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Vehicle Licence Plate Recognition Using Surveillance Cameras

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ABSTRACT
Number plate detection is an image processing technology that uses a license (number) plate for vehicle identification. The objective is to design and implement an efficient vehicle identification system that identifies the vehicle using the vehicle's license plate. The system can be implemented on the entrance of parking lots, toll booths, or any private premises like college, etc. to keep the records of on-going and outgoing vehicles. It can be used to allow access to only permitted vehicles inside the premises. The developed system first captures the image of the vehicle's front, then detects the license plate and then reads the license plate. The vehicle number plate is extracted using the image processing of the image. Optical character recognition (OCR) is used for character recognition. The system is implemented using OpenCV and its performance is tested on various images. It is observed that the developed system successfully detects and recognizes the vehicle license plate.
To recognize License number plates using the Python programming language. We will utilize OpenCV for this project in order to identify the license number plates and the python pytesseract for the characters and digits extraction from the plate. We will build a Python program that automatically recognizes the License Number Plate.The development of an intelligent vehicle identification system based on optical character recognition (OCR) method to be used on intelligent transportation systems. The proposed system makes use of an intelligent parking system named Smart Parking Service (SPANS), which is used to manage public or private spaces. Using computer vision techniques, the SPANS system is used to detect if the parking slots are available or not. The proposed system makes use of SPANS framework to capture images of the parking spaces and identifies the license plate number of the vehicles that are moving around the parking as well as parked in the parking slots
Keywords: Vehicles License plate images, Opencv, pytesseract OCR.

1. INTRODUCTION

In last few years, ANPR or license plate recognition (LPR) has been one of the useful approaches for vehicle surveillance. It is can be applied at number of public places for fulfilling some of the purposes like traffic safety enforcement, automatic toll text collection [1], car park system [2] and Automatic vehicle parking system [3] Computer vision is a science discipline focused on technologies enabling machine extraction of important features from images for specified task solutions. In other words, computer vision is human vision imitated by computer. The main purpose is description of objects we see by one or more images and reconstruction of its features as shape, illumination or color.

Computer vision is used in many different areas. One of them is image and video processing for purposes of object detection in these images or video files. Nowadays, very common application of object detection in images is detection of car license plates. There already exists few license plate detection systems, which are mostly being used in parking areas with paid parking or areas with restricted entry for vehicles. These systems are unified under common name ALPR systems, what stands for Automatic License Plate Recognition systems.

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To introduce a solution for car license plate detection used for access restriction and monitoring cars accessing the parking area through the entrance ramp. The cars are being monitored by camera on the entrance ramp. After video processing the access can be granted. The purpose of the solution is detection of license plate area in this video file and recognition of license plate number.

The solution proposed in this paper was implemented using OpenCV library. OpenCV (Open Source Computer Vision Library) is an open source library used for creating applications in field of computer vision and machine learning. The library supports many programming languages, including Python which was used for implementation of the solution. The library is compatible with operating systems Windows, Mac OS, iOS, Linux or Android. During implementation of designed solution, we used OpenCV library for detection and recognition of license plate objects in a way of applying filters and operators for image and video processing.

Recognition of license plate number was implemented using Tesseract library. Tesseract is a library for optical character recognition (OCR), which enables a machine to recognize and read text characters. The library supports many programming languages, including Python, and it is compatible with operating systems Windows, Linux and MAC OS.
Text characters from more than 100 languages worldwide can be read and the output of the recognition can be written in txt, pdf, hocr or tsv file. Object detection from input image is a process of image processing during which suitable techniques for image and object features quality improvements are applied.
In Image Processing Module experimentation, there are four parts which are going to be examined. Each part will influence the algorithm and the detection threshold of the license plate identification. The first part which is going to be examined is the ratio of the image. This process is relevant compare detected blob with its actual size as the requirement for the license plate candidate. The second part is a test on the rotation or alignment of the image. This particular process is important in determining the threshold of the skew that the license plate does have in order for it to be identified by the program. It is also conducted in order to anticipate the probability in which the image will slant as a result from inappropriate position of the camera or a tilted license plate. The third part is distance measurement.
This particular measurement is needed in order to evaluate the 2 megapixels camera in terms of determining the required distance for it to identify and detect a license plate accurately. The fourth part is determining the binary threshold value with the Global Threshold and Adaptive Threshold.
Automatic Vehicle number plate recognition system used for identifying number and obtaining owner information from a large database of registration details. Recognition process includes, submitting a query, and extracting characters of the image that best matches with template if matched, obtain the owner details. In which visual contents, normally called as features are used to recognize alphabets and numeral characters to obtain registration details from large databases. Vehicle number plate recognition systems are used as core modules for intelligent infrastructure systems like electronic payment systems (toll payment and parking fee payment) and freeway and arterial management systems for traffic surveillance.
License plate recognition may be complicated by frames that obscure parts of the plate, debris, complex backgrounds, and a wide variety of fonts. Furthermore, license plates are not configured in a standard format; license plates typically vary across issuing states and countries.

2. LITERATURE SURVEY

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In the year of 2017 Dalarmelina, N. do V., Teixeira, M. A., & Meneguette, R. I [1] Automatic License Plate Recognition has been a recurrent research topic due to the increasing number of cameras available in cities, where most of them, if not all, are connected to the Internet. The video traffic generated by the cameras can be analyzed to provide useful insights for the transportation segment. This paper presents the development of an intelligent vehicle identification system based on optical character recognition (OCR) method to be used on intelligent transportation systems. The proposed system makes use of an intelligent parking system named Smart Parking Service (SPANS), which is used to manage public or private spaces. Using computer vision techniques, the SPANS system is used to detect if the parking slots are available or not. The proposed system makes use of SPANS framework to capture images of the parking spaces and identifies the license plate number of the vehicles that are moving around the parking as well as parked in the parking slots.

In the year of 2016 Cheng, G., Zhou, P., & Han, J [2] Object detection in very high resolution optical remote sensing images is a fundamental problem faced for remote sensing image analysis. Due to the advances of powerful feature representations, machine-learning-based object detection is receiving increasing attention. Although numerous feature representations exist, most of them are handcrafted or shallow learning-based features. Asthe object detection task becomes more challenging, their description capability becomes limited or even impoverished. More recently, deep learning algorithms, especially convolutional neural networks (CNNs), have shown their much stronger feature representation power in computer vision. Despite the progress made in nature scene images, it is problematic to directly use the CNN feature for object detection in optical remote sensing images because it is difficult to effectively deal with the problem of object rotation variations.

B., Mirhassani, M., & Muscedere, R in 2017 [3]Optical Character Recognition system (OCR) can be used in intelligent transportation systems for license plate detection. However, most times the systems are unable to work with noisy and imperfect images. In this work, a robust FPGA based OCR system has been designed and tested with imperfect and noisy license plate images. The OCR system is based on feed forward neural networks, which uses an efficient and precise neuron. The neuron transfer function is based on an approximation of the Hyperbolic Tangent Activation Function. The neuron is utilized in a $189 - 160 - 36$ feed forward neural network configuration. The network parameters were optimized and then tested with noisy images of license plates numbers. The network was able to maintain a 98.2% accuracy in recognizing the characters despite the image imperfections. Automatic License Plate Recognition has been applied in applications such as automatic toll collection, traffic control, and monitoring, as well as parking lot control and access. These systems are becoming more important asthe automotive industry moves toward intelligent transportation and smart roads. In these applications, the system should be able to find and recognize the characters on the plate and be operational in a variable environment.

In 2008 study Pan, M.-S., Yan, J.-B., & Xiao, Z.-H [4] Vehicle license plate (VLP) character segmentation is an important part of the vehicle license plate recognition system (VLPRS). This paper proposes a least square method (LSM) to treat horizontal tilt and vertical tilt in VLP images. Auxiliary lines are added into the image (or the tilt-corrected image) to make the separated parts of each Chinese character to be an interconnected region a new approach is proposed to deal with VLP character segmentation. LSM is adopted to correct the tilt in the tilted VLP images by adding auxiliary lines to make separated parts

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of Chinese characters become a connected region. After two source images are fused, the characters are segmented by PM and the final character images are obtained. This method effectively overcomes previous difficulties. But we have to mention that this method is not effectively adapted to the images where there are two-rows in a VLP, so the study of this problem will be the focus of a future research activity.

3. PROPOSED SYSTEM

In proposed method we are performing the OpenCV using pytesseract OCR method to implement to train the image to multi type format and in grey image format we crop the image in only number plate to consider the show the text format.

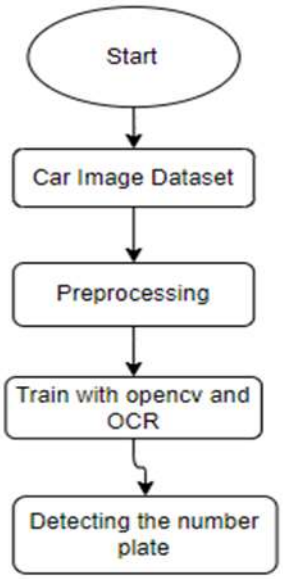

Fig. 1: Block diagram of proposed system.

3.1 Advantages of proposed system

- Accurate classification
- Less complexity
- High performance
- Easy Identification

3.2 Methodology

Computer Vision

Computer vision is a process by which we can understand the images and videos how they are stored and how we can manipulate and retrieve data from them. Computer Vision is the base or mostly used for Artificial Intelligence. Computer-Vision is playing a major role in self-driving cars, robotics as well as in photo correction apps.

OpenCV

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To identify image pattern and its various features we use vector space and perform mathematical operations on these features.

The first OpenCV version was 1.0. OpenCV is released under a BSD license and hence it's free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. When OpenCV was designed the main focus was real-time applications for computational efficiency. All things are written in optimized C/C++ to take advantage of multi-core processing.

Image-Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image and or to extract some useful information from it. If we talk about the basic definition of image processing then "Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality".

Digital-Image:

An image may be defined as a two-dimensional function f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of fat any pair of coordinates (x, y) is called the intensity or grey level of the image at that point. In another word an image is nothing more than a two-dimensional matrix (3-D in

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case of coloured images) which is defined by the mathematical function f(x, y) at any point is giving the pixel value at that point of an image, the pixel value describes how bright that pixel is, and what colour it should be. Image processing is basically signal processing in which input is an image and output is image or characteristics according to requirement associated with that image.

PyTorch:

PyTorch is an open source machine learning library based on the Torch library, used for applications such as computer vision and natural language processing, primarily developed by Facebook's AI Research lab. It is free and open-source software released under the Modified BSD license

Tesseract OCR:

Tesseract is open source text recognition (OCR) Engine, available under the Apache 2.0 license. It can be used directly, or (for programmers) using an API to extract printed text from images. It supports a wide variety of languages. Tesseract doesn't have a built-in GUI, but there are several available from the 3rdParty page. Tesseract is compatible with many programming languages and frameworks through wrappers that can be found here. It can be used with the existing layout analysis to recognize text within a large document, or it can be used in conjunction with an external text detector to recognize text from an image of a single text line.

OCR = Optical Character Recognition. In other words, OCR systems transform a two-dimensional image of text, that could contain machine printed or handwritten text from its image representation into machine-readable text. OCR as a process generally consists of several sub-processes to perform as accurately as possible. The sub processes are:

- Pre-processing of the Image
- Text Localization
- Character Segmentation
- Character Recognition
- Post Processing

The sub-processes in the list above of course can differ, but these are roughly steps needed to approach automatic character recognition. In OCR software, it's main aim to identify and capture all the unique words using different languages from written text characters.

For almost two decades, optical character recognition systems have been widely used to provide automated text entry into computerized systems. Yet in all this time, conventional OCR systems (like zonal OCR) have never overcome their inability to read more than a handful of type fonts and page formats. Proportionally spaced type (which includes virtually all typeset copy), laser printer fonts, and even many non-proportional typewriter fonts, have remained beyond the reach of these systems. And as a result, conventional OCR has never achieved more than a marginal impact on the total number of documents needing conversion into digital form.

LSTMs are great at learning sequences but slow down a lot when the number of states is too large. There are empirical results that suggest it is better to ask an LSTM to learn a long sequence than a short sequence of many classes. Tesseract developed from OCRopus model in Python which was a fork of a LSMT in Python, called CLSTM. CLSTM is an implementation of the LSTM recurrent neural network model in Python, using the Eigen library for numerical computations.

Word finding was done by organizing text lines into blobs and the lines and regions are analyzed for fixed pitch or proportional text. Text lines are broken into words differently according to the kind of character spacing. Recognition then proceeds as a two-pass process. In the first pass, an attempt is made to recognize each word in turn. Each word that is satisfactory is passed to an adaptive classifier as training data. The adaptive classifier then gets a chance to more accurately recognize text lower down the page.

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Modernization of the Tesseract tool was an effort on code cleaning and adding a new LSTM model. The input image is processed in boxes (rectangle) line by line feeding into the LSTM model and giving output. In the image below we can visualize how it works.

4. RESULTS AND DISCUSSION

This proposed approach for number plate recognition and extraction work well for all types of input images. Many vehicle images are tested. Images are taken in different illumination conditions. The images are taken at different distances relative to camera and are of different colours and different size images. The proposed method works well for low contrast, noisy and low-resolution images.

To display the result in this project Vehicle license plate Recognition

The initial page for any user will be displayed as follows that is Home page

After the home page the **About page** of the project is displayed in which it contains brief explanation of project

The next displayed page is User Login Page for user to login if the user has already registered.

If the user doesn't has registered then for new users the new registration page will be shown as:

After successful login or registration of user had completed the home page of the user is opened as follows:

In the user page there is an upload button to upload the vehicle licence plate images by clicking the choose file button which directs to

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the images that are stored in particular path or file for further processing of the images.

And finally, The exact result is displayed

6. CONCLUSION

In this project we successfully detect vehicle license plate in car image with using OpenCV and Tesseract Ocr. In ANPR system, the picture of vehicle number plate is taken with the camera and the license number of the vehicle is perceived with the goal that the data and information of the vehicle number can be obtained. In our proposed system, we have performed a technique in which the picture of the vehicle plate is taken. At that point, the noise diminishment is performed on it to show signs of enhancement come about. After this, segmentation is performed. We make a matrix dataset of characters and train then identification of characters are done using trained OCR. Hence we can conclude that ANPR solutions tend to gain a huge popularity today. Starting from enforcement to providing smoother day-to-day facilities, it has served all. Yet technology is evolving and you will get to see much advancements in the near future.

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