A Survey on Vehicle License Plate Recognition System Using Deep Learning Technique

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***Abstract*—** Automatic Number Plate Recognition (ANPR) is to extract vehicle license plate information from an image. ALPR systems have variety of significant applications such as law enforcement, public safety agencies, toll gate systems, parking fee payment system, traffic surveillance etc. The aim of these system is to recognize the characters on the license plate through high accuracy. ALPR has been enforced exploitation varied methods. Traditional recognition approaches use handcrafted features for obtaining features from the image. In contrast to typical strategies, deep learning techniques automatically select features and are one of the dynamic technologies in the field of computer vision, automatic recognition tasks and natural language processing. This research applies deep learning techniques to the ALPR problem of recognizing the license number. In this paper, we present a comprehensive review on the state of the art techniques for ALPR.

Keywords— *Automatic Number plate recognition (ANPR), Optical Character Recognition, Deep Learning, License Plate Recognition, License plate detection, Image Preprocessing.*

I. INTRODUCTION

Automatic number plate recognition (ALPR) as a very important analysis field employed in computer vision, pattern recognition, image processing and artificial intelligence. It is one in all the important aspects of the intelligent transportation system of human society in the 21st century. This method is widely being employed to crub criminal activities around the globe. Alternative areas using this system include parking facilities, traffic management by making certain enforcement of traffic rules and regulation and automating the task of manually comparing vehicle plates thus reducing human efforts.

A number of factors impact the performance of system. There are several measures that are relevant to the overall performance of the technology [1].

1. Read Accuracy – It is a degree of the accuracy of ALPR system interpretation of captured plates with the actual alphanumeric characters of the plate.

2. Matching Effectiveness – a measure of the effectiveness of ALPR units to accurately match license plates reads to records.

3. Capture/Read Factors – there are some factors that may influence the ability of ALPR units to capture and accurately read and match license plates. Capture/Read factors include the following:

a. Character and/or plate color
b. Plate design factors (logos, stacked characters etc.)
c. State of origin (i.e., the state which delivered the plate)
d. Plate covers or other obstructions
e. Plate location on the vehicle
f. Interval between vehicles
g. Lighting conditions (e.g., day vs. night)
h. Weather conditions
i. age or ability camera
k. camera angle

Vehicle license plate recognition involves license plate detection (LPD), character segmentation and recognition. License plate detection is the basic component of vehicle license plate recognition. The performance of license plate detection, in terms of each detection accuracy and run-time efficiency, largely determines the overall accuracy and processing speed of the recognition system. License plate detection influences the support provided for intelligent transport systems in smart cities. Correct vehicle identification depends extremely on the accuracy of automatic number plate recognition (ANPR) system as number plate is the only trustworthy identity of a Vehicle Intelligent Transportation Systems (ITS). This paper covers a survey on different techniques which are used for automatic number plate recognition.

II. LITERATURE SURVEY

K.Yogheedha et al. [2] presented image processing and template matching based vehicle license plate recognition system. The main objective is to increase the effectiveness of license plate recognition system for University Malaysia Perlis (UniMAP) smart university. The image processing approach

contains colour conversion, Otsu's thresholding, noise removal, image substraction and cropping also bounding box feature. To recognize the printed characters on the segmented license plate image and yield output data the character recognition based on template matching approach is used. For recognizing performance of system 14 cars have been evaluated. The presented system is capable of successfully recognizing 13 cars. When the car is tested on nonstandard license plate character the mismatch happened in this system as it is specialized for standard license plate characters only.

Mahesh Babu k and M V Raghunadh [3] proposed vehicle number plate detection and recognition based on Bounding Box Method. The system consist of four major steps: Preprocessing of captured image, Extracting license number plate region, Segmented and Character recognition. For recognition of each characters in number plate template matching method with the use of correlation is used. The system has difficulties in recognizing license plate in blur images, broken number plate, similarities between some characters such as O and D, 5 and S, 8 and B, 0 and O etc.

Gajendra sharma [4] presented template matching based performance analysis of vehicle number plate recognition system using Matlab. To measure the performance of a system through comparing the result of accuracy of system using template matching algorithm such as normalized cross correlation and phase correlation algorithm. It is concluded that the normalized cross correlation technique was additional correct to recognize the number plate than phase correlation method besides recognition accuracy of normalized cross correlation was 67.98% and phase correlation was 63.46%. The system was verified through 90 patterns under several conditions. It includes experiment of the number plate recognition by phase correlation and normalized cross correlation strategies. The future scope offers extension of work to improve the accuracy of phase correlation and normalized correlation by taking inputs from live video feed also select the best vehicle frame for classification of vehicle types and recognizing number.

Bhavin V Kakani and Sagar Jani [5] presented a blended algorithm for recognition of license plate which is simulated on 300 motor vehicle LP images. The system can be categorized under three major modules License Plate Localization, Plate Character Segmentation and Plate Character Recognition. The training period taken by ANN was 12 seconds and once trained, it identifies the test samples fed to the network competently. The system has less time complexity, High Flexibility to untrained test inputs with much less features to calculate. Accuracy of the algorithm is largely dependent on the change in the environmental conditions and equally depends upon the quality of the image captured by the device (CCTV or Camera). Since it has large processing time so not good for real time, the system still has a large scope for further expansions.

Tran Due DuaJl [6] presented approach using the combination of Hough transform and contour algorithm produces the higher accuracy and faster speed for VLP detection. The method can be used on VLP images that have been taken from various distance. Future scope offers the combination of a number of texture based approaches and machine learning methods to evaluate plate-candidates. It will improve the accuracy and the speed of the algorithm furthermore.

Dong-Su Kim and Sung-I1 Chien [7] presented a method which estimates symmetry of plate comers and extracts car license plates captured from the arbitrary directions. Also, we propose scan line based GST to expand time complexity of the GST significantly due to selective attention to particular distortions in case of a large searching window. In this system adopt the verifier which evaluates a candidate license plate to enhance extraction rate. Further work will focus on assessing extraction performance in terms of an oblique angle of gazing also enhancing further recognition accuracy when this extraction method is coupled with the recognition engine.

Bo Li et al [8] proposed license plate detection algorithm which divided into three steps: Decomposition, Modeling and Inference. In first step one license plate is decomposed into various constituent characters. To extract candidate characters in images conditional random field (CRF) model is constructed. The relationship between the characters is integrated in CRF in the form of probability distribution. Through the belief propagation inference on CRF the exact bounding boxes of license plates. In future more effort can be taken to improve accuracy and performance efficiency.

Wengang Zhou et al. [9] proposed a novel scheme to automatically locate license plates by principal visual word (PVW), discovery and local feature matching. The approach is fail when the license plate resolution is too low and when the distortion from the observation angle is too severe. The extension of approach offers detection of logos and trademarks.

Yong Zhao [10] presented a method which uses all kind of features to select a license plate from an image which consist of four parts such as image graying and enhancement, voting to get candidate blocks in first round, horizontal and vertical boundary adjustment, the second round of voting to locate the real plate image. Future work offers the combination of character segmentation and recognition module.

Yule Yuan et al. [11] proposed vehicle license plate detection method using a cascaded license plate classifier. It is based on linear SVMs using color saliency features to identify the true

license plate between the candidate regions. The future scope involves the MSER or Hough transform approach which address difficult cases.

Amirgaliyev Beibut et al. [12] presented number plate recognition system based on Optical character recognition and Sobel edge detector. The proposed approach gives 90% accuracy for recognition of number plate from different sides and climates. The limitation of system is distance from camera to the vehicle and weather conditions decreases the performance of system. Future scope offer artificial neural network approach for segmentation and optical character recognition.

Riazul Islam et al. [13] proposed an approach which built on morphological operations using different structuring elements to exclude non interested region and enhance object area. The system is computationally very inexpensive but have limited area coverage. Future scope offers to increase the accuracy of a system with the help of train database.

Y.Y.Nguwi and W.J.Lim [14] presented number plate recognition in Noisy images using combination of filters and morphological transformation for segmenting number plate. For recognition of character the system uses resilient back propagation neural network. The proposed approach tolerate noise level up to 20% with recognition rate of 85%. The future scope involves work on variation in number plate and font size.

Worawut Yimyam and Mahasak Ketcham [15] proposed an automated parking fee calculation using license plate recognition. The system is used to reduce manual license plate identification that is widely employed at parking area of leading malls where vehicle circulation is high. The presented approach requires license plate images are clear, sharp, no reflection and background should be white or light color. The future enhancement involves work on imperfect image.

III SYSTEM ARCHITECTURE

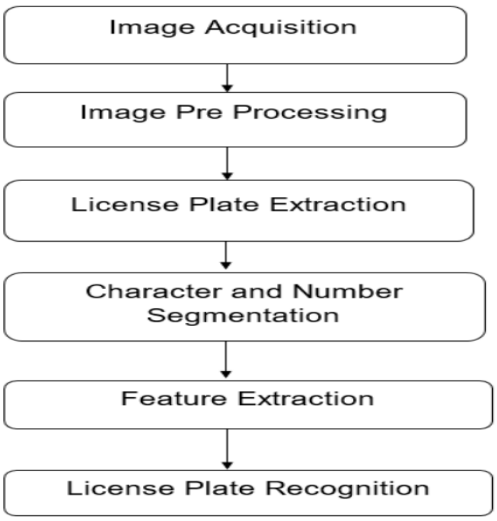
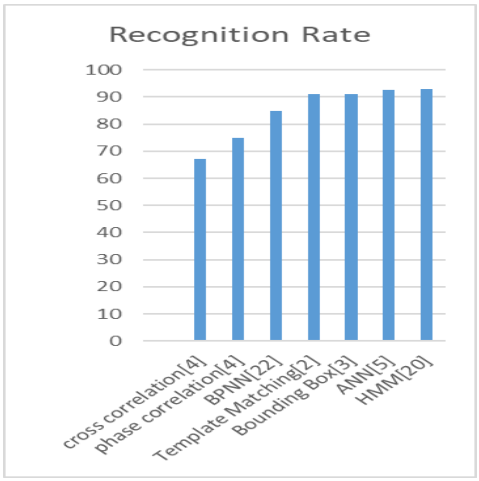
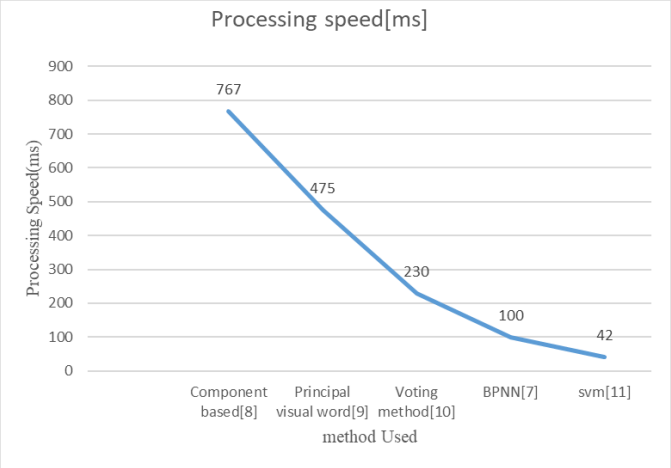


Fig. 1 Flow of work in Proposed System

IV ANALYSIS AND DISCUSSION



A] Analysis of different OCR algorithms w.r.t. accuracy



B] Analysis of various technologies w.r.t. processing time

Fig. 2 Performance comparison of some typical ALPR Systems

From figure 2 Performance comparison of some typical ALPR system is observed. Figure 2(a) shows recognition rate of number plate from given images in terms of accuracy of system with respect to different OCR algorithm. Fig. 2(b) represent Average Run times of different methods for processing an Image. From these it is observed that there is still expansion of increasing accuracy of system and decreasing processing time of image.

V. CONCLUSION

This paper discuss a comprehensive survey on existing ALPR techniques. ALPR techniques by categorizing them according to the features employed in each stage. Comparisons of them in terms of accuracy as well as processing time. Automated License Plate Recognition (ALPR) is a technology that uses Optical Character Recognition (OCR) to automatically read License plate number. The mechanism of the OCR system contains the Processing of Image, Number Plate Localization, Character Segmentation and Character Recognition. The proposed system uses deep learning techniques to extend the performance of system in terms of accuracy and processing time of Image.

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