License Plate Detection and Recognition SystemforCharacter-Specific Region

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ABSTRACT

License Plate detection (LPD) is very challenging and it plays an important role in the field of Intelligent Transportation System (ITS). Stickers or advertisements on the vehicle have become common nowadays and hence it has become difficult to identify the license plate of the vehicles. This paper proposes a method thatclassifies the input image to clean, medium or dirty based on the HOG features and applies adaptive threshold based on the type of image to detect the license plate region from other character candidate regions.

Index Terms: License Plate Detection, Adaptive thresholding, Optical character recognition

I.INTRODUCTION

Rapid growth in automobiles has also increased traffic problems. For example, running the red light, car theft, speeding, etc. Due to these traffic control problems, vehicle tracking, recognition and management have become major topics of the modern traffic control system. License Plate Recognition Systems makes use of the concept called optical character recognition to read and fetch the characters on a vehicle license plate. That is, the License Plate Recognition System takes the image of a vehicle as the input and outputs the characters written on its license plate.

License Plate Recognition (LPR) is a computer vision method which is used to identify vehicles by their license plates. Recently, LPR has been widely used as a core technology for security or traffic applications such as traffic surveillance, parking lot access control, and information management. LPR also called as ALPR (Automatic License Plate Recognition) has 3 major stages.
*License Plate Detection***:** This is the most important stage of the system. The position of the license plate is determined during this stage. The input for this stage is an image of the vehicle and the output is the license plate.
*Character Segmentation***:** The characters on the license plate are mapped out and segmented into individual images at this stage.
Character Recognition: The characters segmented in the above stage are identified here.

Each of the above stages plays an important role in the final accuracy. Many problems such as size variations, viewing angle, low contrast plates, vehicles high speed and time-consuming algorithms have prevented researchers from introducing a single class of algorithms to solve the problem. There have been, however, many algorithms proposed for each part.

This paper focuses on detecting the License plate from a vehicle which has a number of stickers on it. The rest of the paper is organized as follows. The related work is mentioned in section II. Proposed System isexplained in section III. Results are presented in section IV. Concluding remarks are given in section V.

II. RELATED WORK

[1] This paper proposed a method to detect license plate in complex scenes. To achieve this, first, histogram equalization is applied to the image and then the plate-like region is enhanced. A multi-layer method is proposed to identify license plate box, using Sobel operator, 2D Gaussian filter and morphological operators to find candidate region(s) for LPD, and a mixture of Gaussian function and Bayesian network to identify true plate region is used. But it failed to detect low contrast plates and plate was not detected properly if there was any other character region. [2] proposed a method based on deep learning model. Compared with other LPD methods, the proposed method is more robust and can detect license plate in various environments quickly. But fails to detect plates from images with bad illumination condition. [3] increased the detection ratio from 91.09% to 96.62% while decreasing the run time from 672 ms to 42 ms for the processing of an image with a resolution of 1082×728.This approach could not detect the plates when there is reflective glare. [4] Riesz fractional model enhanced the license plate image quality and improved the performances of license plate detection and recognition.The proposed recognition method reports poor results compared to license plate detection.

III.PROPOSED SYSTEM

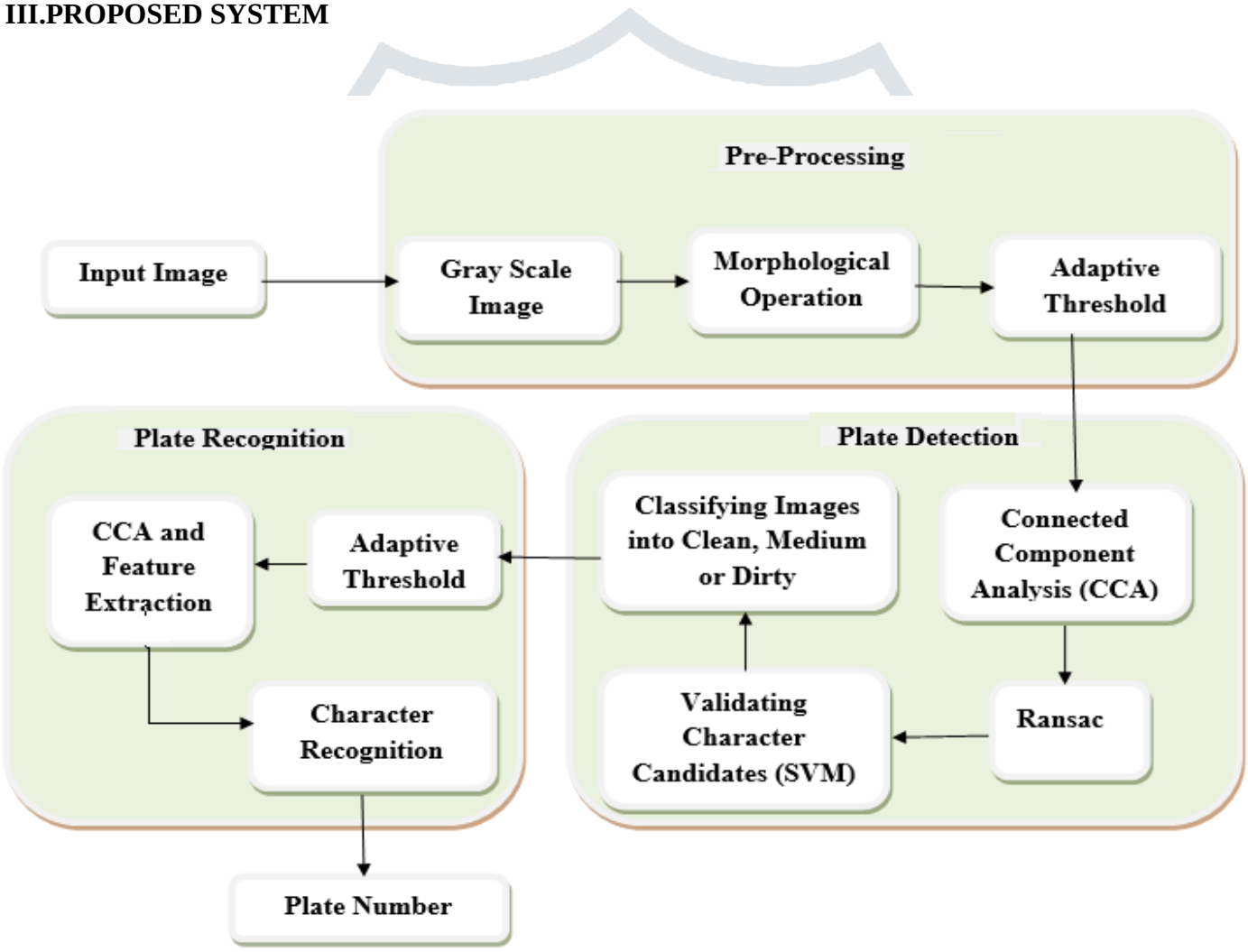

Fig. 1.1: Architecture

The proposed system is developed in 3 stages.

A. Pre-processing
B. Plate Detection
C. Plate Recognition

A. ***Pre-Processing:*** The colour input image is converted to a grayscale image as colour is not a discriminative feature in identifying the vehicles license plate. It involves the following processes:

1. RGB to Grayscale conversion.
2. Adaptive Thresholding

1. RGB to Grayscale conversion:

Convert input image to grayscale image: Converts the color image (RGB) to the grayscale intensity image. The rgb2gray function is used which converts RGB images to grayscale. This function eliminates the hue and saturation information and retains the luminance.

2. Adaptive Thresholding:

Adaptive thresholding calculates the threshold value for smaller regions. Hence there will be different threshold values for different regions. It takes a color image or a grayscale image as its input and, outputs a binary image representing the segmentation. For each pixel in the image, a threshold is calculated. If the pixel value is below the threshold it is set to the background value otherwise, it is set to the foreground value.

B. ***Plate Detection:***This stage involves the following processes:

1. Connected Component Analysis.
2. Ransac.
3. Support Vector Machine.
4. Adaptive Thresholding based on the type of image

1. Connected Component Analysis:

MATLAB **bwconncomp** method is used to find connected components in the binary image.
CC = bwconncomp(BW) function returns the connected components found in the binary image. The binary image can have any dimension. CC is a structure with four fields.
For example, the output for one image would be as follows. sss

```
CC =  Connectivity: 8
      ImageSize : [120 150]
      NumObjects: 1
      PixelIdxList: {[2478x1 double]}
```

2. RANSAC:

Random sample consensus, or RANSAC, is an iterative method which estimates a mathematical model from a data set that contains outliers. This algorithm works by identifying the outliers in a data set and gives an output that does not contain the outliers.

3. Support Vector Machine

Support-vector machines (SVMs), used for classification and regression analysis are supervised learning models with associated learning algorithms that analyse data. SVM training algorithm builds a model that will assign new examples to one of the two categories, making it a binary linear classifier, given a set of training examples, each belonging to one or the other of two categories.

HOG feature is used to train the SVM classifier. HOG feature vectors are extracted from the training images. Hence, it is important to make sure that the HOG feature vector encodes the right amount of information about the object. Visualization output is returned by the extractHOGFeatures function. The training data is placed in different folders whose name is taken as the label. The input image is then classified as clean, medium or dirty.

4. *Adaptive Thresholding and CCA based on Type of Image*

Based on the type of image, Adaptive thresholding and connected component analysis are performed again. The region that has the maximum intensity and maximum area is considered as the license plate. The plate region is then segmented for plate recognition.

C. *Plate Recognition*: The segmented plate is subject to pre-processing and then the following steps are performed**:**

- Segmentation and creation of bounding box and normalization: After pre-processing the input image, the input image is converted with 'background color to Black, and foreground color to White' for further analysis and later, it is normalized.
- Feature extraction based on 'number of connected components': CCA is performed on this image. Based on the number of connected components, the character is recognized by using OCR.

IV.RESULTS

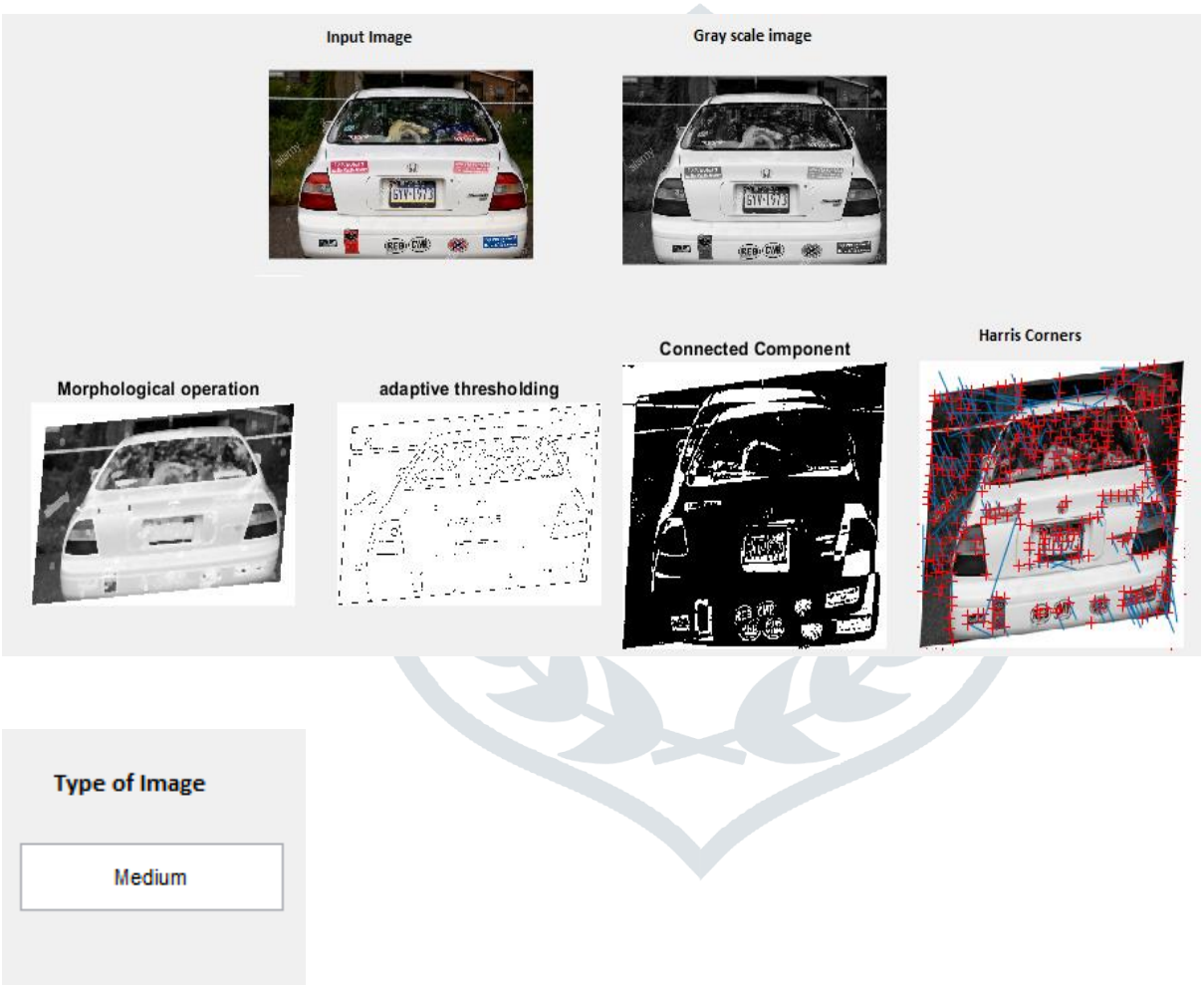

Fig.2: Pre-processing and Classifying the image

Fig.3: Adaptive Threshold Based on Type of Image

Fig.4: Plate Detection

Fig.5: Plate Segmentation

Fig.6: Character Recognition

V.CONCLUSION

This paper proposes a method in which the input image is classified as clean, medium or dirty and based on the type of image, the corresponding threshold is applied to detect the plate region. The license plate area is detected correctly from other character candidate regions. Also, if the image is dirty or low contrast image, then the system will identify all the possible characters from the license plate area and hence the system does not fail.

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