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Optical Character Recognition (OCR) based Vehicle's License Plate Recognition System Using Python and OpenCV

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***Abstract*—License Platform Detection is a computer technology that enables us to identify digital images on the platform automatically. Different operations are covered in this system, such as imaging, number pad locations, alphanumeric character truncation and OCR. The final objective of the system is to construct and create efficient image processing procedures and techniques to position a licensing platter on the Open Computer View Library picture. It was used and implemented the K-NN algorithm and python programming language. The technology can be used in different industries such as security, highway speed detection, lighting violations, manuscript documents, automatic charging system, etc. Auto plate recognition is an integrated technology which identifies the auto licence plate. Auto plate auto recognition. Multiple applications include complex safety systems, public spaces, parking and urban traffic control. Automatic Vehicle License Plate Recognition (AVLPR) has undesirable aspects because of many effects, such as light and speed. This work presents an alternative technique to leverage free software for the implementation of AVLPR systems including Python and the Open Computer Vision (openCV).**

***Index Terms*—License plate, Computer vision, Optical Character Recognition (OCR), Image processing , Python programming.**

I. Introduction

Computer vision is certainly one of the most popular applications when we talk about AI. Hype aside, we were ever captivated by it since it is the most significant organ of human sense that concerns the human sight [8] [22]. We found plenty of computer vision projects with people's faces and/or bodies. As a result, we have decided to instead undertake a project on auto registration plates [9] [6]. Another reason why we've worked on this topic is that it makes it possible to recognize, extract and display the license plate number, immediately after detection of the license plate, in the usage of Optical Character Recognition (OCR) [7] [3]. Today's magical science deploys research in smart transport systems that touch the lives of humans greatly. The AVLPR is a computerized vision system that detect car numeric plate from images [27] [13]. All standard AVLPR systems involve proprietary technologies and are therefore pricey to implement. People from many groups interact to discover solutions to hu-man problems never ending in a diversified setting. Python is one of the leading contributors to this scientific realm by the open source community [21] [11]. Intel's Computer Vision research bores fruit, the Open Computer Vision (openCV) library that supports the growth of computer vision.

The recognition of the number plate is done via the uploading of photographs from the front or back of a vehicle and then the processing of the image for the iden-tification of the vehicle license plate [20] [18]. There are three primary phases such as: First of all, the identification and location of a number plate in this segment improves the visuals of the scene throughout the processing [1] [5]. The second step is to separate the character segmentation characters from the detected numeric plates in order to retain the useful information for future processing [19] [14]. In the third step the text is translated into encoded text data using OCR.

A. Problem Statement

This project aims at the development and development of smart and novel architectures for automated platform ANPR recovery by a high definition (HD) and real time operator.

II. Related Work

S.Uma et. al [23] proposed a "Implementation of License Plate Recognition System in ARM Cortex A8 Board". This paper provides a process of implementation for the detection of

license plates. Author J. Jameson et al [12] "Multiple Frames Combination Versus Single Frame Super Resolution Methods for CCTV Forensic Interpretation". The methodology is the functionality of the camera is discussed to interpret in super-resolution frame [2]. Zotova et al [30] developed a technology "Image registration methods: a survey". This paper provides a technique for the registration of images that can be detected at the time of supervision. Author S. C. Park et al [17] developed "Super-resolution image reconstruction: a technical overview". This paper is discussed about construction and formation of an image in good resolution [15]. P. Vandewalle et al [24] proposed a method "A frequency domain approach to registration of aliased images with application to super-resolution". The processing of the formation of a captured image created with a super-resolution. Author Nobuyuki Otsu et al [16] proposed a methodology "A threshold selection method from gray-level histograms". It provides a platform for the study of a histogram. Y. Zhu et al [29] proposed a model "Unpaired image-to-image translation using cycle-consistent adversarial networks". So this paper provides a methodology for number plate detection in adversarial networks. N.Vishwanath et al [25] described a technique "Connected Component Analysis for Indian License Plate Infra-Red and Color Image Character Segmentation". The process of character segmentation is performed from the license plate through analysis of the component. Author Ragini Bhat et al [4] proposed a technique "Recognition of vehicle number plate". This paper provides a method and properly implements it for the detection of number plates at the time of driving [10].

III. Proposed System

The project algorithm is created specifically to recognize the vehicle licence plates. First and foremost, the system has to train and validate and repeat this procedure on certain data acquired on the number plate. If the machine is successful, further pro-cessing will occur. The system input is the acquired picture of a licence platform number of a vehicle. The picture is shot at 2/3 feet distant. This image is processed by the Platinum Extractor (NPE), which gives the segmentation section its output. Seg-mentation phase takes the extracted plate region and processes it further, separates the picture characters and saves the data for each character in a row matrix. The reconnaissance portion ultimately identifies the characters via the neural network training and resulted in the plate number which is depicted in Figure 1. This proposed system shows that the license plate image is captured by a camera which is processed in the following ways such as: a. First of all, the captured image is uploaded into Pycharm IDE which is forwarded to the section of image processing. b. In the second phase, the image processing unit is processed their functions by using the "imutils" library tool. c. In the third phase, the license plate detection and segmentation are performed through the function "findControus()" of the "imutils" library. This phase has just segmented the area of the number plate. d. Thus in the last phase, the characters are extracted from the detected number plate by using the "pytesseract" tool which provides scope for optical character recognition. So it will read or recognize the text embedded in the number plate. We can use several models to depict the system in various ways such as:

• We model the context or the surroundings of the system from an external per-spective. In an interaction perspective, we shape the connections between the subsystem the elements.
• And we model the system's dynamic behavior from a behavioral standpoint and how it answers events.

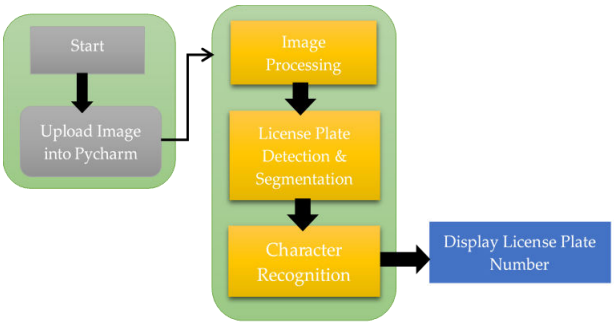

Fig. 1. Proposed system for license plate recognition

A. The Input Image

The number plate of the car is recorded using a high-resolution camera. The resolution of the plate recognition system varies depending on which image you click. As a result, the RGB image must be converted to a grey scale image.

B. Pre-Processing

Before the processing is a collection of techniques that enhance image to make the grey image a binary picture. The image is treated to decrease noise before converting into a binary image. The threshold algorithm may be used for pre-processing.

C. Localization of Number Plate

The licensing platform is extracted by either a form inspection or a color sample selection. The General License Panel is a rectangle shaped and so the algorithms are rectangular [28]. Our country's main licensing plate is white or yellow; colour analyses can therefore also be employed. You must either have a binary image size or know the boundaries of the image before you find the rectangle in the snapshot. Then we must find out and link to the relevant rectangular corners [26]. All areas linked to the rectangle are joined in the last phase and all rectangular areas are removed.

D. Architecture

Test scenario of proposed model represent in Figure 2.

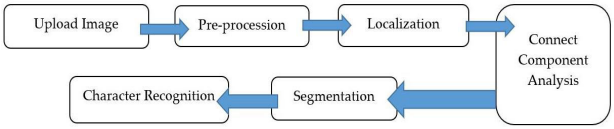

Fig. 2. Test scenario of proposed model

IV. Methodology

In the proposed paper is implemented by using various methods for detecting number plate. So these methods are discussed below:

A. OS - Windows 10:

Windows 10 is a major arrival of the Microsoft-built Windows NT operating frame. The product was supplied almost two years earlier, was supplied on July 15^{th} 2015, and was delivered extensively for the populace on July 29^{th} 2015. It is a substitute of Windows 8.1. Recognized improvements in packaged Windows 10 programming over Windows 8.1, the Xbox Live mix, as well as Cortana's usability and capabilities on the right and Web Pilgrim's removal by Microsoft Edge.

B. IDE PyCharm:

PyCharm is an Integrated Development Environment (IDE) that is expressly used in the Python language for computer programming. The Czech company JetBrains developed it (once in the past known as IntelliJ). It provides code analysis, a graphic debugger, an integrated unit tester, VCS integration and supports Django Web development similar like Anaconda's Information Science. The cross platform PyCharm is available with versions/variants Windows, MacOS and Linux. So it is shown in Figure 3.

C. Database - SQLite3:

C library programming contains the SQLite relational database system. In contrast to many other DBMS, SQLite is not a client-server database engine and is integrated into the end-user app.

D. Front End - Tesseract:

Between 1984 and 1994, HP created and released free software OCR Tesseract in 2005. UNLV (1995) has introduced Tesseract and is currently developing Google's Annual Test OCR Accuracy, published under its Apache license. Now up to 6 lan-guages can be recognized and UTF8 can be fully used.

E. Back End - Python:

An interpreted high-level programming language which provides constructs that help programming on both small as well as the large scales. It is meant to be an easily readable language which is comparatively easier to practice compared to the other languages. Python helps writing programs in less time than in the other languages in Figure 3. By using the above IDE to designing python code for an adaptive way to detecting number plate, that is performed through importing four modules like cv2, imutils, numpy and pytesserract. Generally, these library modules are precisely detecting numbers or license plates and also extracting characters.

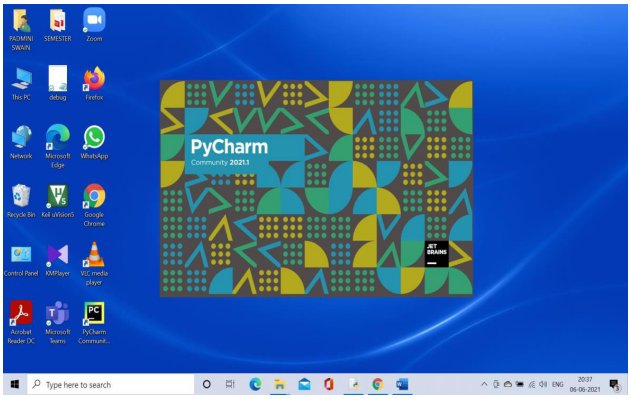

Fig. 3. PyCharm IDE for developing python code

A. Horizontal and Vertical Positioning Projection Method

It is important to evaluate approximately the positioning of the licence plate in order to segment and precisely recognise the character in order to ensure the exact placing of the licence plate. The horizontal projection can be derived by the equation:

$$IM(i,j) =\mid PI(i,j) - PI(i,j-1) \mid, G \tag{1}$$

$$G = \{i = 1,2,3,...,M, j = 2,3,4,...,N\} \tag{2}$$

Here, $IM(i,j)$ is the image IM pixels, $PI(i,j)$ is the image PI pixel and M and N are the PI image pixels accordingly in the height and width.

So the projection value of the row x named $P_1(x)$ can calculate pixel value of an image IM per row, that is derived Thus, $P1(x)$ row projection value can be calculated by calculation of the pixel of the picture IM picture per row. as:

$$P_1(x) = \Sigma_{y=2}^{n} IM(x,y) \tag{3}$$

V. Result Analysis and Discussion

The license plate detection is performed by applying the above AVLPR code. So that is accurately generating characters' form extracted rectangular shape of the frame of number plate recognition. Whenever the proposed method is performed through the following steps which are discussed below:

Step 1: The proposed model is smartly capturing an image of the license plate which is forwarded to the python module for number plate extraction. So it is shown in Figure 4.

Step 2: License plate detection process(Localization) is displayed in this step where the Grayscale and also canny images are generated which is Figures 5 (a) and (b).

Step 3: The License Plate is detected, segmented, and recognized in this step which is depicted in Figure 6.

Step 4: For the final step, The number plate is detected and displayed in a new dialogue window, that is shown in Figure 7 (a). Similarly, the characters of the license plate are extract-ed in the tested frame interface that is shown in Figure 7 (b).

Fig. 4. Real time inserted vehicle license plate at time of driving

Fig. 5. a. Grayscale image of inputted vehicle & b. Canny image is generated by inputting Grayscale image

Fig. 6. License plate detected image frame

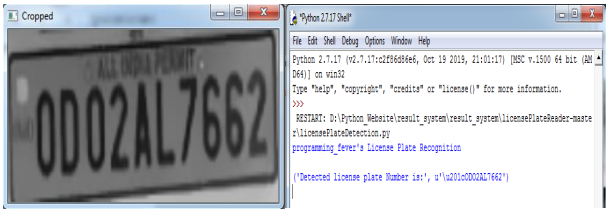

Fig. 7. a. Cropped License plate detected frame & b. Character extracted from cropped license plate detected frame

A. Performance Evaluation

The System for various measurements of performance and accuracy has been put through a lot of tests. Here the table 2 success ratio is calculated in accordance to formula:

$$SR = \frac{NS_s}{TN_s} * 100 \quad (4)$$

TABLE I
ACCURACY ANALYSIS TABLE

Name of the Operation	Total No. of Samples	No. of successful Samples	Failure Samples	Success Ratio
Localization of License Plate	15	14	1	93.34%
Separation of the Characters	14	12	3	85.71%
Character Recognition	12	11	1	91.67%

Where SR= Success Ratio, NS_s= number of success samples and TN_s= total number of samples.
The framework is acceptable in light of circumstances for a large variety of species and various kinds of plates normally seen in India. Unlike existing exclusive frame-works, it is a higher option, albeit there are known restrictions.

B. Discussion

These databases provide sensitive, personal data including a vehicle's time and lo-cation and driver. The first phase of an ANPR project normally involves data collection and adequate examples in various settings. If we do not have a license plate dataset, let us presume that it does not detect deep objects that we will exercise classical computer vision. If we had an educated object sensor model, it would have been nice, but Today, I want you to allow the trainer rolls to work with the toll technology firm, a red light camera integration system, a speed ticket system, a parking vehicle park where 99.97% or more are required.

VI. CONCLUSION AND FUTURE SCOPE

The goal of this research is to demonstrate the maturity of free and open source technology for scientific fields. For researchers and Computer Vision students, Python and openCV are appropriate starting places. In the ANPR system, the camera takes the picture of the car number plate and the number of the car is recognized in order to provide the owner with the data and information. We have conducted a technology in our proposed system to take the photograph of the vehicle plate. There is a noise reduction at that stage to display signs of improvement. Segmentation and banalization are subsequently done. In the near future, an Image capturing system can be installed, with a camera placed on the door and as a car arrives, a picture is captured by the camera of the front of the car then it localizes the number plate and does further recognition. The door opens, otherwise, an alarm will ring if the number plate is approved. The image collection system takes an illustration of the vehicle number plate in the NPR system and the vehicle license number is recognized with the aim of obtaining the information and the data of the vehicle owner. We have done a system for our paper that takes a photograph of the vehicle plate. The noise reduction occurs simultaneously to show evidence of improvement. The characters will be segmented and identified using the matching

approach of the template. In any event, the technique can only be used for binary images and not RGB images.

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