

Recognition of Vehicle Number Plate by Using Python and Open CV

Prof. Aditya Bakshi¹, Neha Devendra Parande², Shubhada Sudhir Kekapure³,
Radhika Shankarrao Gawande⁴, Tejaswini V. Rathod⁵, Ketan Kale⁶

Assistant Professor, Department of Computer Science and Engineering¹

Students, Department of Computer Science and Engineering^{2,3,4,5,6}

Jawaharlal Darda Institute of Engineering And Technology, Yavatmal, India

Abstract: A computer System called License Plate Recognition that recognizes any digital image automatically on the number plate. [7] We used OpenCv library along with python language for image processing by using pytesseract. The input image is then converted from high scale image to grayscale image and the processed image is filtered through bilateral filter to remove unwanted characters.[6] In india there is need of ANPR because large number of vehicles travelling on the roads and it would help in tracking of vehicles , traffic examining, finding stolen vehicles, supervising parking toll and imposing strict actions against red light breaching .[1] This technique is used to localize number plate from an image and extract characters from the detected number plate.[1] Our objective is to use various morphological operations in such a way that the number plate of vehicle would be identified accurately. It includes various operation such as image enhancement, morphological transformation, edge detection and extraction of number plate from vehicle image. After a series of operations we apply segmentation to recognize the characters present on number plate using template matching.[2] ANPR in India can be challenging due to different lighting conditions, changes in fonts, shapes, angles, letters size, number of lines and padding between lines, different languages used. In our project we proposed a system that can detects vehicle number plate with considering all irregularities. The OCR has two parts Character segmentation and Character Recognition. The OCR system is used to extract characters of different fonts and non-roman script as well and the quality of the OCR would depend on the quality of image, image contrast, text font style and size.[1].

Keywords: Recognition, Automatic Number Plate Recognition (ANPR), OCR (Optical character recognition), license plate, Character Segmentation Image Segmentation

I. INTRODUCTION

Each country has its own ANPR system for traffic control, traffic monitoring, vehicle monitoring violations, restricted area security, parking management ,traffic law management, registration and detection of unregistered vehicles. Therefore India also has its own system for assigning unique numbers to vehicles.[1] There has been a significant increase in the use of vehicles across the country. Each vehicle is assigned a unique vehicle identification number which serves as its primary identifier. This vehicle identification number is included in the vehicle's license number and is required to obtain a legal license for public movement . Each vehicle in the world must have its own number plate that must be installed on its body (at least on the back) . [7]Identification of vehicles is necessary in parallel with the increasing number of vehicles. This identification system helps with safety, automatic switching systems, highway speed detection, light detection, stolen vehicle detection, and human and non-human loss collection systems. The computer system has now replaced the manual process of writing down license plate numbers. This has been made possible through the implementation of an automated license plate recognition system.[7]The ANPR system consists of following steps:-

1. Vehicle image capture
2. Preprocessing.
3. Number plate extraction

4. Character segmentation.
5. Character recognition.

The ANPR system works in these strides, the initial step is the location of the vehicle and capturing a vehicle image of front or back perspective of the vehicle, the second step is the localization of Number Plate and then extraction of vehicle Number Plate is an image.

The final stride use image segmentation strategy, for the segmentation a few techniques neural network, mathematical morphology, color analysis and histogram analysis. Segmentation is used for individual character recognition.

Optical Character Recognition (OCR) is a technology used to recognize and interpret printed or handwritten text in images or documents. It involves analyzing and identifying individual characters and converting them into digital text that can be edited, searched, and manipulated. OCR does not involve the use of a database to match individual characters, but rather uses algorithms to analyze the image and identify the shapes and patterns of the characters .[4]

II. METHODOLOGY

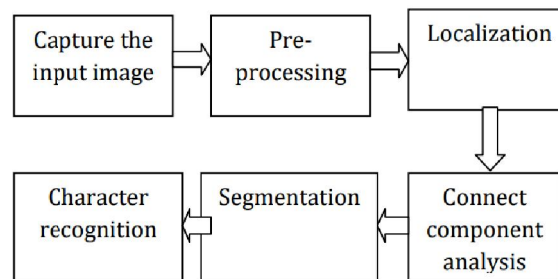


Fig 1. System Methodology

2.1 Capture the Input Image

The initial step is the Acquisition of an image is taken from a high resolution camera. The resolution of the number plate recognition system depends on the captured image. The image would be captured in RGB format and must be converted to a gray image.

2.2 Pre Processing

When an RGB image is captured, it can be affected by a variety of factors such as optical distortion, system noise, insufficient exposure, excessive relative motion between the camera and the vehicle, and more. These factors can degrade the quality of the captured image and negatively impact subsequent image processing. To mitigate these effects, preprocessing of the captured image is required before the main image processing can take place. Preprocessing techniques include converting the RGB image to grayscale, removing noise, and enhancing edges to improve brightness. There is a different kind of threshold like

- Global threshold
- Adaptive mean threshold
- Adaptive Gaussian threshold

2.3 Localization

The license plate can be extracted using either a shape analysis or a color analysis method. In the General License Panel has in form of a rectangular shape. Thus, algorithms look for geometrical shapes of a rectangular proportion. In India, most license plates are white or yellow, and therefore can also use color analysis. Finally, the areas connected to the box are connected and all rectangular areas of interest are extracted.

2.4 Connect Component Analysis

To remove the unwanted image space, the algorithm of the component connected to the binary filter is applied first. In connect component analysis the parsing of the connected component is done to determine the characters in the image. The basic proposal is to pass through the image and find a connected pixel. Each component (dots) is distinguished and extracted.

2.5 Segmentation

Once the license plate has been extracted, each character must be fragmented. For component division, the component label is used to see the computer in order to discover the connected areas in binary digital images. The connected components label works by scanning a pixel-in-pixel image from top to down to find connected pixels and connected pixel cards.

2.6 Character Recognition

This is the most essential and basic phase of the ANPR system. It displays the techniques that were used to order and then perceive the individual characters from the vehicle number plate. To identify characters, the segmented characters in the license panel must match the templates that are already created. The recognition process returns the license number in ASCII format and would save it in a text document. In this recognition is a two-track process. In the first pass, an attempt was made to identify each word in turn. Each satisfactory word is passed to the adaptive workbook as training data.

III. RESULTS AND DISCUSSION

The text from the image was obtained as same as the license number plate image of license plate . To read the output image we use Tesseract. We have implemented our system on random dataset and found that our code run perfectly over most of them.

Step-1: Detecting License Plates

Detecting Plates from an Image : If the following code runs successfully, it will be able to detect the license plate of a vehicle in both a given input image and a real-time feed.

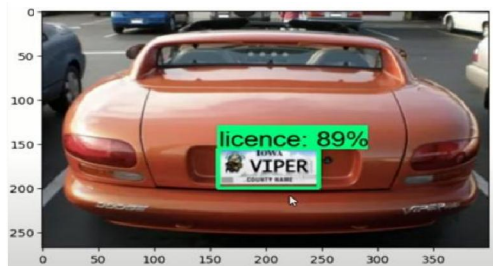


Fig 2. The detected image of license plate

Detecting Plates in real time –



Fig 3. Detection of license plate in real time

Step-2: Applying OCR to Text (Image) -

The Optical Character Recognition (OCR) technology enables us to extract text from specific areas of interest. In our case, we will be utilizing EasyOCR, which is a PyTorch-based tool. Therefore, we will need to allocate our GPU resources accordingly, allowing both TensorFlow and PyTorch to run smoothly

Fig. 1 A sample line graph using colors which contrast well both on screen and on a black-and-white hardcopy

Fig. 2 shows an example of a low-resolution image which would not be acceptable, whereas Fig. 3 shows an example

Apply OCR to Detection:

```
In [27]: |pip install easyocr
...
In [25]: |pip install torch==1.8.1+cu111 torchvision==0.9.1+cu111 torchaudio===0.8.1 -f https://download.pytorch.org/whl/torch_stable.ht
...
In [23]: |import easyocr
```

Fig 4. Installation of Easy OCR

PyTorch Build	Stable (1.8.1)		Preview (Nightly)	
Your OS	Linux	Mac	Windows	
Package	Conda	Pip	LibTorch	Source
Language	Python		C++ / Java	
Compute Platform	CUDA 10.2	CUDA 11.1	ROCm 4.0 (beta)	CPU
Run this Command:	<pre>pip3 install torch==1.8.1+cu111 torchvision==0.9.1+cu111 torchaudio===0.8.1 -f https://download.pytorch.org/whl/torch_stable.html</pre>			

Fig 5. Installation of EasyOCR

Apply ROI filtering and OCR-

By implementing Region of Interest (ROI) filtering, we can extract the license plate image from the entire car image that was previously detected, simplifying the process of extracting characters from the cropped license plate image.

```
In [46]: # Apply ROI filtering and OCR
for idx, box in enumerate(boxes):
    print(box)
    roi = box*[height, width, height, width]
    print(roi)
    region = image[int(roi[0]):int(roi[2]),int(roi[1]):int(roi[3])]
    plt.imshow(cv2.cvtColor(region, cv2.COLOR_BGR2RGB))

[0.44817042 0.41779158 0.5760875 0.6141038 ]
[103.97553825 208.8957876 133.65229416 307.05189705 ]
```



Fig 6. Applying ROI filtering

OCR filtering

If the given extracted number plate image has more characters or words rather than number and variables then we use OCR filtering to crop only the car number on the number plate or variable and erase other unwanted words/characters.

Final Output

Bring it together- It is the final step to verify whether the sequence of the image characters/variables are correct and convert the number plate image to text



Fig 7. Final Output Image to Text

IV. CONCLUSION

From our proposed system we can conclude that the technology that we are using can be successfully used to detect the vehicle number plate region from the image which consists of vehicle number & then apply character segmentation and recognition of characters. This paper presents a method for detecting vehicle license plates that is both effective and efficient. The input image undergoes pre-processing techniques such as bilateral filtering, and the resulting cropped license plate image is saved in a designated folder. [6] Scanning number plate sometimes goes unsuccessful by using the shape analysis method to detect exact area of the plate. [7] The text from the license plate image is then extracted and converted into a string using Tesseract OCR, and the result is displayed in the Python output terminal. The method was tested on various images, and it was observed that the code performed accurately on a majority of them. Our code worked on number plate whose number plate was white background color and failed on images which have lot of background noises. [6] Scanning number plate sometimes goes unsuccessful by using the shape analysis method to detect exact area of the plate.

The future scope is that the automatic vehicle recognition system plays a major role in detecting threats to defense [5]. Moreover the Future extension of this work is to develop character recognition using template matching algorithm. Detecting number plate characters during night times work efficient but it gets inefficient in case of sunny time [7]. It can also improve the security related to the women's as they can easily detect the number plate before using cab or other services. The robustness of the system can increase if bright and sharp camera is used. Government should take some interest to develop this system as this system is money-saving and ecofriendly, if applied effectively in various areas

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