



Smart Number Plate Recognition Using Deep Learning Technique

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ABSTRACT:

The number of vehicles on the road has increased dramatically over the past decade. The use of heavy vehicles increases the likelihood of traffic violations, accidents and traffic violations. This project proposes a solution for an automatic license plate recognition and tracking system for fast-moving vehicles using road surveillance cameras in an efficient system that automatically recognizes licensed vehicles using license plates 'registration'. This can be done using an efficient deep learning model for TensorFlow object detection using EasyOCR technology. The proposed solution consists of three major steps. First, traditional security cameras take video, convert it into images, and detect vehicles every frame. The next step is to determine the license plate of the detected vehicle. The final step is recognizing the license plate character read from the detected license plate. EasyOCR technology with filtering algorithm is used to extract the license plate area. Each character on the license plate is segmented using a bounding box approach. In the recognition part, features are extracted and classified through transfer learning. The resulting data is used to store license plate results and then compare them to database records.

Keywords: *Object recognition, Image processing, Number plate recognition and NLP_ Natural Language Processing, ANPR-Automatic Number Plate Recognition.*

I. Introduction

The explosive increase in vehicle traffic on the road, the demand for traffic monitoring and management technology has increased significantly. Manually detecting a fast vehicle on the road in this case is almost impossible. Labor and time are wasted. Even manual work reflects big problems and big mistakes. There are already solutions that use machine learning algorithms to track vehicles and license plates. Automatic Number Plate Recognition (ANPR) also plays a vital role in parking management systems, toll payment processing systems, etc., and various systems that require a lot of authorization. By automating the process, it can help security personnel save a lot of time. Over the past few decades, computer vision techniques have made advancements in solving various real-world problems. Very early on, vehicle license plates were recognized using pattern matching techniques using width, height, outline area, etc. Live CCTV images are converted to images. These frames are sent through the TFOD algorithm to find the vehicles involved. Detected vehicles are saved as separate images in a folder. Check out this image for license plates. Detected license plates are cut and saved to another folder. The characters on these license plates are recognized by Optical Character Recognition (OCR). The extracted text is copied into an Excel spreadsheet along with time, date and license plate number. The system tends to be more accurate than existing systems, with the added benefit of being implemented in real time. In recent years, automatic license plate recognition has taken a big step forward in the application of machine vision technology. is expected to make further improvements in the future. It can support various communities with its efficient and useful applications, such as parking management system, toll collection system, vehicle fine collection system, road vehicle tracking system. ANPR also helps collect tolls by recognizing the license plate number of the vehicle. Vehicle tracking also helps pay fines for those who try to break traffic and road rules. Fonts, spacing, letters and numbers may vary. The main goal of this project is to more accurately detect and recognize Indian license plates. The system's main goal is to develop a deep learning model that can use surveillance cameras to read license plates of fast vehicles on the road and record license plates. data. It is extracted to an excel sheet. The system also uses the Image AI library to make the process easier and more efficient. It also preprocesses received images using various image processing techniques. To annotate the images, an efficient annotation tool called Labelling is used. The whole system is implemented in Jupyter Notebook using the Python programming language.

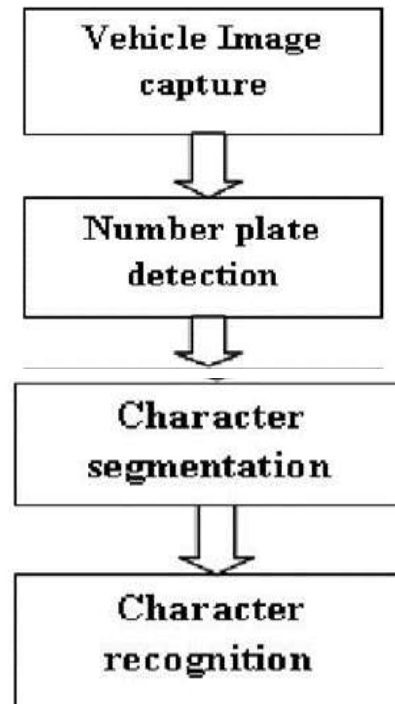


Fig. 1 Layout for Number plate recognition.

II. Literature Review

- [1]. Selmi Zied & Ben Halima Mohamed & Alimi Adel (2019). License Plate (LP) detection and recognition is a key technology in most vehicle movement applications. Moreover, it is a very hot and active research topic in the field of image processing. Different methods, techniques and algorithms have been developed to detect and identify LPs. However, since LP features vary from country to country in numbering system, color, character language, font and size. This area still requires further research to make the detection and identification process highly efficient. Although this area has been covered by many researchers, some existing systems operate under well-defined and controlled conditions. For example, some images require complex hardware to create high quality images or capture vehicle footage at a very slow speed. Therefore, the detection and identification of LP under different conditions and various climatic changes are always difficult to achieve and obtain good results. To this end, in this paper, we propose an automatic LP detection and recognition system based on deep learning methods, which is divided into three parts: detection, segmentation, and character recognition.
- [2]. Paridhi Swaroop, Neelam Sharma (2020) Imagery is an emerging trend in computer vision. A common image processing problem is determining the proximity of objects through a model when the scale and rotation of the actual object is unknown. Templates are basically parts of objects that need to match different objects. Pattern matching is one of the most well-known targeting strategies because it is often flexible and easy to use. Pattern matching is performed in various fields such as image processing, signal processing, image compression, and pattern recognition. A predefined template. Pattern matching can be a digital imaging technique for identifying small components of a graphic that match an image to a pattern. We tend to map models onto images. A model here is a sub-image containing the shape we want to detect. This technique is repeated for the whole image, and the point that produces the best fit (highest score) is defined as the point in the image where the shape (given by the model) is located. Stencils are often used to print characters, ID numbers and other small and simple objects.
- [3]. Lucky Kodwani & Sukadev (2021) use a region-based approach to segment extracted license plates into individual characters. The recognition scheme combines adaptive iterative thresholding and pattern matching algorithms. The method is invariant to lighting and robust to character size and weight, skew, and small character breaks. The main advantage of our system is its real-time capability, which requires no additional sensor input other than the video stream. We evaluate the system on numerous vehicle images. Experimental results demonstrate the reliability and efficiency of our method. The OCR engine system is based on a pattern matching algorithm. The shapes identified as possible symbols in the previous step of the process are binarized and scaled according to the size of the model in the database (42x24 pixels). Matching is selected from among them. Pattern matching algorithms work best when sources interact with each other.
- [4]. Riazul Islam, Qazi Fatima Sharif, and Satyen Biswas (2020) Automatic License Plate Recognition (ANPR) is an image processing technique for license plate recognition. The system also allows users to automatically locate, tag and monitor moving vehicles by extracting license plates. It also plays an important role in intelligent traffic control systems. Identify vehicle license plates. The technique relies on morphological manipulations based on different structural elements to minimize regions of no interest and enhance object regions. The system has been tested using a database of license plates and the simulation results show a great improvement over other traditional systems. Neural networks and statistical classifiers can provide better results than ordinary model matching techniques because they have strong memory and adaptive

abilities that can overcome this problem. However, to get good performance, you need a large number of samples and neurons to create a neural network. This leads to unexpected civil problems such as traffic control and vehicle identification issues.

- [5]. Automatic Number Plate Recognition (ANPR) systems play an important role in solving these problems, as their applications range from parking lanes to city traffic monitoring and vehicle theft detection. There are many ANPR systems available based on different approaches. In this article, we'll look at the different methods and their uses. The ANPR system was implemented using pattern matching, and its accuracy was shown to be applicable to license plates. A correlation method or model matching method that combines feature matching, feature detection, motion detection, and inference processing. Area-based methods combine matching parts with feature detection.
- [6]. Rahul R. Palekar, Sushant W. Parab, Dhruvil (2022). Information is retrieved from image files. Consider the shortcomings of the various image processing applications available and overcome them by using different levels of image processing and filtering. This system has been tested using a license plate database and simulation results show significant improvements over other existing systems.
- [7]. Hung Ngoc Do, Minh-Thanh Vo, Bao Quoc Vuong, (2021). Template Matching may be a high level machine vision method which determines the components of a figure which matches a predefined template. The alphanumeric values are extracted from the image containing the number plate, one after the other, and are matched with its corresponding template with the help of the template matching methodology. With an increased number of vehicles, there is a need for a vehicle identification mechanism that is effective, affordable and efficient. This template matching block compares each and every pixel value of the original image with the pixel values of the corresponding stored template. Template Matching could be a methodology in digital image processing to identify little components of a figure which match a template image. Identify vehicle number plates. The proposed technique is built on morphological operations based on different structuring elements in order to maximally exclude non-interested region and improve object area. This system has been experienced using a database of number plates and simulated results demonstrate major improvements as compared to other conventional systems.
- [8]. Pratiksha Jain, Neha Chopra, Vaishali Gupta (2022). Automatic License Plate Recognition is a built-in, real-time system that automatically recognizes vehicle license plates. Applications range from sophisticated security systems to public spaces, from parking access to city traffic management. Automatic License Plate Recognition (ALPR) is complicated by various effects such as light and speed. Most ALPR systems are built using proprietary tools such as Matlab. This paper presents an alternative method of implementing ALPR systems using Free Software including Python and the Open Computer Vision. There are numerous ANPR systems available today. These systems are based on different methodologies but still it is still a really challenging task as some of the factors like high speed of vehicle, non-uniform vehicle number plate, language of vehicle number and different lighting conditions can affect a lot in the overall recognition rate. The technique is built on morphological operations based on different structuring elements in order to maximally exclude noninterested region and improve object area. This system has been experienced using a database of number plates and simulated results demonstrate major improvements as compared to other conventional systems.
- [9]. Tella Pavani, DVR Mohan (2018). An image processing technology which uses number (license) plate to identify the vehicle. The objective is to design an efficient automatic authorized vehicle identification system by using the vehicle number plate. This system can be implemented at entrances to control security in high security areas, for example around military areas or high government offices. Systems developed by Congress, Supreme Court, etc., detect vehicles first and then capture images of vehicles. This will convert the car's license plate area to grayscale. Then the license plate. collect. It then uses the K-Nearest Neighbors (KNN) algorithm to recognize numbers and alphabets. You can use this data to find the car owner, place of registration, address, and more. The system is implemented in Python and performance has been tested on real images. Experiments show that the developed system successfully detects and recognizes license plates of vehicles.
- [10]. Dening Jiang, Tulu Mulune Mekonnen, Tirune Embiale Merkebu, Ashenafi Gebrehivot (2021). License plate recognition is one of the most exciting and challenging research topics in the past few years. License plates come in different shapes and sizes, and different colors for different countries. In India, the most common car license plates use yellow or the background color, while black is used as the foreground color. In this paper, a license plate location recognition system is proposed mainly for vehicles in West Bengal, India, and each number is classified by dividing the number. In this article, we present a simple and efficient morphological task and an approach based on the Sobel edge detection method. We also presents a simple approach to segmented all the letters and numbers used in the number plate. After reducing noise from the input image we try to enhance the contrast of the binarized image using histogram equalization. We mainly concentrate on two steps; one is to locate the number plate and the second is to segment all the number and letters to identify each number separate.
- [11]. Albert Mayan, Kumar Akash Deep ,Mukesh Kumar Livingston Alvin, Siva Prasad Reddy (2019). In a diverse country like India, gated communities, corporate premises and university campuses witness a lot of unfamiliar vehicles with number plates in different formats, fonts, font sizes and sometimes even in various languages which enter and leave the estate every day, and it is difficult to register the vehicle numbers manually even for a multi-lingual person. This document aims to extract image frames from a streaming CCTV footage, recognize the vehicle number and convert it into its corresponding text format. Template matching has been used earlier in recognition of digits and letters, this paper also uses the concept of template matching methodology using a SIMULINK model in MATLAB which is developed to extract the vehicle number from the number plate. The alphanumeric values are extracted from the image containing the number plate, one after the other, and are matched with its corresponding template with the help of the template matching methodology. This template matching block compares each and every pixel value of the original image with the pixel values of the corresponding stored template and returns a template metrics value as an output. The templates stored in the model consists or various fonts in English as well as templates of some of the widely used

languages (22 official languages) across India. The SIMULINK model uses the Digital Signal Processing Toolbox and the Computer System Vision Toolbox in MATLAB.

- [12]. Pratistha Gupta, G.N. Purohit, Manisha Rathore (2020). As an application of CCTV Traffic surveillance, retrieval of the number plate from the vehicles is an important dimension, which demands an intelligent solution. In this document, a template matching block of a computer vision toolbox has been used to extract the vehicle number plate. It is assumed that images of the vehicle have been captured at a particular resolution and orientation. It is also assumed that the alphanumeric characters on the plate have been written with a particular font style, type and size. This paper presents a new SIMULINK model in MATLAB which has been developed to extract the number plate from the vehicle. Each alphanumeric character on the plate is extracted and matched against the template image using a pattern matcher. This block matches the pixel values of the original image with one of the template images and provides the template metric values. MATLAB uses digital signal processing tools and a computer vision system to develop this SIMULINK model. The approach used in this model is pattern matching used to recognize letters and numbers. This method can be used for security purposes.
- [13]. Kirti Pholoria, Sachin Mahajan (2020). Vehicle license plates can contain up to 10 characters. In general, a license plate consists of two main parts. The upper part contains basic license plate information and the lower part is for the state name. To speed up the process, a histogram projection is used to divide the license plates into two groups. The first group usually consists of 3-4 letters and 3-2 numbers. The second group mainly contains country names. Therefore, two sets of SVMs are designed according to these two character groups. One set of SVMs is for recognizing license plate characters and the other is for characters representing status. From the presented experiments, it was concluded that "one-to-one" (OAA) can achieve higher accuracy than the one-to-one (OAO) method. Factors that cause misrecognition. For example, the orientation of the video system may cause numbers to appear skewed, lighting conditions may change with the time of day and weather changes, and letters on license plates may be obscured by rust, dirt or peeling paint, dull color. Also, the contrast between the sign and the license plate surface can be affected by color.
- [14]. N. E. Anagnostopoulos (2020). Security and management of transportation systems are key in controlled locations such as campuses. As the number of vehicles increases, efficient, inexpensive and efficient vehicle identification mechanisms are required. This paper presents the development of an automatic identification system using NP recognition in POLIMAS. License plate recognition (NP) is an image processing technique in computer vision that captures an image of a vehicle and recognizes the NP. The system is installed at the main entrance to ensure that only authorized vehicles can enter the campus. When a vehicle is detected by the input sensor, the system captures an image of the vehicle's license plate. An image is then extracted and investigated for character segmentation by using optical character recognition. The method used for detection of a plate number is by pre-processing of the image and using a combination of Sobel Edge Detection and Laplacian Edge Detection Techniques. Bounding Box technique is used to find the NP and character recognition.
- [15]. Priyanka Prabhakar, Anupama P, Resmi S R (2018). The fundamental process steps such as detection of number plate, segmentation of characters and recognition of each characters, segmentation plays an important part, since the accuracy of recognition is based on how perfect the segmentation is done. To avoid problems like unwanted illumination, tilt that degrades the segmentation which in turn affects the recognition accuracy numerous algorithms are developed for this work. This paper presents a strong technique for localisation, segmentation and recognition of the characters within the located plate. Images from still cameras or videos are obtained and regenerated in to grayscale images. Hough lines are determined using Hough transform and therefore the segmentation of a grey scale image generated by finding edges for smoothing the image is employed to cut back the quantity of connected part and then the connected part is calculated. These systems are based on different methodologies but still it is still a really challenging task as some of the factors like high speed of vehicle, non-uniform vehicle number plate, language of vehicle number and different lighting conditions can affect a lot in the overall recognition rate. Most of the systems work under these limitations
- [16]. Lee J.W., Kweon (2019) Vehicle number from the moving vehicle because of the speed of the vehicle. Therefore, there is a need to develop an Automatic Number Plate Recognition (ANPR) system as a one of the solutions to this problem. These systems are based on different methodologies but still it is still a really challenging task as some of the factors like high speed of vehicle, non-uniform vehicle number plate, language of vehicle number and different lighting conditions can affect a lot in the overall recognition. There are numerous ANPR systems available today. These systems are based on different methodologies but still it is still a really challenging task as some of the factors like high speed of vehicle, non-uniform vehicle number plate, language of vehicle number and different lighting conditions can affect a lot in the overall recognition rate. Most of the systems work under these limitations. In this paper, different approaches of ANPR are discussed by considering image size, success rate and processing time as parameters. Different methods, techniques and algorithms have been developed to detect and recognize LPs. Nevertheless, due to the LP characteristics that vary from one country to another in terms of numbering system, colors, language of characters, fonts and size. Further investigations are still needed in this field in order to make the detection and recognition process very efficient. These systems are based on different methodologies but still it is still a really challenging task as some of the factors like high speed of vehicle, non-uniform vehicle number plate, language of vehicle number and different lighting conditions can affect a lot in the overall recognition.
- [17]. Eun Ryung Lee; Pyeoung Kee Kim; Hang Joon Kim(2019). This pattern matching block compares the value of each pixel in the source image to the pixel value of the corresponding stored pattern and returns the pattern metric value as output. The templates stored in the model consist of templates in various fonts in English and some languages widely used in India (22 official languages). The SIMULINK model uses Digital Signal Processing Toolbox and Computer System Vision Toolbox license plates in a moving vehicle due to the speed of the vehicle. Therefore,

as one of the methods to solve this problem, it is necessary to develop an Automatic License Plate Recognition (ANPR) system. Many ANPR systems exist today. Although these systems are based on different methodologies, they are nonetheless still very challenging as some factors such as high vehicle speeds, non-uniform license plates, license language and different lighting conditions can significantly affect the overall recognition. put. Most systems operate within these limits. This article describes different approaches to ANPR using image size, success rate and processing time as parameters.

- [18]. Cheng Y., Lu J., Yahagi T. (2020). For segmentation, an approach based on the histogram analysis method with Hough transform is presented. It is robust to car plate inclination within 15 degree. Subsequently, in the recognition phase, Principle components analysis to extract the feature of input images and then feed to neural networks with radial basis function networks is used for symbols recognition. Experimental results show that the PCA method proposed reduces the dimension of image effectively and the recognition performance using RBF networks with is better than back- propagation (BP).It is robust to car plate inclination within 15 degree. Subsequently, in the recognition phase,components analysis to extract the feature of input images and then feed to neural networks with radial basis function networks is used for symbols recognition. Testing of license plate localization and the efficiency is analyzed. The system is also trained in vehicle detection and license plate localization.
- [19]. Irrfan Kilik, Galib Aydin (2019). This article presents an efficient and first computational technique for identifying license plates. In this method, the algorithm uses a limited number of calculations. Therefore, it is computationally very cheap compared to most existing methods. The proposed system can recognize all types of license plates in a short time of less than 0.5 seconds. This method is so clever that it doesn't matter whether the vehicle is stationary or moving at high speed. In addition, the license plate's letters can be identified even when the license plate is rotated up to 45 degrees. The presented method can be used in transnational areas, toll booths and all vehicle numbers protected from moving vehicles due to vehicle speed. Therefore, as one of the measures to solve this problem, it is necessary to develop an Automatic License Plate Recognition (ANPR) system. Many ANPR systems exist today. Although these systems are based on different methodologies, they are nonetheless still very challenging as some factors such as high vehicle speeds, non-uniform license plates, license language and different lighting conditions can significantly affect the overall recognition. put. Most systems operate within these limits. This article describes different approaches to ANPR using image size, success rate and processing time as parameters.

III. Conclusion

The main goal of this project is to detect license plates from images received from surveillance cameras or existing surveillance cameras. Efficient algorithms have been developed to detect license plates under different lighting conditions. Implemented a license plate recognition system for various applications using TensorFlow and EasyOCR. To do this, 80% of the data is acceptable for training and 20% of the data is acceptable for license plate localization testing and performance analysis. The system is also trained in vehicle detection and license plate localization. License plate localization and character recognition have been more successful than existing systems. Projects can be improved more improvisedly through implementation. The Automatic Number Plate Recognition (ANPR) system improves i's accuracy to achieve the benefits of real-time license plate recognition.

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