M_A} > T \end{cases}$$

Where,

X and y → coordinates of the examined pixel

I_{AND} → resulting image

M → statistical measurement (mean/ SD)

X_1, X2, Y1, Y2 and I → can be updated according to the specific application

2) The second technique used for number plate detection is also a SCW based system. It was implemented on Korean license plates. This technique focuses on the one of the major problems of license plate detection i.e. tilt correction, as the number plates may appear different from different angles. The distance between the camera and the vehicle ranges from 3-7 meters.

   Initially, SCW is applied on the image of the license plate after that the HSI color model (Hue Saturation Intensity) is been used for the purpose of color verification. At last, the tilt is been corrected by applying the Least Square fitting with perpendicular offsets (LSFPO). In this, each rectangular candidate region is been rotated until and unless all the rectangular candidate regions are in the same manner as before the candidate decomposition.

   There are five steps involved in this method, they are as follows-

   - Detecting rectangular regions
   - Authenticating candidate regions color
   - Correcting tilt
   - Decomposition candidate
   - Recognition License Plate alphanumeric character

The input image (RGB) is been transformed into grey-level image so as to improve the pace of the image processing.

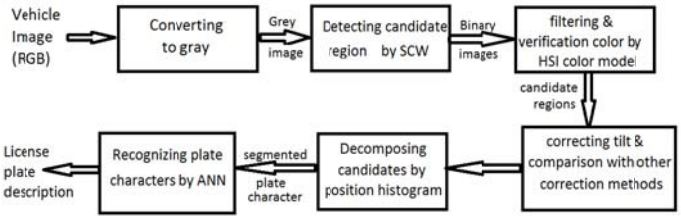

Fig. 2

The license plate candidate region is been fit into a straight line for the correction of tilt. The computation of tilt or rotation angle is been done after the line slope is achieved.

The angle α is the angle between the principal axis X and horizontal axis X' of the license plate region. Tilt correction is done by rotating the whole image in the horizontal direction by the angle α.

3) The basic objective behind this technique is for the identification of the characters in a non-standard license plate by the usage of pixel based segmentation algorithm. This makes it convenient to be exercised in different countries particularly in trans-border traffic.

   The technique performs in two parts- the first part specifies the peculiarities of the segmentation algorithm which is a four step procedure that includes- Median filtering: to remove the noise, Adaptive thresholding: for the binarization of the image using the Otsu's method, Component labelling and Region growing: for labelling the pixels according to their color value, Segmentation and Normalization: for the segmentation of the license plate of 15x15 pixel size. The Bounding Box method is used for the segmentation process.

The second part specifies the interactive building of the database for training which is optional. This is an option for re-training the Artificial Neural Network (ANN) according to the requirement for example, recognition of various fonts.

This technique was tested on 150 license plates from various countries and was found to be 91.56% of accuracy.

4) This technique involves Global edge features and local Haar-like features. The extraction and recognition is been done on real-time traffic videos.

   Global features contain Edge density and Edge density variable. Computation of these features is been done by the application of fixed size sample image whose scaling is done in the training phase i.e. 48x16.Haar like features comprises the digital images features generally used for the procedure of Object Segmentation. They are generally the collection of functions to identify the number of rectangles covering the adjoining image region.

   The detection is based on the scanning windows which moves around the vehicle image and distinguishes the license plate region from the non-license plate region based on the pre-defined classifiers. The training phase includes the construction of six cascade classifier layers with 160 features for future processing which uses Ada Boost algorithm. The testing phase includes the derivation of global edge features and local Haar-like features.The characters are derived by implementing an improved blob detection algorithm used for the removal of unwanted areas. The character recognition is carried out by using a modified open source OCR.This technique was carried out on a personal computer with Pentium 2.8 GHz CPU. The average processing time is 0.204 s. And the overall accuracy is 94.03%.

4. CONCLUSION

Automatic Number Plate Recognition has a wide range of applications since the license number is the primary, most widely accepted, human readable, mandatory identifier of motor vehicles. ANPR provides automated access of the content of the number plate for computer systems managing databases and processing information of vehicle movements.

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