License Plate Extraction and Recognition of Characters of a vehicle Using Sliding Window Technique

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ABSTRACT

This paper represents a algorithm to detect license plate and character recognition with various sizes of license plate and different distances between camera and vehicle with different backgrounds . Obtaining license number of a vehicle is an important task in many applications like automatic toll payment and in security applications. In this vertical edges are detected and edge density is calculated. Edge density and integral edge image are used to filter out candidate region. License plate is recognized using character segmentation and character recognition. The efficiency is improved by using integral edge image.

1.INTRODUCTION

License plate detection and character identification is used in many applications including identification of stolen vehicles, automatic toll payment and in some security applications. A license plate recognition system generally consists of three processing steps: license plate detection, character segmentation, character recognition. There are many factors that affect license plate recognition. License plate varies from country to country and images are captured under different illumination conditions. These images contains buildings, vehicles, trees e.t.c. and the distance between camera and the vehicle may vary. These factors made license plate detection as an important task.

The most common approaches to detect license plate are edge detection, morphological operation colour analysis. In [1], Robert's edge operator is used to detect vertical edges. A horizontal rank filter and the vertical projection are used to localize the license plate. The problem with edge-based methods are they are sensitive to back ground edges when it is a complex back ground. In [2], by removing back ground curves and noise, vertical edges can be used to localize license plate. In [3], the high- gradient averaging method is applied to remove back ground regions. In [4], edge detection and morphological operations are used to detect license plate.

Most of these methods work well under some working conditions. The restrictions in these methods are fixed distance between camera and vehicle, familiar back ground. This paper aims to develop a method which can detect a license plate of a moving vehicle in unfamiliar back ground.

2.PROPOSED SYSTEM

In this wiener algorithm, wiener filters are used to remove motion blur of the image. Median filters are used to remove noise in the image. A sliding window and conditions with adaptive threshold values are used to detect the license plates of various sizes. To ensure fast processing, two stage candidate window detection and features based on edge density are used. Edge density is the rectangular sum in edge map. In this integral edge map is calculated, introduced in [5].

The method for license plate detection and character recognition consists of removing motion blur, image preprocessing, coarse window detection,finewindowdetection,candidateverification, character segmentation and character recognition. These steps are illustrated in rest of the paper.

2.1To remove motion blur:

Motion blur is an ill-posed problem. The relative motion between camera and scene results in a blurred image in which high frequencies are lost. It is due to varying vehicle speed and dynamic change in back grounds. To remove motion blur a wiener

algorithm is used. Wiener filters and medium filters are used to remove the noise in the image caused due to motion blur.

2.2Pre processing:

Preprocessing is used to enhance the image prior to processing of the image. In this image is binarized as in [6]. License plate is an area containing rich edge and textural information. By using this property, sobel operator is used to detect vertical edges. Experiments show that by detecting only vertical edges accuracy of detection can be improved. Horizontal edges preserve minor edge information in the plate area. Vertical edge map is binarized using adaptive threshold based on mean value and standard deviation of pixel neighbourhood. Finally integral edge image I_1 is computed using following terms:

$$I_1(X,Y)=I_1(X-1,Y)+r_{sum}(X,Y) \quad (1)$$

where

$$r_{sum}=r_{sum}(X,Y)+e(X,Y) \quad (2)$$

In this r_{sum} is the cumulative row sum, e(X,Y) is the binary edge map,$I_1(X,Y)$ is the integral edge image.

2.3Coarse window detection:

In coarse window detection, a sliding window and edge density conditions are used to detect the license plate location. These conditions used adaptive threshold values to detect license plate of various sizes. This is because of the nature of edge density that decreases by increasing license plate size. The edge density is defined as:

$$ed=\frac{1}{w\times h}\sum_{x=1}^{w}\sum_{y=1}^{h}e(x,y) \quad (3)$$

Where ed is edge density, w and h are width and height of the image. The required small portion is marked on the image and the marked areas are further examined by a complex algorithm described in next section.

First, the window is set to minimum size and moved through out the image. At each position the edge density is computed using I_1

$$ed_{int}=I_1(Xmax,Ymax)-I_1(Xmax,Ymin)-I_1(Xmin,Ymax)+I_1(Xmin,Ymax) \quad (4)$$

Where Xmin,Xmax,Ymin,Ymax are boundary coordinates of window. For every time if the edge density is larger than threshold then the window is marked. This process repeats until the window size reaches maximum.

2.4 Fine window detection :

After the coarse window detection there are again some background regions which are similar to edge density of license plate. To distinguish them from license plate we use the property that the edges of license plate are uniformly distributed and are high compared to license plate height. By using this property, the edges are analysed and the edges with small height and edges larger than current window are removed. As these parameters depend on window size these are to be executed every time when the window size is changed. In next iteration the window size is increased and edge analysis is performed again. After this integral edge image I_2 is computed. After the window height is set and analysis is performed the window is moved through the image. At each position the conditions are evaluated and the window is saved if it satisfies all conditions. Window edge density is calculated in I_1 and I_2 and is tested between maximum and minimum threshold values. First the window is divided into four sub windows and minimum edge density in I_2 is checked. Then the window is divided into smaller vertical and horizontal sub windows and the number of sub windows with edge density higher than the threshold is computed. The window is removed if the number is smaller than the threshold value. This condition aims to remove inaccurate windows. There are some objects like head lights edges are present, so to remove this vertical and horizontal sliding windows are used.

2.5 Candidate verification

In this, there are again some patterns which are similar to license plate are removed. License plates have relatively uniform size and shape. By using this, the candidate areas which do not satisfy below conditions are removed.

$$2.2\leq\frac{bw}{bh}\leq 6.2 \quad (5)$$

$$\frac{bw\times bh}{area}\leq 1.2 \quad (6)$$

where bw is bounding box width, bh is the bounding box height and area is the number of pixels in candidate area

.

2.6 Character segmentation and Character Recognition:

Character segmentation is the procedure of extracting the characters and numbers from the license plate image. Different aspects make the character segmentation task difficult like image noise, plate frame, space mark and light variance. The approach for character segmentation used in this paper is based on thresholding and connected component analysis, introduced in[8].

After segmentation the characters are to be recognized. The character recognition gives license plate recognition. In this the characters are recognized by using pixel values in the segment and are compared with the database. After recognizing that character, it goes to second segment and so on up to last one. This gives license plate recognition.

3.CONCLUSIONS

A method for license plate detection and obtaining license plate number is presented in this paper. In this, the motion blur is removed by using wiener algorithm. Then the vertical edges are obtained by using sobel operator. Then the license plate is detected by using sliding window technique based on edge density and integral edge image. Finally, candidates are verified using geometrical and textural properties and license plate number is obtained.

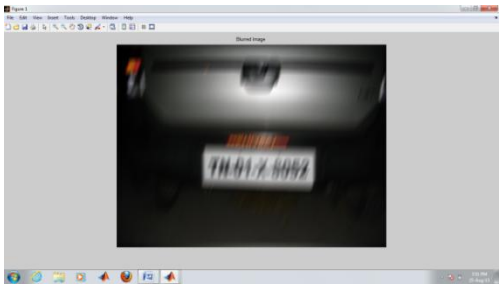

Fig 1.Input image

Fig 2. After removing motion blur

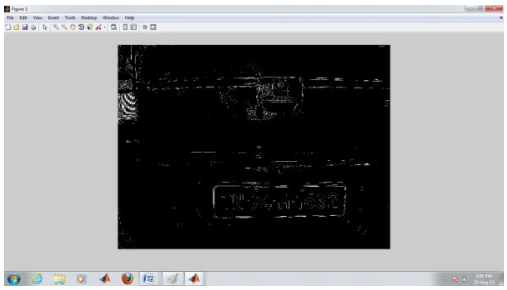

Fig 3.preprocessing

Fig 4

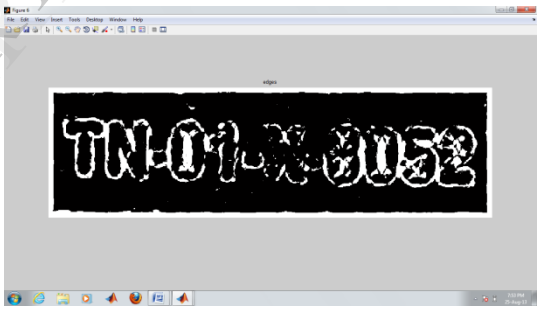

Fig 5.

Fig 4.&5 coarse window detection and fine window detection, edges of license plate.

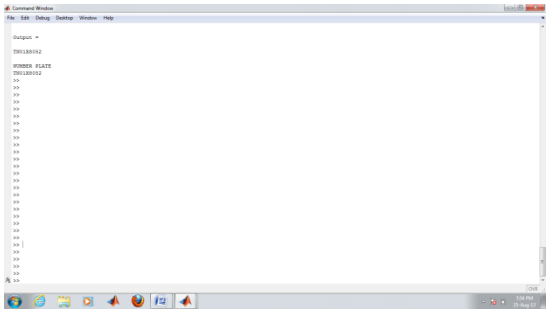

Fig 5.License plate number

To test the ability to detect different license plates at different distances between camera and the vehicle, few images are taken and processed.

TABLE.1

Experiment	Number of Samples	License plate Extraction	License plate Recognition
1	20	19	18
2	10	10	9

From this we say the accuracy is given for license plate extraction is 96.67% and for license plate recognition 90%.It is tabulated as below.

TABLE.2

Algorithm	License plate Extraction	License plate Recognition
[7]	95%	----------
Proposed	96.67%	90%

This table gives the comparison between the method [7] and the method proposed.

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