LICENSE PLATE DETECTION FOR A MOVING VEHICLE

Abstract:

In general, video surveillance systems are utilized for monitoring and security purposes. However, one difficult aspect of video surveillance is the detection of moving objects. But one difficult aspect of video monitoring is the detection of moving objects. Due to the decreasing costs of high-quality video surveillance systems nowadays, human activity detection and monitoring has become more and more impractical. As a result, automatic structures were created for a variety of detection jobs, but the work of finding vehicles that were parked illegally has been mostly left to the human operators of surveillance structures. Security applications for homes, the military, banking, and ATM security, traffic monitoring, etc. all use video surveillance systems. Human activity identification and monitoring have grown more feasible in recent years thanks to falling prices for high-quality video surveillance systems. As a result, automated systems have been created to perform a variety of detection duties, but the work of identifying unlawfully parked vehicles has generally been delegated to surveillance system operators. It has been noted that number plates for automobiles vary in size, form, and colour throughout different nations. The method for detecting and identifying vehicle number plates that is proposed in this project will aid in the identification of legal and unauthorized vehicle number plates. After the numbers and characters on the license plate have been segmented, a template-matching approach is utilized to identify the numbers and characters. In order to partition all the numbers and letters and identify each number separately, the focus is supplied to correctly locate the number plate region.

Keywords: *Image Segmentation, Image Extraction, Py-tesseract, OpenCV, canny edge, contours, greyscale*

1.Introduction

License Plate Recognition (LPR) is a technology that combines image processing, character segmentation, and recognition to identify vehicles based on their license plates. With the rapid development of highways and the widespread use of vehicles, researchers are beginning to focus more on efficient and accurate intelligent transportation systems. (ITS). It is widely used for car speed detection, security control in restricted areas, highway surveillance, and electric toll collection [1].

One of the most important requirements of an ITS is vehicle license plate (VLP) recognition. Although any ITS, and particularly any VLP recognition, has two parts in general, license plate detection and recognition, correctly detecting and segmenting VLP is critical due to existing conditions such as poor illumination, vehicle motion, view-point and distance changes. Government regulations standards used in license plates can significantly reduce computational requirements while improving accuracy. Because the license plate text size, style, and orientation can vary significantly between images, constraints include a range of values rather than exact measurements. The quality of license plate recognition software with recognition algorithms used and the quality of imaging technology, including camera and lighting, are the two most important aspects of license plate recognition systems.

Elements to consider include maximum recognition accuracy, faster processing speed, handling as many different types of plates as possible, managing the widest range of image qualities possible, and achieving maximum distortion tolerance of input data.

2.Objective

The primary goal of moving vehicle number plate detection is to detect the license plate in the video and extract the characters from the detected License Plate.

We aim to achieve maximum recognition accuracy, faster processing speed, handling as many different types of plates as possible, managing the widest range of image qualities possible, and maximum distortion tolerance of input data.

3.Literature Review

In video analysis of number plate detection, computer vision and deep learning algorithms for license plate recognition play an important role. As a result, they are essential components of any moving vehicle registration late detection system. A camera, a frame grabber, a computer, and custom designed software for image processing, analysis, and recognition comprise the license plate recognition system. Vehicle identification has been an active research topic in recent years. Several studies have been conducted to determine the type of vehicle, such as a car, truck, scooter, or motorcycle.

Since the 1990s, researchers have been researching the problem of automatic VLP recognition. The first approach was based on boundary characteristics. An image was binarized and then processed by certain algorithms, such as the Hough transform, to detect lines in this method. Texture colour feature, edge extraction, combining edge and colour, morphological operation, and learning-based method are the most common approaches for VLP detection. When the lightening is constant and constant, using the colour feature is advantageous.

Methods based on edge and texture, on the other hand, are nearly invariant to different illumination and thus widely used for VLP detection. These methods take advantage of the fact that the license plate contains a lot of characters, so the area has a lot of edge and texture information. Zhang et al. proposed a learning-based method for VLP detection based on AdaBoost. To detect the license plate, they used both global (statistical) and local (Haar-like) features.

A Raspberry Pi-based system exists that automatically recognizes plate numbers. The system proposes the use of the Raspberry Pi processor to implement an automated plate number recognition system that uses Optical Character Recognition (OCR) to interpret information on images of a vehicle plate number.

There's also a proposed system that detects over speeding vehicles and alerts authorities in the event of a violation. To determine the speed of a moving vehicle, the system employs LIDAR (Light Detection and Ranging) technology. LIDAR is a remote sensing method that uses light in the form of pulsed laser light to measure the distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor

4. Research Gap

With the growing demand for vehicle surveillance systems, processing vehicles for traffic management and secularity has become a difficult field of study.

Many issues must be addressed during automatic license plate detection and recognition. Different cities' license plate models are not uniform, and the length of the number plates may also differ. The low resolution of vehicle license plates in video frames under standard surveillance systems is another major challenge.

These issues are expected to be solved by developing the sequential coordination of image and video processing tasks. Algorithms such as object tracking and segmentation, locating the license plate area, detecting the number and its color may be included in this processing sequence.

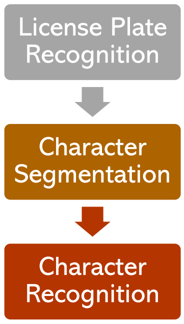
5.Problem Definition

Automatic license plate recognition necessitates the use of multiple image processing and algorithm algorithms within a single application. To determine the license plate number in a given image or video frame, text localization, extraction and enhancement, character segmentation, and recognition operations are used. Only a few previous studies covered the entire process of an LPR system, from image acquisition to verification. A complete license plate recognition system based on constraints and operating in real time has been designed and implemented in this study.

The most time-consuming stage of a typical system is license plate localization and extraction. In order for LPR systems to locate license plates in real time, assumptions and optimizations are required. However, the computational requirements grow in tandem. Constraints and prior knowledge are used to reduce this side effect. The resulting region is then processed for character segmentation and recognition after the license plate area has been extracted.

5.Proposed Algorithm

The presented system is intended to recognize license plates from vehicles. The system receives an image captured by a camera of a license plate as input, and its output is the recognition of characters on the license plate in a separate notepad window. The system includes the standard six main modules found in an LPR system: vehicle speed estimation, image acquisition, license plate extraction, license plate segmentation, and license plate recognition. The first task is to obtain the image. The second task is to extract the region containing the license plate. As in the case of Indian License Plates, the third task isolates the characters, letters, and numerals (total of ten digits). The final task is to identify or recognize the segmented characters.



License Plate Recognition: A video is fed into the system as an input, and the video is converted into frames and each frame is fed into the model in order for it to detect the license plate.

Character Segmentation: The detected license plate coordinates, along with the frame, are passed to the character segmentation method. The frame is now preprocessed, and each license plate character is segmented using OpenCV.

Character Recognition: The Tesseract OCR engine includes a Python wrapper, making character recognition quick and simple.

6.Implementation

6.1 Licence Plate Extraction

Due to large variations in the size, shape, colour, texture, and spatial orientations of licence plate regions in such images, localization of potential licence plate regions from vehicle images is a difficult task. In general, the goal of any Automatic License Plate Recognition (ALPR) system is to identify potential licence plate regions from vehicle images captured by a roadside camera and interpret them using a template matching method to determine the vehicle's licence number. In an online ALPR system, licence plate localization and interpretation occur instantly from incoming still frames, enabling real-time tracking of moving vehicles via the surveillance camera. In contrast, an offline ALPR system captures vehicle images and stores them in a centralised data server for further processing. i.e., for interpretation of vehicle license plates.

6.2 Reduction of Colours

Colour can appear differently in different lighting conditions, which causes a problem when processing images. To address this, we limit the number of colours to around 50. Images with more than 256 colours will need to be dithered or mapped and may not display properly.

6.3 Greyscale Conversion

From the 24-bit colour value of each pixel (i, j) the R, G and B components are separated and the8-bit Gray value is calculated using the formula: Gray(i, j) = 0.59 * R(i, j) + 0. 30 G(i, j) +0.11 * B(i, j) (1)

6.4 Dilation

Dilation causes objects to expand, highlighting the shapes/geometry of objects in an image. A structural element is simply a matrix of 0s and 1s that can be of any shape or size.

6.5 Filling

The dilated image is filled with 'holes' to highlight the area of interest.

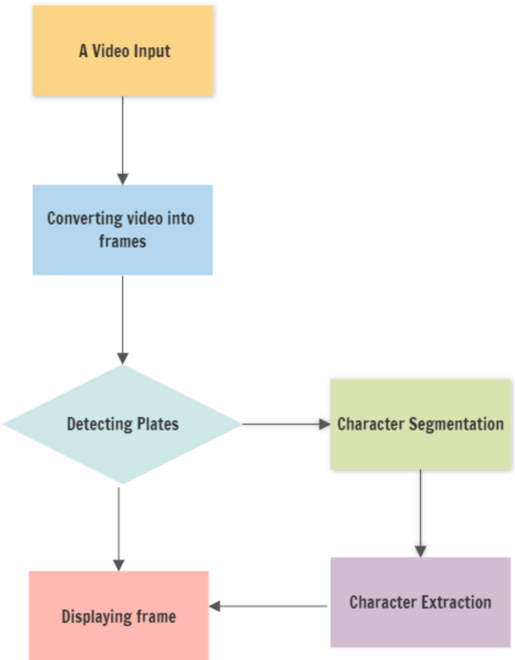
Images before dilate and erode operations are shown in the examples below.

6.6 Edge Detection

We extracted the edges created by the characters on the licence plate in this work. When the licence number characters are written horizontally, the vertical edges of each character appear at regular intervals and have a specific height. The pattern and concentration of the vertical edges are also consistent with the licence number pattern. This appearance of a vertical edge pattern is statistically seen to occur within the licence plate, and nowhere else within the image's natural scene. The region's area should not be less than the specified threshold values. The length-tobreadth ratio, or aspect ratio, should be between 10:1.

6.7 Image segmentation

The process of dividing an image into parts or regions is known as image segmentation. The characteristics of the pixels in the image are frequently used to divide the image into parts. Looking for abrupt discontinuities in pixel values, which typically indicate edges, is one way to find regions in an image. These edges can be used to define regions. Another approach is to divide the image into colour-valued regions.



7. Modules Used in Python

7.1 Python-tesseract:

Py-tesseract is a Python-based optical character recognition (OCR) tool. In other words, it will recognise and read text embedded in images. Python-tesseract is an OCR engine wrapper for Google's Tesseract. It is also used as a standalone script because it can read all image formats such as jpeg, png, gif, bmp, tiff, and so on. Furthermore, when run as a script, Python-tesseract will print the recognised text rather than writing it to a file. It can recognise over 100 different languages.

7.2 OpenCV

OpenCV is a computer vision library that is open source. The library contains over 2500 optimised algorithms. These algorithms are frequently used to search for and recognise faces, identify objects, recognise scenery, and generate markers for augmented reality images, among other things.

7.3 OS Module

In Python, the OS module provides functions for interacting with the operating system. Python's standard utility modules include OS. This module allows you to use operating system-specific functionality on the go. Many functions for interacting with the file system are included in the os and os.path modules.

7.4 Shuttle Module

Shutil module provides high-level file operations such as copy, create, and remote operation on the file. It's one of Python's standard utility modules. This module aids in the automation of file and directory copying and removal. This module will be covered in this article.

8. Result

9. Conclusion

Our work primarily focuses on the detection of a moving vehicle's licence plate, which uses OpenCV to detect the licence plate and Python Tesseract to extract characters with greater accuracy, allowing us to view the vehicle's information at any time.

The system is by far one of the most affordable means of implementing traffic management in a smart city.

We can perform this image process with varying degrees of accuracy for all other licence number plates. As a result, the number plate recognition model is complete. The system performs admirably under a wide range of lighting conditions and with various types of number plates commonly found in India. Even though there are known limitations, it is unquestionably superior to existing proprietary systems.

10.References

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