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A Model for License Plate Recognition

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Abstract-License plate recognition (LPR) plays an important role in various applications like transportation systems, traffic monitoring, and detection of stolen vehicles, driver navigation support or any statistical research. A number of methods have been proposed, but only for particular cases and working under constraints (like fixed illumination, limited vehicle speed, designated routes, and stationary backgrounds). This paper presents a robust model of license plate recognition that uses optical character recognition on images to read vehicle registration plates. The software aspect of the system runs on standard home computer hardware and can be linked to other applications or databases. It first uses a series of image manipulation techniques to detect, normalize and enhance the image of the number plate, and then optical character recognition (OCR) to extract the alpha-numeric of the license plate.

Keyword-license plate recognition, LPR, model LPR, number plate detection, Automatic LPR.

I. INTRODUCTION

License plate recognition is a mass surveillance method that uses optical character recognition on images to read vehicle registration plates. They can use existing closed circuit television or road-rule enforcement cameras, or ones specifically designed for the task. Most previous works have in some way restricted their working conditions, such as limiting them to indoor scenes, stationary backgrounds, fixed illumination, prescribed driveways, limited vehicle speeds, or designated ranges of the distance between camera and vehicle.

A. Related Works

An license plate detection system using Viola-Jones [8] object detector is proposed by Limberger et al. [1] It verifies each frame of the input video for the license plate region and tracks the license plate using Kalman filter After the license plate detection license plate area is given as input to an OCR. In the work of Jia et al. [3] color images were segmented by the Mean-Shift algorithm into candidate regions and subsequently classified as number plate or not. The AdaBoost algorithm used by Dlagnekov and Belongie for license plate detection on low resolution video frames in comparison. In other approach, Shapiro et al. [13] use a combination of edge detection and vertical pixel projection for the license plate detection module. Yun-Chung Chung et al [2] proposed an approach in which, the license plates are detected using the color edge method and uses fuzzy training for the detection. Matas and Zimmermann [4] proposed a different approach for the localization of license plates. Instead of using properties of the plate directly, the algorithm tries to find all character in the image. This is achieved by using a region based approach. Regions are enumerated due to a region descriptor using a neural network. If a linear combination of character-like regions is found, the presence of a whole license plate is assumed. A detailed survey on automatic license plate detection techniques from still images and video sequences can be found in [7]. A more recent survey on state of the art techniques for license plate detection can be seen in [9]. Most of the approaches work only under restricted conditions such as fixed illumination, limited vehicle speed, designated routes, and stationary backgrounds, etc. Processing time, computational power, and recognition rate, etc are the other issues concerned with various ANPR techniques.
The aim of this study is to lessen many of these restrictions.

B. Application

LPR systems may also be used for/by:
Section control, to measure average vehicle speed over longer distances.
Border crossings

Automobile repossessions
Petrol stations to log when a motorist drives away without paying for their fuel.
A marketing tool to log patterns of use
Targeted advertising, a-la "Minority Report"-style billboards
Traffic management systems, which determine traffic flow using the time it takes vehicles to pass two LPR sites
Analyses of travel behavior (route choice, origin-destination etc.) for transport planning purposes
Drive through Customer Recognition, to automatically recognize customers based on their license plate and offer them the items they ordered the last time they used the service.
To assist visitor management systems in recognizing guest vehicles.
Police and Auxiliary Police
Car parking companies
Hotels

II. METHODOLOGY

The software aspect of the system runs on standard home computer hardware and can be linked to other applications or databases. In fig.1, we can see the steps involved in process, It first uses a series of image manipulation techniques to detect, normalize and enhance the image of the number plate, and then optical character recognition (OCR) to extract the alpha-numeric of the license plate. LPR systems are generally deployed in one of two basic approaches: one allows for the entire process to be performed at the lane location in real-time and the other transmits all the images from many lanes to a remote computer location and performs the OCR process there at some later point in time. When done at the lane site, the information captured of the plate alphanumeric, date-time explaining, lane identification, and any other information required is completed in approximately 250 milliseconds. This information can easily be transmitted to a remote computer for further processing if necessary, or stored at the lane for later retrieval.

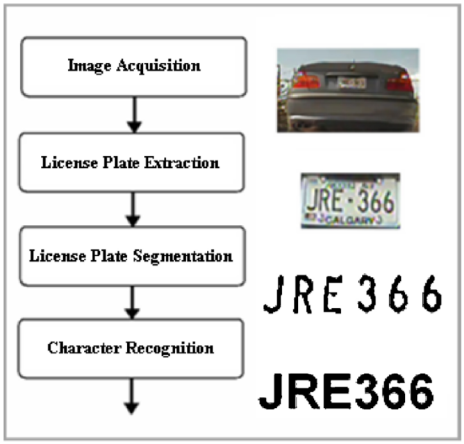

fig.1 An approach for LPR system

A. Algorithm

There are seven primary algorithms that the software requires for identifying a license plate:

1) Plate localization – responsible for finding and isolating the plate on the picture.
2) Plate orientation and sizing – compensates for the skew of the plate and adjusts the dimensions to the required size.
3) Normalization – adjusts the contrast and brightness of the image.
4) Character segmentation – Searches the individual characters on the plates.
5) Optical character recognition- matches the character
6) Syntactical/Geometrical analysis – check characters and positions against country-specific rules.
7) The averaging of the recognized value over multiple fields/images to produce a more reliable image

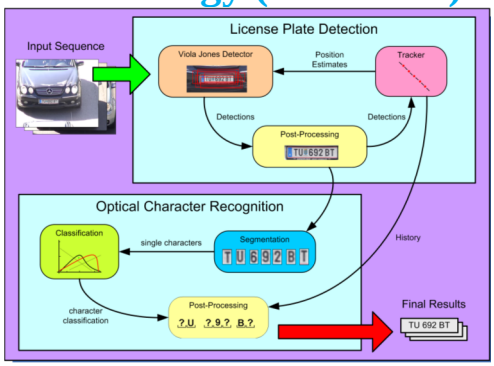

Fig.2 working of a model (LPR system)

B. Functions

The matlab code does two basic functions.
Detecting the license plate area

Recognizing the characters from the plate.

Code functions

The code contains following 7 scripts and functions:

- Writecarnumber.m
- Recar.m
- Locatplat.m
- Ocr2.m
- Create_templates.m
- Read_letter.m
- Lines.m

The main program ‘writecarnumber.m’ does the initial conditioning of the environment by closing all previously open windows and clearing all variables.
Also in calls ‘recar.m’ for further operation.
The function ‘recar.m’ creates the UI for taking the input image. And gives the
user provided ‘,jpg’ file to ‘locatplat.m’. it also gives the picture of license plate to ‘ocr2.m’ for character recognition.
The function ‘locatplat.m’ takes the image from ‘recar.m’ and applies basic morphological transform on it. Then it examines all the possible license plate candidates and gives the image of license plate back to ‘recar,m’.
The function ‘ocr2.m’ takes the input license image from ‘recar.m’, recognizes all the characters and then gives its output in ‘.txt’ file. It does so with the help of ‘lines.m’ and ‘read_letter.m’.
The function ‘create_templates.m’ creates character templates for comparison and detection.
The function ‘lines.m’ detects all the character candidates in the image.
The function ‘read_letter.m’ identifies the characters and returns it back to ‘ocr2.m’.

III. IMPLEMENTATION AND RESULT

The images were taken by an apple 5 phone. These are the vehicles parked in parking area of Gateway College of engineering. Originally images were taken with a 4128*3096 (13m) aspect ratio. But then pre-processed and resized to an aspect ratio of 640*480 for faster processing without any loss of information.
Here is an example of running of the project.
The code asks for the image of the vehicle.
In the matlab when we start running the program it will ask to upload a image (an input image) for processing, the main program ‘writecarnumber.m’ does the initial conditioning of the environment by closing all previously open windows and clearing all variables

An image is selected which is shown in a window.

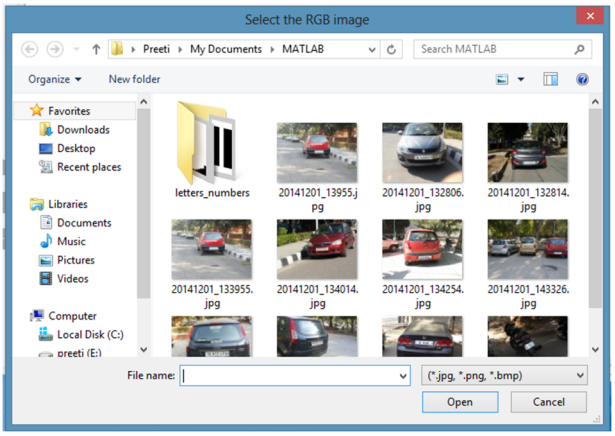

Fig.3 Selection of the image

we already have loaded some captured image to the matlab which will be shown as options in window screen. Among the various images we select an image of car(fig 4). The function 'recar.m' creates the UI for taking the input image and gives the user provided ',jpg' file to 'locatplat.m'.

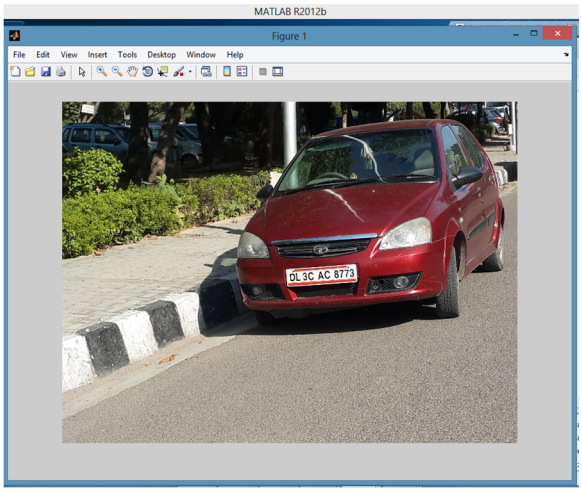

Fig.4 Input image

A license plate is detected and displayed.

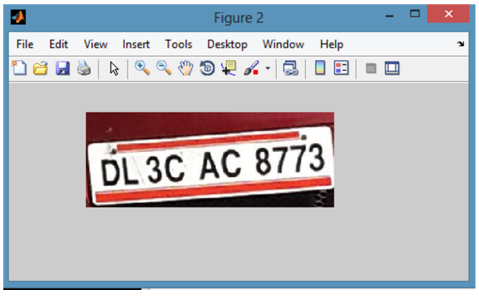

Fig.5 Extracted license plate

The extracted part of image, fig 5 from the complete image of car. The function 'ocr2.m' takes the input license image (fig 4) from 'recar.m', recognizes all the characters and then gives its output in '.txt' file (fig 5). It does so with the help of 'lines.m' and

'read_letter.m'. Finaaly, we have the desired part of image for further processing.

The license plate number is displayed in a .txt file

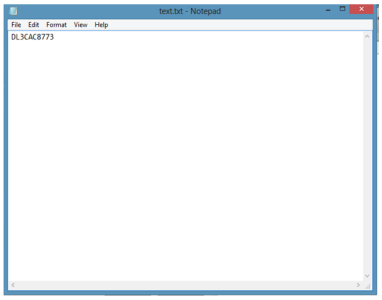

Fig.6 License plate displayed as text

The function 'lines.m' detects all the character candidates in the image and give the output as a text file, which shows on window screen.

IV. CONCLUSION AND FUTURE WORK

A. *Success Rate Of Model*

The matlab code runs fine as expected.
The license plate recognition part with success rate of 0.9.
The OCR part has success rate of 0.8.
The overall success rate is 0.72

B. *Advantages Of Model*

It is a static algorithm so it does not require implementation time training. Its run time is lesser than the other earlier proposed methods. However, due to lack of training, there is no way for the program to be adaptive in nature according to the scenario.

C. *Case Of Failures*

The code fails in the following cases:
When the image has a more whiter portion than the license plate
When the characters are skewed in format.
Inappropriate lightning conditions.
Hence although the code is good for academic purpose, it still is not fit for commercial use and hence it needs further improvement. Also some learning process may also be involved to improve the success rate above the limit of simple morphological processes. These issues are to be dealt in our future work.

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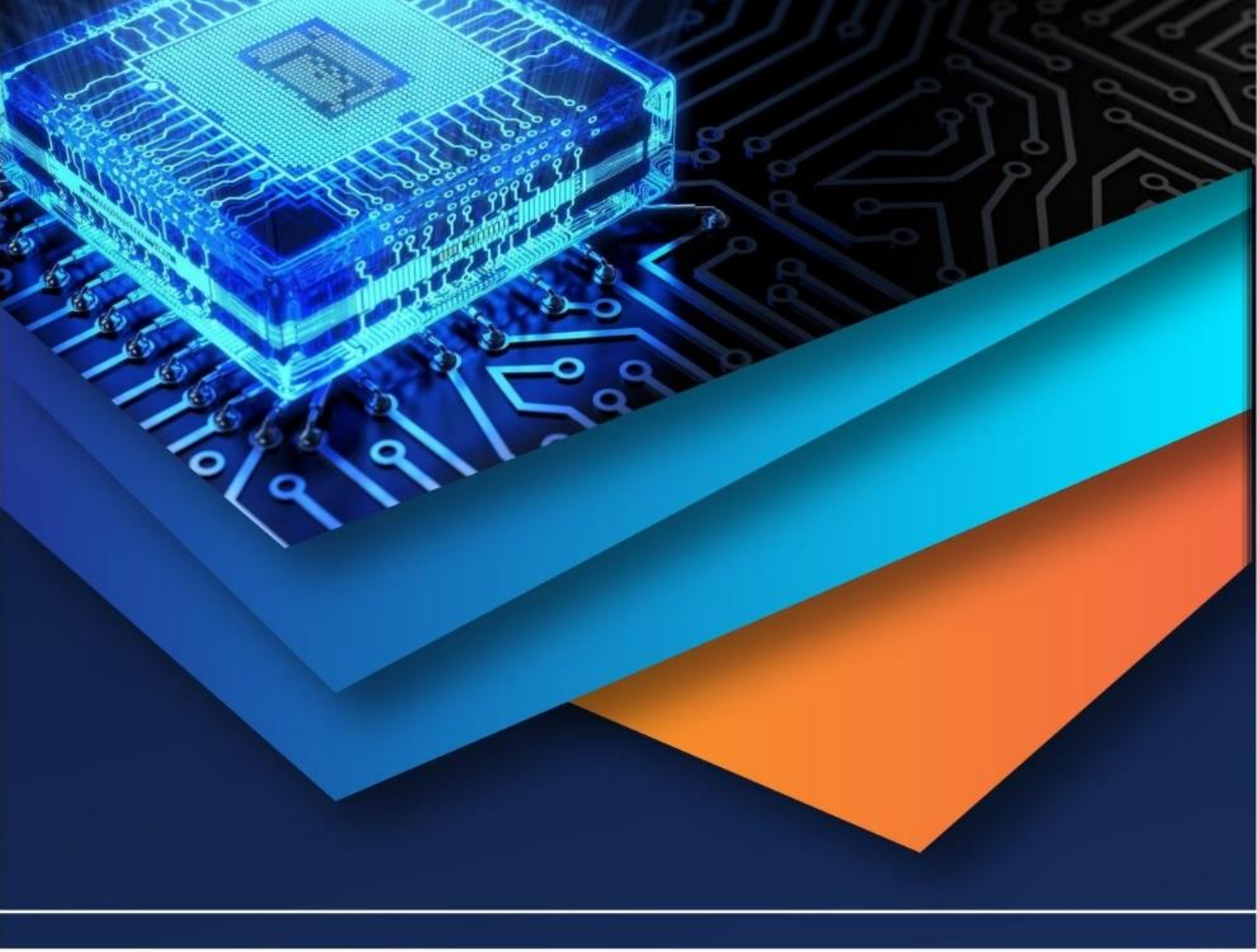

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