Number Plate Detection in Fog and Haze

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Abstract—The technique of vehicle license plate recognition can recognize and count the vehicles automatically, and thus many applications regarding the vehicles are greatly facilitated. The paper proposes the use of the Faster Regions with convolutional neural network to detect the number plate in the vehicle from the surveillance camera which is placed on the traffic areas. However, the recognition of vehicle license plates are extremely difficult especially in some fog-haze environments because the fog and haze blur the boundaries and characters of license plates significantly, which makes the license plates hard to be detected or recognized . This paper proposes a vehicle License Plate Recognition method for Fog-Haze environments. A dark channel prior algorithm based on the local estimation of atmospheric light value is applied to dehaze the blurred images preliminarily . Then, the images are further dehazed, and the license plate regions are detected through a Joint Further-dehazing and Region-extracting Model on basis of an object detection convolution neural network. Finally, the image super-resolution is accomplished with a convolution-enhanced super-resolution convolutional neural network, and hence the characters of license plates can be recognized successfully.

Keywords—R-CNN, De-hazing, LPR, ITS

I. INTRODUCTION

The transportation system has become an indispensable component of modern society. To manage the numerous vehicles conveniently, the Intelligent Traffic System(ITS) is proposed to provide innovative services relating to the transport and the traffic management. Each vehicle around the world has a license number as its principal identifier, as an essential stage in ITS; the technique of vehicle License Plate Recognition (LPR) can recognize and distinguish the vehicles automatically ,but it is hard to identify the number plates which are blurred due to fog and haze environments under this fog-haze weather which has become progressively more serious , the fog and haze blur the boundaries and characters of license plates significantly, which makes the license plates hard to be detected and recognized. Most of the existing license plate detection methods are based on the feature extraction technique, and they cannot detect the license plates accurately in fog-haze environments, due to the fact that the fog-haze interference and image ambiguity make the features very difficult to be extracted. Likewise, the character recognition is also affected by the fog-haze interference significantly. This paper proposes a vehicle License Plate Recognition method for Fog-Haze environments , and as shown in Figure 1, this method provides a framework which includes the image-dehazing technique based on an Object Detection Convolution Neural Network and the super-resolution technique based on a Convolutional Neural Network.Firstly, a dark channel prior algorithm based on the local estimation of atmospheric light value is applied to dehaze the images preliminarily. Then, the images are further dehazed , and the license plates are extracted with an ODCNN to reduce the distortion of image restoration caused by the cumulative errors of multiple parameters, and thus the license plates can be accurately extracted from these improved images. Finally, the image super-resolution technique is realised to improve the accuracy of the characters recognition of license plates.

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Fig 1 : License plate in haze-fog environment

II. PREVIOUS WORK

[1] In this paper LPDR plays a significant role to recognize vehicles registration number at a certain distance. Over past few years, researchers have developed many techniques to detect vehicle license plate but still it remains a challenging task. Vehicle identification approach can be classified into four main steps such as pre-processing, License plate region extraction, characters segmentation and each character recognition in the licensed number plate. In this paper, first various vehicle images have been acquired through camera, then input color image is converted to gray scale image, brightness adjustment, contrast up to optimum values and removing noise using median filtering is done in order to get better quality image. Finding exact location of license plate is the most important processing step in vehicle detection system, because all others steps depend on exact extraction of license plate region. Exact location of license plate region is masked and extracted from image. Segmentation of each character is done for extracted region. Segmentation is a process of subdividing a digital image into the consequent parts. The main purpose of image subdividing into consequent parts or objects present in the image is that we sought for the analysis extract some meaningful information. Segmentation is the crucial step in recognizing the vehicle license plate. After segmentation, character recognition is done. Each segmented character is compared with template matching, if characters are matched then it will display the output in text. First we select the image, remove noise and find the interested area of image, then the license plate location is extracted using edge detection then segmentation of each characters individually

[2] In this paper they discuss that human can easily read the character but the computer cannot read the character easily unless the computer is pre-trained to do so. VLPR deals with License Plate localization and vehicle number recognition. VLPR has three modules namely License Plate Extraction, Segmentation and Recognition. Extraction of plate is mostly carried out using edge detection. In Segmentation various tasks such as Filtering, Thinning, Vertical and Horizontal projections are performed. Recognition is the final stage to recognize character and numbers. The fulfillment of the Automated License Plate recognition system depends on quality of the input image. The performance of VLPR is degraded due to noise such as shadow, occlusion, rain streaks and blur due to vehicle speed. This paper analyzes various VLPR methods, classifies the VLPR literature based on feature extraction and classification schemes, presents the survey of approaches for detection, localization and recognition of plate character & numbers and addresses the challenges in performance improvement. Based on the challenges, an efficient scheme is suggested for VLPR which can handle dynamic weather condition. Due to exponential growth in number of vehicles, VLPR is needed in automated traffic surveillance and vehicle monitoring. All vehicles have unique ID through license plate. VLPR is very much useful in detection of stolen vehicles, monitoring illegal transport, gate monitoring, speed monitoring and automatic parking. VLPR should be fast to recognize the vehicle in real time. Though there are several approaches for vehicle number plate recognition, the efficiency of VLPR system depends on the quality of an image which is degraded based on weather condition, viz., static and dynamic.it shows the types of weather conditions which degrades the license plate image. Static condition includes fog, mist, and haze whereas dynamic condition includes rain and snow. Also, other challenges such as partial occlusion and shadow degrade the recognition performance detection of VLPR.

[3] License Plate recognition is the most efficient and cost-effective technique used for vehicle identification purposes. Automatic license plate recognition (ALPR) is used for finding location of the number plate. These approaches and techniques vary based on conditions like, image quality, car at fixed positions, conditions of lights, single image etc. It should also be able to cope with the variations in license plates from different nations and states. We mainly focus on detection and recognition of multiple cars license plate from a single frame. Proposed system consists of two steps: plate number detection and recognition. In plate detection part we apply both Spanish and Indian license plate. Automatic number plate recognition (ANPR) can be used to store and process license plate images captured by cameras with a high rate of accuracy and efficiency. In ALPR we can enact different techniques based on varying conditions like, image quality, fixed car positions and multiple plates extraction. The ever increasing vehicle count in our roads have hindered the smooth flow of traffic. It finds great use in managing real-life applications such as border control, parking, motorway road tolling, journey time measurement, access control, road traffic monitoring etc. A vehicle in a country is distinguishably identified by a unique alphanumeric number, which will be depicted on its license plate. Systems commonly use IR cameras to take the picture. Due to a change or a distinct form in color, texture size, shape,

and position of plate regions in such images the localization of plate regions is a challenging task. ALPR system completes the entire process passing through different stages. The stage is based on some features of the captured image to extract the license plate from the image. In image processing technique established on number plate recognition (NPR) system, to identify vehicles by applying neural networks and image co-relation. Extracting license plate from lacking brightness and less brightness image obtained recognition rate of 89.64%. detection is used to identify vehicles, using image co-relation and neural networks. Different novel approaches have been presented to improve the results. Pattern recognition are divided into two broad categories: recognizing abstract items and recognizing concrete items. They were used a multi thresholding and neural pattern recognition (NPR) techniques combined with artificial neural networks.

[4] Among the ranking of the largest road network in the world, India stood at third position. According to a survey held in 2016 the total number of vehicles in India were 260 million. Therefore, there is a necessity to develop Expert Automatic Number Plate Recognition (ANPR) systems in India because of the tremendous rise in the number of automobiles flying on the roads. It would help in proper tracking of the vehicles,expert traffic examining, tracing stolen vehicles, supervising parking toll and imposing strict actions against red light breaching. Implementing an ANPR expert system in real life seems to be a challenging task because of the variety of number plate (NP) formats,designs, shapes, color, scales, angles and non- uniform lightning situations during image accession. So, we implemented an ANPR system which acts more robustly in different challenging scenarios then the previous proposed ANPR systems.The goal of this paper ,is to design a robust technique for License Plate Detection(LPD) in the images using deep neural networks, Pre-process the detected license plate sand perform License Plate Recognition (LPR) using LSTM Tesseract OCR Engine. According to our experimental results, we have successfully achieved robust results with LPD accuracy of 99% and LPR accuracy of 95%just like commercial ANPR systems. Open-ALPR and Plate Recognizer. In recent years, Automatic License Plate Recognition (ALPR) had contributed a pivotal part in the growth of smart towns as a supervision system for automobile tracking, traffic regulation, enforcing strict traffic rules. ALPR has been tremendously used in traffic toll system ,smart parking system and security systems across many countries. The recent advances in Artificial Intelligence(AI),Machine Learning(ML), Deep Learning (DL) especially neural nets and Parallel Processing have contributed to the development of numerous Computer Vision projects, such as Object Identification, Object Detection and Optical character recognition(OCR), which benefitted ANPR systems. Undoubtedly, Region-based Convolutional Neural Networks (RCNNs) have been the dominant ML technique applied for automobile and Number Plate (NP) detection Besides Research papers, many commercialized ANPR systems have been immensely using DL Algorithms. These variations result in false positives on plate detection and poor LPR accuracy. Despite the advancements in the commercial ALPR systems, they mostly capture automobiles with frontal view and Number Plates(NP) which is common in applications such as smart parking system, Internet of Things (IOT) security systems, smart toll management systems. Our major input is the integration of a Faster RCNN Network which is able to successfully identify the NPs in numerous different scenarios and with an efficient detection accuracy. An additional contribution is, permitting the RCNN training from scratch using 1000 manually annotated images. The cropped License plate goes through a series of pre- processing methods that improves the quality for robust results .

[5] Vehicle's plate number is a unique identity by which individual vehicle can be identified. Vehicle plate recognition system helps to capture a vehicle plate number, extract the numbers on the plate and check the details of the car owner. As the number of car owners in a country increases, identifying and charging unlawful vehicles on the road has been a tedious work for law enforcement agents. In this paper, we present an automatic vehicle plate recognition system using Raspberry pi. A Camera was incorporated to help in capturing the plate number images and it is interfaced to a Raspberry pi processor for authentication. Using the Open Computer Vision (Open CV) and Optical Character Recognition (OCR), the system can extract numbers from the captured plate image and completely automate the license plate recognition. The experimental results from several testing in different locations and conditions show that the system performed better than most of the baseline studies considered. Automation is believed to be the most frequent term in most area of electronics and intelligent systems. Due to automation, a revolution has occurred in the existing technologies. Identifying vehicles automatically has become necessary due to its several applications. From the three key automatic recognition techniques, the most crucial task is to detect the license plate and failure of which will greatly affect the accuracy of the recognition. According to edge-based methods seems to be popular and widely accepted. The second task after detection is character segmentation, where the captured characters are segmented according to their height and width values. Different methods can be used to achieve this, such as; template matching , corner detection algorithm , Neural Networks, Raspberry Pi , etc. In this study, raspberry pi is the heart of the system. In many industries environment, unknown vehicles are not allowed. Security is of high importance hence this study will help to recognize the plate number of vehicles approaching at the gate by allowing security officials to automatically verify the plate number of vehicles entering and exiting seamlessly. Thus, confirming the identity of the owner and the vehicle's particular through the system stored information. The recognition of the vehicle number plate is in four steps. The first is image acquisition, second is license plate extraction, third is license plate segmentation, and last is character recognition. The development of the vehicle plate

recognition system shows how the use of the Open CV and OCR can be applied in the character extraction and recognition of vehicle plates. Although, this design is just a proof of the concept (prototype) and hence, includes the very initial step in a study that has the potential to be expanded in the future. In order to improve the design efficiency, other forms of character extraction and recognition technologies will be examined.

[6] Automatic Number Plate Recognition (ANPR) is a real time embedded system which automatically recognizes the license number of vehicles. In this paper, the task of recognizing number plate for Indian conditions is considered, where number plate standards are rarely followed. The system consists of integration of algorithms like: 'Feature-based number plate Localization' for locating the number plate, 'Image Scissoring' for character segmentation and statistical feature extraction for character recognition; which are specifically designed for Indian number plates. The system can recognize single and double line number plates under widely varying illumination conditions with a success rate of about 82%.ANPR is a mass surveillance system that captures the image of vehicles and recognizes their license number. Some applications of an ANPR system are, automated traffic surveillance and tracking system, automated high-way/parking toll collection systems, automation of petrol stations, journey time monitoring. Such systems automate the process of recognizing the license number of vehicles, making it fast, time- efficient and cost-effective. In designing this system , various Image Processing algorithms were designed in Matlab and implemented on the Digital Signal Processor which is optimized for video and image processing applications. A rear image of a vehicle is captured and processed using various algorithms. Initially, the number plate area is localized using a novel 'feature-based number plate localization' method which consists of many algorithms. This algorithm satisfactorily eliminates all the background noise and preserves only the number plate area in the image. These characters are given to the character recognition module, which uses statistical feature extraction to recognize the characters.Vehicle detection module detects the presence of vehicle by using inductive sensors in which metal wire loop is placed beneath the road. The system was tested with a set of images not used during testing, having wide variations in illumination conditions. The complete recognition process takes an average of 2 seconds. This can be further improved by optimizing the code. If cases where the number plate script is non-English or the number plate is badly distorted are excluded then, 82% of the plates were recognized correctly. The performance of individual sections is: 87% for number plate localization, 95% for character segmentation and 85% for character recognition.

[7] Automatic Number Plate Detection is the technology which is used to read vehicle number plate from an image containing a still or moving photograph of a vehicle. It is a major breakthrough in the technology which is very helpful for the law enforcements and traffic management authorities. The variation of the plate type and some environmental illuminations are considered in this paper. This technology uses special kind of surveillance cameras to track down and record the vehicles registrations and track down their activities easily. Due to rapid increase in vehicles all over the world it is very difficult to keep track of all these vehicles and to figure out the criminal activities. Therefore it is vitally important to keep track of all these vehicles by the respective authorities. To simplify their enormous task this technology is developed which helped them a lot in their management.in today's world, traffic management has become a major issue for most of the developing countries. The numbers of vehicles are increasing at an alarming rate, so the numbers of traffic violations are also rapidly increasing. Over- speeding, accidents, stealing of vehicles are increasing now a days. Due to the shortage of parking places, it leads to parking of vehicles in unauthorized places which results in huge fines. ANPD is a key aspect in rectifying all these problems, and also we can identify and track the vehicles, fix the time and coordinates of appearance and disappearance of the cars. ANPD consists of three main parts like number plate localization, number plate segmentation and optical character recognition. ANPD plays an important role in traffic management, automatic parking, automatic toll collection, tracking of a stolen vehicle, tracking of a potential terrorist activities, etc. Various problems arising in the plate detection are Variations of the number plates, Location of the plate, It is not necessary that the number plate only exists in the foreground of the image, it may exist in any part of the image. Quantity: An image may contain more than one license plate. In Automatic Number Plate Detection system works by capturing the photograph of the passing by vehicles, it is then divided into two parts namely foreground and background. Various parameters in considering a camera are camera megapixel, focal length, shutter speed, inclination and orientation. The image is then sent to a recognition unit which detects the number plates by applying selective techniques and processes namely Character recognition, etc the conclusion is derived that the vehicle license plate detection algorithm performs effectively on an input image. And the number plate detection was achieved successfully. Some factors does effect the detection of the number plate and they are quality of the camera, noise, visibility in the darkness, tilting, etc. In our future work we will work on rectifying these factors.

[8] Due to recent developments of highway and the increased utilization of vehicles, significant interest has been paid on the latest, effective, and precise intelligent transportation system (ITS). The process of identifying particular objects in an image plays a crucial part in the fields of computer vision or digital image processing. Vehicle license plate recognition (VLPR) process is difficult because of variations in viewpoint, shape, color, multiple formats and non-uniform illumination conditions while acquiring images. This paper presents effective deep learning based VLPR model using optimal K-means clustering based segmentation and convolutional neural

network (CNN) based recognition, called OKM-CNN model. The proposed OKM-CNN model operates on three main stages, namely license plate (LP) detection, segmentation using (OKM) clustering technique, license plate number recognition using the CNN model. LPR is considered to be more significant in various applications like unmanned parking fields, security management of unattended regions, as well as traffic safety administration. Unfortunately, these operations are very tedious, since the distinct format of plates as well as dynamic outdoor illumination constraints at the time of image acquisition, namely, background, brightness, vehicle's speed, and distance among the camera and vehicles. The process of location procedure is considered to be more complex throughout the mechanism, due to the fact that it has a direct impact on accuracy and efficiency of the consecutive procedure. Therefore, it becomes more complex to resolve the issues as the illumination conditions and some other tedious backgrounds existed. Many developers have been presented with massive approaches to placing the LP, like the edge prediction model, line sensitive filters used for extracting plate regions, window scheme, and arithmetic morphology approach Even though these methods are able to compute the task of placing an LP segmentation and analysis, several models perform only on individual line character segmentation and 2 kinds of character analysis were established namely, English and numerals. This paper presents an effective DL based VLPR model using optimal K-means clustering based segmentation and CNN based recognition, called OKM-CNN model. The proposed OKM-CNN model operates on three main stages. In the first stage, LP localization and detection process take place using Improved Bernsen algorithm (IBA) and Connected component analysis (CCA) model. The proposed OKM-CNN model operates on three main stagesIn future, the performance of the OKM-CNN model can be extended to recognize multilingual LPs.

[9] Automatic license plate recognition (ALPR) is generally considered a solved problem in the computer vision community. However, most of the current works on ALPR are designed to work on license plates (LP) from specific countries and use country-specific information which limits their practical applicability. Such ALPR systems require changes in the algorithm to work on other countries' LPs. Previous works on multinational LP recognition are tested on datasets from various countries that share the same LP layoutParticularly, tiny YOLOv3 was used for the first step whereas the second step uses YOLOv3-SPP – a version of YOLOv3 that consists of the spatial pyramid pooling (SPP) block. The localized LP is fed into YOLOv3-SPP for character recognition. The character recognition network returns the bounding boxes of the predicted characters and does not provide information about the sequence of the LP number. A LP number with an incorrect sequence is considered wrong. Thus, to extract the correct sequence, we propose a layout detection algorithm that can extract the correct sequence of LP numbers from multinational LPs. Given an image containing a LP, the proposed system can extract the LP number with the correct sequence.Given the correct bounding boxes, the layout detection algorithm can extract the correct sequence of LP number from various LP layouts belonging to different countries. To the best of our knowledge, we present the first publicly available1 Korean car plate dataset (KarPlate dataset) containing more than 4,000 full HD images of Korean cars. Based on the experimental results on datasets from five different countries, the proposed approach performs better than previous works in terms of performance even though many previous works utilize artificial data to prevent overfitting and to increase the dataset size. We did not use any artificial data in our system. This paper presented a generalized solution for multinational license plate recognition. Our algorithm consists of LP detection, unified character recognition, and multinational LP layout detection stepsThe proposed layout detection algorithm is simple, yet it can effectively classify among various LP layouts.

[10] This paper proposes a framework combing a fully convolutional network with broad learning system for license plate recognition. The fully convolutional network, which is designed as a pixel-level two-class classification method, is pro- posed for random-positioned object detection by the fusion of multi-scale and hierarchical features. For character segmentation, a trained Ada Boost cascade classifier is employed to locate a key character representing for an administrative area. We design a symmetric region horizontal projection method to estimate the license plate slant angles, and an approach based on vertical projection without hyphens to solve the problem of touching characters. For character recognition, the broad learning system with stacked auto-encoder of mapped feature nodes is proposed, and two structures are explored to recognize letters and digits, respectively. Generally, each country or region has its own license plate standard, thus ALPR is often designed locally Basically, there are two main factors to influence the performance of ALPR: plate variations and environment variations. To our knowledge, localizing one target license plate between two or more plates attached to the front or to the back of a vehicle is still unsolved. It can be regarded as a random-positioned object detection problem. Our motivation is to design a method using neural network techniques for ALPR and recognize the target license plate from multi-plates. Typically, ALPR consists of three steps: license plate detection, license plate character segmentation and license plate character recognition LPD is the first step for ALPR, which has a significant influence on the whole system. LPCS, forming a link between LPD and LPCR, has an immediate effect on recognition accuracy. LPCR, the step of generating license plate numbers, is expected to be robust for different scenarios. Above all, each step should be robust with a high accuracy for final results.In this paper, we propose a new method for license plate recognition. The proposed fully convolutional network is aimed for random-positioned object detection, and it is implemented by a fusion of multi-scale and

hierarchical feature maps. We applied this network to license plate detection and achieve remarkable results. To distinct similar characters such as letter 'B' and digit '8', letter 'O' and digit '0', we explore a dual-SAE_BLS structure for the recognition of letters and digits, respectively. All these techniques contribute to the promising results in accuracy and comparable processing speed. It is demonstrated by the comparisons with Faster-RCNN, Plate Recognizer, and other approaches at all stages of ALPR. In the future, it would be interesting to integrate these modules and apply our method to other regions that have similar situations as Macau.

III. PROPOSED SYSTEM

An image-dehazing technique based on an CNN which takes into account the fog concentrations is proposed. The images are divided into several regions according to the fog concentrations, and a finer transmission map can be generated by the values of local atmospheric light rather than those of global atmospheric light, and then the fog-haze interference can be filtered from the original images as much as possible. A Joint Further-dehazing and Region-extracting Model is provided. JFRM can dramatically reduce the distortion of image restoration caused by the cumulative errors and accurately detect the license plate regions of the preliminarily-dehazed images. In the proposed convolution-enhanced RCNN,the image quality can be significantly improved. OCR technique will take an image as input data then produces output in the form of text.

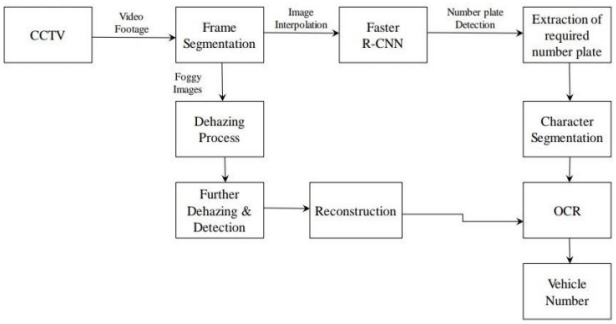


Figure 2: Proposed System

Frame Segmentation: It is the process of converting the video into Image format by converting it into frames

Faster R-CNN: It is a deep convolutional network used for object detection, that appears to the user as a single, end-to-end, unified network. The network can accurately and quickly predict the locations of different objects. Here It is used to detect the number plate from the frames.

Dehazing Process: Here we use dark channel prior algorithm to dehaze foggy or unclear images. We dehaze images so that the number plate can be detected properly.

Character Segmentation: Character segmentation is an operation that seeks to decompose an image of a sequence of charac- ters into subimages of individual symbols. It is one of the decision processes in a system for optical character recognition (OCR). Here we divide the characters of the detected number plate into segments.

OCR: It is a technology that recognizes text within a digital image. It is commonly used to recognize text in scanned documents and images. OCR software can be used to convert a physical paper document, or an image into an accessible electronic version with text. Here we use this to recognize the characters of the number plate we detected.

IV. METHEDOLOGY

A. VGG16

Vgg16 is a convolutional neural network is also known as a ConvNet, which is a kind of artificial neural network. A convolutional neural network has an input layer, an output layer, and various hidden layers. VGG16 is a type of CNN (Convolutional Neural Network) that is considered to be one of the best computer vision models to date. The creators of this model evaluated the networks and increased the depth using an architecture with very small (3 × 3) convolution filters, which showed a significant improvement on the prior-art configurations. They pushed the depth to 16–19 weight layers making it approx — 138 trainable parameters.VGG16 is object detection and classification algorithm which is able to classify 1000 images of 1000 different categories with 92.7% accuracy. It is one of the popular algorithms for image classification and is easy to use with transfer learning.The 16 in VGG16 refers to 16 layers that have weights.

In VGG16 there are thirteen convolutional layers, five Max Pooling layers, and three Dense layers which sum up to 21 layers but it has only sixteen weight layers i.e., learnable parameters layer. VGG16 takes input tensor size as 224, 244 with 3 RGB channel Most unique thing about VGG16 is that instead of having a large number of hyper-parameters they focused on having convolution layers of 3x3 filter with stride 1 and always used the same padding and maxpool layer of 2x2

filter of stride 2. The convolution and max pool layers are consistently arranged throughout the whole architecture Conv-1 Layer has 64 number of filters, Conv-2 has 128 filters, Conv-3 has 256 filters, Conv 4 and Conv 5 has 512 filters. Three Fully-Connected (FC) layers follow a stack of convolutional layers: the first two have 4096 channels each, the third performs 1000-way ILSVRC classification and thus contains 1000 channels. The final layer is the soft-max layer.

B. Dark Channel Prior Algorithm

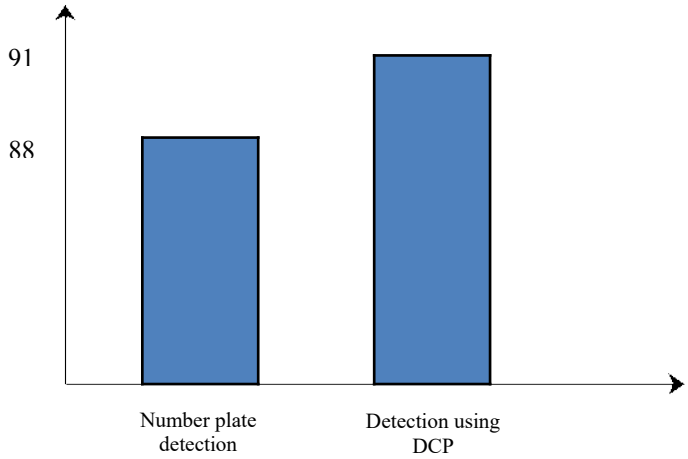
Dark Channel Prior (DCP) is one of the significant dehazing methods based upon the observation of the key features of the haze-free images. First,a ad fast one-dimensional filter is taken into account, and program optimization to reduce the computational complexity. Next, follow by using a part of the guided filter for sky detection and to preserve the sky region from noise by avoiding over recovery. Then, it proposes an airlight update strategy and adjust the radius of a guided filter to reduce the flickering artifacts and also propose an airlight estimation method to produce the better dehazing result as the final step of algorithm. The improved results from proposed algorithm are stable and are obtained from the real-time processing suitable for ADAS, surveillance, and monitoring systems. The implementation of the proposed algorithm has yielded a high speed .

V. RESULT

The experimental results of the proposed models are discussed here. An image-dehazing technique based on RCNN which takes into account the fog concentrations is proposed. The images are divided into several regions according to the fog concentrations, and a finer transmission map can be generated by the values of local atmospheric light rather than those of global atmospheric light, and then the fog-haze interference can be filtered from the original images as much as possible.

Performance Analysis:-

The output of this project shows great results compared to previous traditional number plate detection techniques. The Dark channel prior method to dehaze number plate detected in fog has shown great results compared to previous normal detection techniques. We can see an increase of 3 percentage from 88% to 91% in accuracy.



VI. CONCLUSION

This study explores the vehicle license plate recognition problem in the fog-haze environments. To reduce the fog-haze interference, a fog concentration dehazing method is first investigated, and in the proposed DCP method, the further-dehazing detection is optimised jointly, which dramatically reduces the distortion of image reconstruction caused by the cumulative errors and accurately extracts the license plates from the preliminarily dehazed images. Finally, the image super-resolution is accomplished with a convolution-enhanced RCNN, and hence the characters of license plates can be recognised successfully. Simulation results demonstrate our method can improve the accuracy of the vehicle license plate recognition in the fog- haze environments.

In the near Future we will be able to detect the number plates in various climatic conditions. Future research focuses on the optimisation of transmission maps in the dehazed images. Extensive experiments have been conducted, and the results indicate that DCP can recognise the license plates accurately even in some severe fog-haze environments.

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