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License plate detection using AI

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***Abstract*---**In today's world, within creasing population number of vehiclesare also increased. Monitoring each and every vehicle in roadside by manual force becomes a tedious job. For effective traffic management some solution is required. The traditional system of licenseplate recognition basically relies on the morphological processing of images. The accuracy of recognition is also lower. In order to provide an efficient solution for license plate position, we propose a new method of license plate recognition. In the license plate position, we use traditional positioning method and Haar Cascade algorithm to detect the license plate. In addition with the traditional identification system cutting and matching, we use the ability feature extraction of Convolution Neural Network (CNN) to detect the license platedirectly, which avoids the recognition error which is caused by the segmentation in the license plate recognition. In this project, we propose a new license plate recognition system. It is divided into two parts, they are license plate positioning and character recognition.

***Keywords*---**Convolution Neural Network (CNN), License Plate Detection (LPD), recognition system.

I. Introduction

License Plate Detection (LPD) has been a methodology used in various Intelligent Transport System (ITS) over the last few decades. It replaced human efforts to recognize the license plate. Instead of high-speed vehicle plate recognition surroundings, this proposed system with the LPD technology is designed

primarily in the scope of a car parking area with acamera stationed statically. In a typical LPD system, the first step is capturing the vehicle image with the license plate from the camera. The digital image is then processed to some useful information by applying some image processing methodologies.

After carrying the image, the grayscale features take place to the input image which is to find the average color value from the three main element color which are red, green and blue (RGB). After that, the grayscale image is further process to the binarization and transform the grayscale image to only black and white for future use. With the image in black and white, the system performs license plate detection by searching through rectangle made up with all four white edges in the image which maybe contains the characters within. This step is crucial as the characters may not be detected when the license plate portion is incorrect. Automated recognition and identification of vehicle license plates (VLP) has great moment in security and traffic systems. It can help in multiple ways in monitoring and regulating the road traffic. For the management of urban and rural traffic, there is a lot interest in the automation of the license plate recognition in order to regulate the traffic flow, to control access to restricted areas, and to survey traffic violations. License Plate Recognition (LPR) has been a method used in various Intelligent Transport System (ITS) over the last few decades. It replaced human efforts to recognize the license plate. Instead of high-speed vehicle plate recognition environment, this proposed system with the LPR technology is designed primarily in the scope of a car park area with a camera stationed statically.

In this project, we propose a new license plate recognition system. It is mostly divided into two parts, one is the license plate positioning, and the other is the character recognition. The license plate positioning is combined with the traditional technology and the Haar Cascade. In the character recognition, the CNN is used to extract the license plate information, and a recognition model is trained for each license plate character.

A Convolutional Neural Network is a Deep Learning algorithm which can take in an input image, assign importance to various aspects/objects in the image and be suitable to seperate one from the other. The pre-processing needed in a ConvNet is much lower as compared to other category algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the capability to learn these filters/characteristics.

Convolutional Neural Network is used in Image data, Classification prediction problems and Regression prediction problems. More generally, CNNs work well with data that has a spatial selection. After detecting the license plate we are in need of finding whether the vehicle is fake or not and we also find the vehicle insurance and other details.

In a typical LPR system, the first step is capturing the vehicle image with the license plate from the camera. The digital image is also processed to some useful information by applying some image processing methods. After carrying the image, the grayscale features take place to the input image which is to find the average color value from the three main component color which are red, green

and blue (RGB). After that, the grayscale image is further processed to the binarization and transform the grayscale image to only black and white for future use. With the image in black and white, the system performs license plate detection by searching through rectangle made up with all four white edges in the image which possibly contains the characters within. This step is critical as the characters may not be detected when the license plate portion is incorrect.

II. Literature Review

The task of vehicle identification can be worked out by vehicle license plate recognition. It can be used in multipleoperations such as entrance admission, security, parking control, airfield or harbor cargo control, road traffic control, speed control and so on. A number of commercial software is developed in this area. Still, they cannot be readily used when vehicle image is delivered in different styles and formats [1-3]. Proposed approach allows removing this disadvantage by ensemble of two methods: (I) detection and extraction of image region included license plate from source images flow and (ii) recognition of character presented on the license plate. Image processing methodologies similar as edge detection, thresholding and resampling have been used to detect and segregate the license plate and the characters.

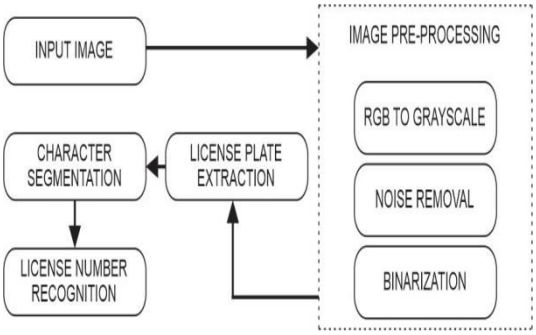
The Convolutional neural network used for successful recognition the license plate number. Once a license plate has been accurately identified, information about the vehicle can be attained from various databases. Should the information suggest that there is anything suspicious about the vehicle, applicable actions can be taken. The algorithm of license plate recognition (LPR) consists of the following steps: (i) to capture the car's images, (ii) to de-blur of image frames, (iii) to extract image of license plate, (iv) to extract characters from license plate image, (v) to recognize license plate characters and identify the vehicle

[1] V.Koval et al proposed a Smart License Plate Recognition System for detecting the vehicles' license plate using Convolution Neural Network. Some of the image processing methodologies similar as image fusion, deblurring technology have been used in this system.
[2] Tejas K et alexecuted an Effective License Plate Detection by Unique Edge Detection Algorithm and Smart Interpretation using IoT in which license plate of the vehicle is detected using Edge Detection Algorithm.
[3] Young Jung Choong et al proposed a system for License Plate Number Detection And Recognition Using Simplified LinearModel by converting the colour image into a binarized image and using character recognition the characters of the license plate are extracted.
[4] Abhishek Kashyap, B. et al proposed a system for Automatic Number Plate Recognition for extracting the text from the license plate of the vehicle. This system is based on an image processing concept. Optical Character Recognition (OCR) is used for extracting the license plate's characters.
[5] Fei Xie et al have proposed a novel license plate detection and character recognition algorithm based on a combined feature extraction model and BPNN (Backpropagation Neural Network) which is adaptable in weak illumination and complicated backgrounds.

[6] P. Surekha et al has proposed a system for Automatic License Plate Recognition Using Image Processing and Neural Network with around 92% accurateness in results.

III. Proposed Methodology

The objective of the proposed system is to give vehicle image as input to the system and input is attained using image acquisition device and output is obtained in the form of editable numbers. Then the input image is acquired and is pre-processed. The pre-processing involves RGB to grayscale conversion, Noise removal by Iterative bilateral filtering and Image binarization. And also license plate is extracted and the characters of number plate are segmented using character segmentation. Eventually, The License number is recognized using Convolution neural network.



IV. Working Modules

A. Collection of Data :

The datasets are collected from the kaggle. The huge amount of datasets have been used for the License plate detection which consists of vehicles data. This step is concerned with selecting the subset of all available data that will be working with.

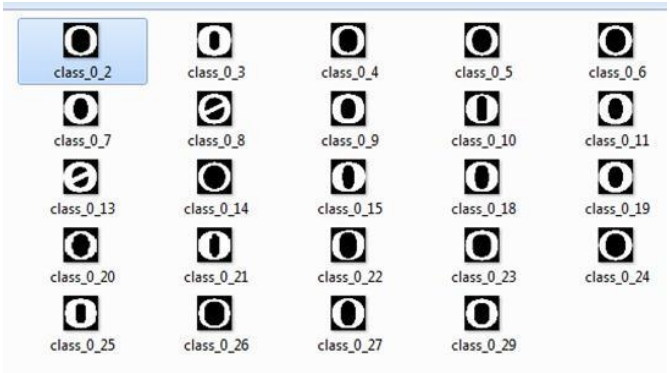


Fig. 2. Data sample-I

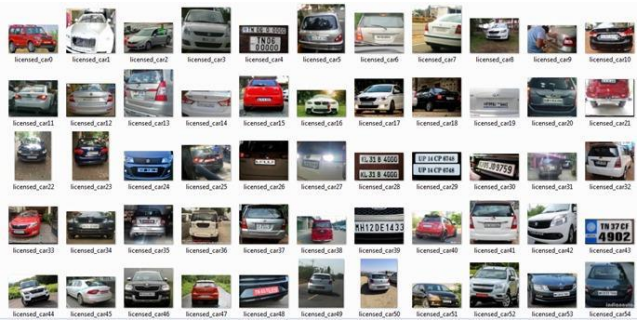


Fig.3. Data sample-II

B. Data Preprocessing :

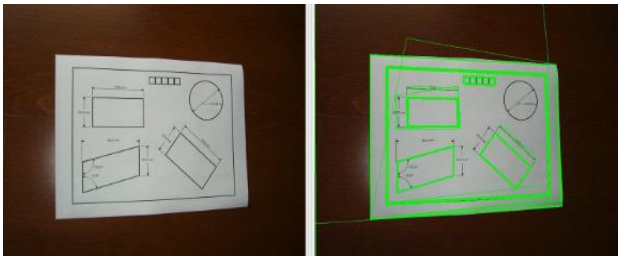
Preprocessing refers to transformation and preparing data suitable for machine learning model and it involves Formatting,Cleaning,Sampling. A small quantity of sample is taken for exploring much faster and protyping solutions before the whole dataset is considered.

C. Number Plate Detection :

Input image is taken,'haar cascade' is applied, pre-trained to detect license plates, parameter Scale Factor stands for a value by which input image can be scaled for better detection of license plate. False positives is removed using Min Neighbors, when thevalue is low, the algorithm may be more prone to give mis-recognized works.

D. Image processing :

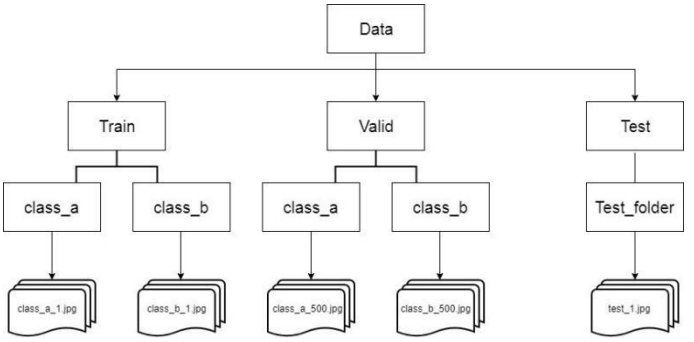
Image is taken as input and operations are performed are as follows: Resizes image into dimension to view all characters distinct and clear.The colored image is converted to a grey scaled image and also it is converted to binaryimage and is ready for process called Eroding.The image is now clean and free of boundary noise. Using OpenCV's grayscale, threshold, erode, dilate, contour detection and by some parameter tuning, we may fluently be suitable to induce enough information about the plate to decide if the data is useful enough to be passed on to further processes or not, also before passing the image to the coming process we need to make sure that it is noise-free and processed.



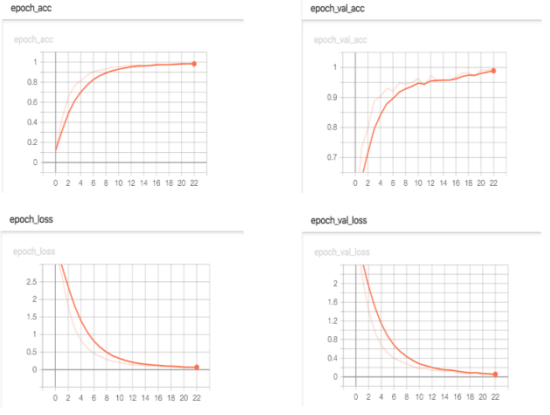
E. Segmentation :

Segmentation involves Finding all the contours in the input image. Dimensions are calculated on their separate bounding rectangle.Parameter tuning is done and filter out the needed rectangle containing needed characters. If everything in the above steps works well, we should be ready to extract the characters from the plate, this can be done by thresholding, eroding, dilating and blurring the image skillfully such that at the end the image we have is almost noise-free and easy for further functions to do on. We now again use contour detection and some parameter tuning to extract the characters.

F. Creating a model and training it:



The data is all clean and ready, now Neural Network is created that will be intelligent enough to recognize the characters after training. For modeling, Convolutional Neural Network is used with 3 layers and for training 'Categorical Cross Entropy' as loss function is used , 'Adam' as optimization function and 'Accuracy' as error matrix.Considering the characters one by one, recognizing the characters, concatenating the results and giving out the plate number as a string. Since we have all the characters, we need to pass the characters one by one into our trained model, and it should recognize the characters. We'll be using Keras for our Convolutional Neural Network model.After training for 23 epochs, the model achieved an accuracy of 99.54%.



V. Implementation and Results

In this paper, A new license plate detection framework is presented. Detecting license plate and classifying characters using CNN related forms.The structure got closeness with high processing speed even under several situations. The license plate detection step and character classification step is combined as single step with single neural network while keeping the same accuracy and speed. Also more data set is collected to enrich dataset, covering more characters captured under more arduous scenarios.

CNNs are used for image classification and recognition because of its high accurateness. It's a Deep Learning algorithm which can take in an input image, assign importance to colourful aspects/objects in the image and be fit to separate one from the other.The pre-processing needed in a ConvNet is much lower as compared to other classification algorithms and the ConvNet infrastructure make the explicit supposition that the inputs are images, which allows us to code certain properties into the architecture. These then make the forward function more effective to implement and vastly reduce the amount of parameters in the network.

Optical Character Recognition or OCR is the technology that's used to convert characters or text that's either handwritten or printed in the form of paper, scrutinized document, announcements, snaps etc. into machine encoded handbook or we can say in the digital form. The way involved in OCR is basically processing the input, recognizing the handbook and processing it further for the needed purpose. In OCR, single characters are recognized at a time. When words or lines or further handbook are recognized, it's called optical text recognition or hanbook recognition models

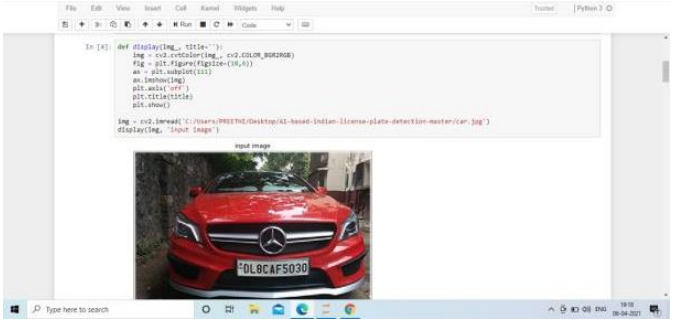


Fig. 4. Input Image

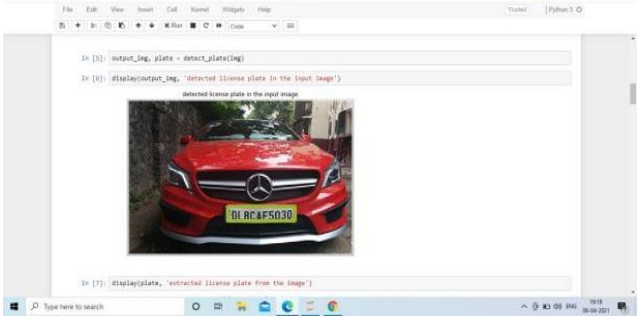


Fig. 5. Input image with number plate highlighted

Fig. 6. Binary image of extracted image

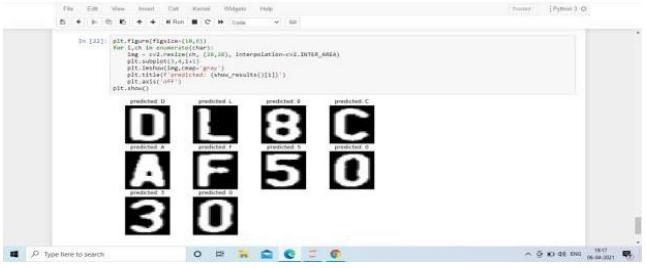


Fig. 7. Extracted Image

The input design is the link between the information system and the stoner. This step is concerned with choosing the subset of all available data that will be working it. Organize the selected data by formatting, cleaning and sampling from it. Three common data pre-processing steps are: Formatting: The data named may not be in a format that's suitable to work with. The data may be in a relational database and in a flat file, or the data may be in a proprietary file format in a relational database or a handbook file.

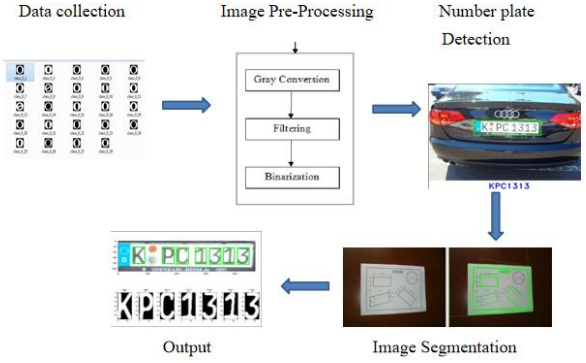
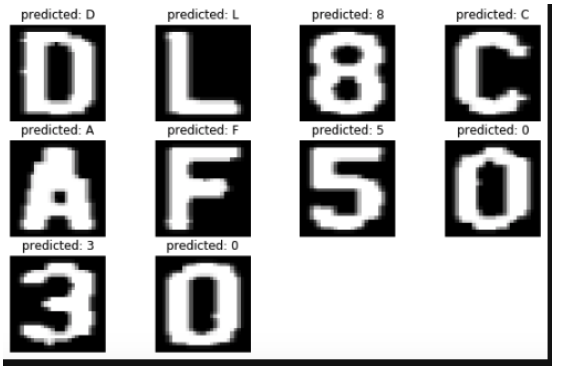


Fig. 8. Proposed system diagram

Taking image as input, then applying 'haar cascade' that is pre-trained to detect license plates, here the parameter Scale Factor stands for value by which input image can be measured for better discovery of license plate. Min Neighbours is

just a parameter to reduce false positives, if this value is low, the algorithm may be more prone to giving a misrecognized outputs. Image processing are applied to extract the individual characters from the license plate.

The steps involved will be chancing all the contours in the input image. The data is all clean and ready, now it's time do produce a Neural Network that will be intelligent enough to recognize the characters after training.



Vehicle info application is used to freely set up and this application allows users to check the basic details of any vehicle by entering the license plate number. In addition this operation has some other point like to get e-challan announcement and can easily download our RC/DL details.

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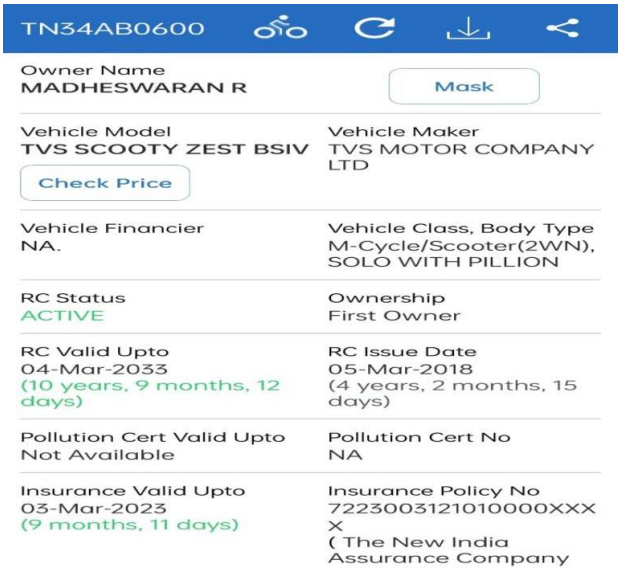
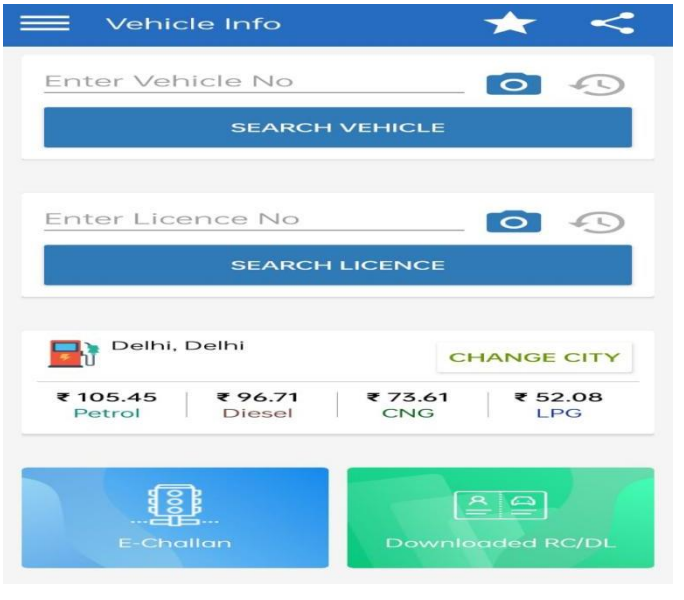

TN34AB0600
Owner Name
MADHESWARAN R
Mask
Vehicle Model
TVS SCOOTY ZEST BSIV
Check Price
Vehicle Maker
TVS MOTOR COMPANY LTD
Vehicle Financier
NA.
Vehicle Class, Body Type
M-Cycle/Scooter(2WN), SOLO WITH PILLION
RC Status
ACTIVE
Ownership
First Owner
RC Valid Upto
04-Mar-2033
(10 years, 9 months, 12 days)
RC Issue Date
05-Mar-2018
(4 years, 2 months, 15 days)
Pollution Cert Valid Upto
Not Available
Pollution Cert No
NA
Insurance Valid Upto
03-Mar-2023
(9 months, 11 days)
Insurance Policy No
72230031210100000XXX X
(The New India Assurance Company


Vehicle Info
Enter Vehicle No
SEARCH VEHICLE
Enter Licence No
SEARCH LICENCE
Delhi, Delhi
CHANGE CITY
₹ 105.45
Petrol
₹ 96.71
Diesel
₹ 73.61
CNG
₹ 52.08
LPG
E-Challan
Downloaded RC/DL

	(The New India Assurance Company Limited)
Seat Capacity 2 (Including Rider)	Engine Capacity NA
Fuel Type PETROL	Fuel Norms Not Available
Vehicle Color CLAS PINK	Unloaded(खाली) Weight 97 Kgs
Engine No FG4AJ23XXXXX	Chassis No MD626FG48J2AXXXXX
Registration Authority TIRUCHENGODE RTO, Tamil Nadu	Tax Valid Upto NA

After extracting the number from the License Plate Detection then we are using Vehicle info app which gives the necessary details from the extracted number. The following information can be obtain in the vahan usage and website when one inputs the registration number of the vehicle.

- Holder's Name
- Registration Date
- Vehicle type
- Registering Authority
- RC status and validity
- Insurance Validity
- Seat capacity
- Fuel type
- Vehicle color and Engine Number

VI. Conclusion

Automatic license plate recognition is a wide field which can be implemented using many different algorithms and techniques. Every method has its own advantages and disadvantages. Here proposed methodology initially does the pre - processing steps which includes RGB to grayscale conversion, noise removal, and binarization of the image. After which the license plate is extracted using edge detection algorithms again the characters are segmented using horizontal scanning which is given as input to the CNN in order to recognize the character exactly. Training our system with the help of ANN made our system more reliable and efficient in order to recognize the characters correctly. In order to handle the cases where people don't follow certain rules, it can be handled in future projects being implemented in this field of license plate recognition. This design helps in many ways such as improving road safety, reduce crimes and prepaid parking members can be easily differentiated from Non-members. This helps to find the fraudulent messages which is like fastag that amount is taken from the fake vehicle number plate. It also find the whether the vehicle's number plate is real or fake through license plate recognition and vahan app.

Even though it is used some of mischief conditioning are done ie, the vehicle have not crossed any toll gates and the amount is taken from the owners without their knowledge. To avoid those situations we are detecting their number plate and

finding whether they have crossed the toll or not and then the amount is taken from account.

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