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Car Number Plate Detection

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Abstract:- Vehicle tracking is no longer feasible due to population growth. It's a waste of time and resources. Tracking individual vehicles has become a very difficult task due to the tremendous development in the vehicular sector on a daily basis.

This work proposes an automatic vehicle monitoring sys- tem for fast-moving automobiles using roadside sur- veillance cameras. In modern smart cities, license plate recognition systems are used in toll payment systems, parking charge payment systems, and residential access control. These electronic technologies are not only useful in people's daily lives, but it also provides management with safe and efficient services. An effective approach for rec- ognizing Indian automobile number plates has been im- plemented in the suggested algorithm.

The proposed system is able to deal with noisy, low illumi- nated, cross angled, non-standard font number plates. This thesis presents effective deep learning-based ALPR (Au- tomatic License Plate Recognition) model using Character segmentation and CNN (Convolutional Neural Network) based recognition model. The experimental result gives an accuracy rate of f1 score of 94.94%.

I. INTRODUCTION

Vehicle NPR (Number Plate Recognition) or LPR (License Plate Recognition) is an increased CV (Computer Vision) technology that relates vehicle while not direct human affilia- tion through their range plates. Every day, the amount of vehi-cles on the road is constant to grow. Due to this, the news un- folds nearly on a daily basis regarding the vehicle being robbed from the parking space or the other place inside town or having an accident and theft. To acknowledge these, vehi- cles establishments ought to thus install variety plate detection and acknowledgement device on CCTV (Closed Circuit Tele- vision) at each corner in each region. This method improves the police's aptitude to trace prohibited activities linking the use of automobiles. NPR systems square measure effectively used by provincial institutions and producing teams all told aspects of safety, examination, traffic supervision tenders.

II. SCOPE

NPR can be used in housing societies or apartments to only letthe resident's vehicle inside by storing the number plate de- tails in a database and cross checking it. This can reduce the man force near the gate. NPR can also be used in parking ar- eas to track down the vehicles violating the rules, ticketless parking, parking automation, parking fee charging, fraud by changing tickets are some areas where NPR is useful. NPR can be also extended to motorway road tolling where efficient road tolling helps to reduce scam linked to non-payment, makes charges effectives and hence thereby decreases work- force to course events of exclusions [1]. NPR can also be used in journey time measurement data where the data collected by NPR and feeding back information to the drivers to increase the security at traffic, optimizing traffic routes and reducing cost and time.

III. NUMBER PLATE DETECTION

The factors that are to be considered for numberplate detectionare:

- Size of the plate: Different vehicles will be having different plate sizes
- Background color: Different vehicle types will behaving different number plate background, for exam- ple a taxi car will be having yellow plate background whereas a private vehicle will be having white plate background.
- Location of the plate: Different plates will be in dif- ferent locations of the vehicle.

We extract number plates with the help of image segmenta- tion. Most common method is image binarization. Otsu's method can also be used to convert images into grayscale.

A. Image binarization

Image binarization is used to convert an image into blackand white form. We choose a certain threshold value to differ-entiate pixels some as black and some as white. This is a bitdifficult but can be overcome using adaptive thresholding.

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Fig. 1: Image converted to grayscale

B. Edge detection

Edge detection is employed for feature withdrawal and have choice. it's totally troublesome to use edge detection in complicated pictures as there may well be ensuing with object boundaries with no connected curves

Fig. 2: Edge detection

C. Character segmentation

After finding the location of the number plate, we then check the characters. There are many methods to perform character segmentation. We can apply the above discussed image binarization to character segmentation. For Indian number plates, blob coloring is not suitable. We should apply image scissoring algorithm where the plate will be scanned vertically and when white pixel is not found it will be scis- sored at that row and the values will be stored in a matrix.

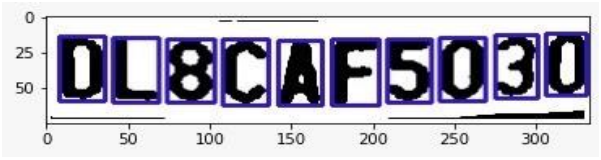

Fig. 3: Segmented characters

D. Character extraction

Character extraction identifies and converts the image text into actual text. All the number plate identification methods use character extraction and some of those methods can be discussed here. Most common methods used in character extraction are OCR (Optical Character Recognition), ANN (Artificial Neural Net- work) and Template matching.

OCR also known as Optical Character Extraction is a charac- ter extraction tool which has numerous software available for character extraction such as tesseract which is an open-source OCR developed by Google. Tesseract has been able to achievea rate of 98.7% for character extraction [2].

ANN contains inter connected artificial neurons. There are so many algorithms based on ANN. For classification of charac- ters MLP ANN model is used. It has three layers, input layer, hidden layer and output layer. The input layer is for decision making whereas the hidden layer computes complicated asso- ciations and finally the output layer for the result. We train ANN using feed forward back propagation. ANN was able to achieve a rate of 99% in character extraction [3].

Template matching can be used for characters that are fixed size. It's principally utilized in face detection and medical im- age process. It has two components: template-based matching and feature based matching. If the template image has strong features, feature based matching can be used. Template match- ing was able to achieve about 95.7%-character extraction rate [4].

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In [32]: print(show_results())

DL8CAF5030
```

Fig. 4: Character extraction

IV. PROPOSED METHODOLOGY

The rising population and technological advancements have drawn attention to the area of transportation. The amount of cars on the road has expanded rapidly, which is one of the primary causes of traffic congestion and violations. NPR was created to decrease traffic offences while also automating traf-fic management. In India, different NPR tactics are used, however their effectiveness is relatively low. The proposed model focuses on the detection of car number plate and recog- nizing it number plate. Various algorithms are implemented in python using Russian blurring method, OpenCV and CNN[5].

The first thing we have to do is data understanding. We input the image of the plate and then our aim is to extract the char- acter images. For that, we perform character segmentation which is the most important step for identifying the number plates.

In brief as the first step, we input the image then we convert the image into grayscale or black and white. Then we perform image binarization proceeded by blurring the image to reduce the unwanted louds. Then we perform character segmentation to take out each and every character, then do the character extraction methods using OCR or Template matching or ANN.

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A. Understanding the Libraries

Numpy, OpenCV, Tensorflow, SKlearn

NumPy is a python package used for various applications. Aside from the obvious scientific applications, it also has a number of other uses. NumPy may be used to store common data in a multi-dimensional container.

The following are some of NumPy's features:

- NumPy Array is a multidimensional array with vectorized arithmetic that is quick and space-efficient.
- sophisticated broadcasting features and opera- tions
- Standard mathematical functions can be used to perform quick operations on big sets of data.
- Without the use of loops, data may be collected.
- Working with memory-mapped files and read- ing/writing array data to disc
- Toolkits for integrating C, C++, and Fortran pro- grams with linear algebra, random number gen- eration, and other capabilities.

Open-Source Computer Vision is an open-source computer vision and machine learning software library. It is used to identify various objects, faces, identify action through photos or videos and has various specialties.

TensorFlow is another Python library used in Deep Learning models with the help of keras. It has various tools like Image Data Generation, Dense, Flatten, MaxPool and more.

Scikit-learn (Sklearn) provides various tools for modelling ML algorithms which includes classification, regression, cluster- ing, SVM, PCA and dimensionality reduction and many more. These are implemented using NumPy, SciPy, and Matplotlib libraries.

The following are some of Sklearn's key features:

- Clustering is a method for arranging unlabeled data into groups.
- Dimensionality reduction is a method for reducingthe number of characteristics in data so thatit can be summed up, visualized, and features chosen.
- As the name indicates, ensemble methods integrate the predictions of several supervised models.
- Feature extraction is a method of extracting data characteristics and defining attributes from images and text.
- Feature selection is a method for discovering desir- able characteristics that may be used to create super- vised models.

B. Flowchart

After inputting the image, it is then converted to gray scaleand then undergo various stages of filtering. Here filtering refers to blur the image to reduce the unwanted edges and louds from the image so we use either Median blur or Gauss- ian blur. These steps are considered as image pre-processing steps. After filtering, then we perform edge detection methods, here we use canny edge detection. After detecting the plate, we then go for character segmentation which is considered as an important step as it is necessary to identify each and every character image. Then we form character extraction using var- ious character extraction tools such as OCR, ANN, Template matching etc.

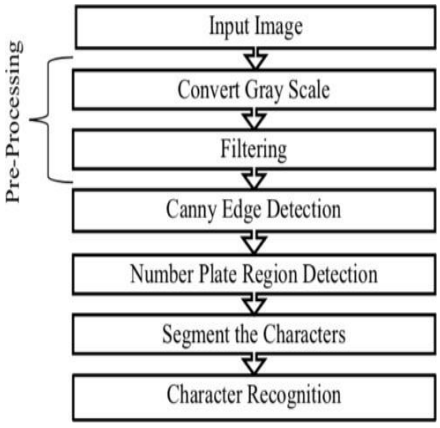

Fig. 5: Flowchart

C. ANN

The ANN has mainly three layers: input layer, hidden layerand output layer.

The input layer is for decision making whereas the hidden layer computes complicated associations and finally the output layer for the result. We train ANN using feed forward back propagation. ANN was able to achieve a rate of 99% in char- acter extraction [6].

Each input will have its own weights and after entering input layer, it undergoes various preprocessing steps and at hidden layer there undergoes convolution and pooling and after reach-ing a certain threshold value, the processed segmented image is then transferred to output layer where we will be obtaining the results.

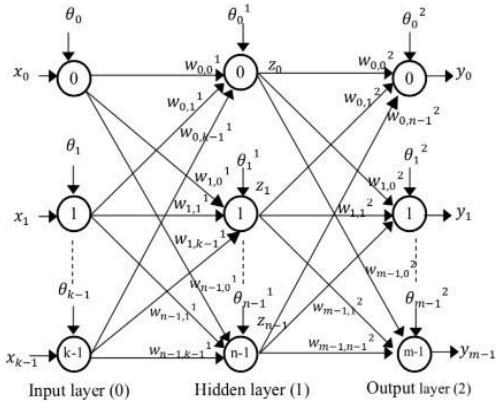

Fig. 6: ANN layers

D. CNN

CNN comprises of various layers of artificial neurons. Thefirst layers detect the edges such as diagonal, vertical and hor- izontal edges. The second layer detect the more complex fea- tures like edges and corners. The deeper layers detect highlevel features like face, object etc.

The vehicle imaged after input undergoes image pre-process- ing that is converting into gray scale and applying blur to re- duce the loud. Then it undergoes edge detection, we use canny edge detection here. After all the filtering process, it under- goes horizontal detection, then vertical

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detection and finally we apply character segmentation to identify the character im- ages and then apply character extraction to extract the vehicle number plate.

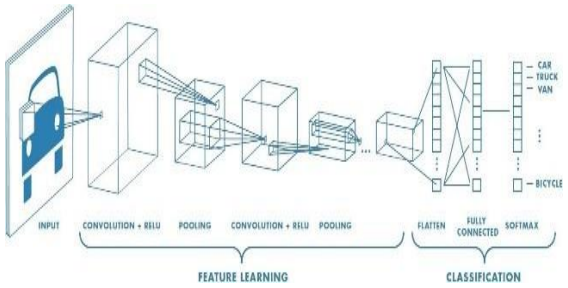

Fig. 7: CNN

E. KNN (K-Nearest Neighbours)

A KNN machine learning structure for programmed auto- mobile authorization number plate extraction was matured. The KNN classifier is going on secondhand in accordance with the sides of the license to recapture the enrollment plate from the p h o t o . They need associate degreed gone through had undergone passed through responded suffered that an au- thorization code is correct labelled through their submittedkind and earned an accuracyon top of ninetieth. Image extrac- tion algorithms in movingneural networks will identify every- thing, from text to ideas, visual and audio recreation transmit- ted via radio waves files, and videos. Neural networks are a mesh set of neurons or perceptron's named growth. every bud uses a alone recommendation information, principally one component of the countenance, And uses a lucid estimation named an incitement perform that produces results and every somatic cell incorporates a mathematical score that decides attract impact. A high-routine-based system for automobile range plate extraction has been matured. They need used edge-based countenance prepare strategies for authorization plate discovery and have too used a three-layer feedforward faux interconnected system for vehicle range plate integrity ac- knowledgment utilizing a learning invention for back-propa- gation.

V. CONCLUSION

NPR programmed number plate applications are strongly in- creasing in Indian platform since there is phenomenal increase in no of cars, bike, auto and Industry vehicles. NPR can be used in various applications including toll collection, Mall parking spaces, even manage vehicle in parking spaces, and it can also be included in traffic cameras which can beused to monitor and regulate traffic violators, etc., This project has many benefits. Character segmentation was used to extract every number from the number plates. Finally, F1 score preci- sion, recall was found for the input image and the result was calculated. The project has its own limitations as the model is not using higher machine learning or deep learning algorithmsbut it works efficiently for an average use case and that will betaken as a future work in scaling up the project to the further level.

The objective of this project was to highlight that free and open-source technologies are competent enough to be used in machine learning fields. The device performs admirably under a wide range of lighting situations and with various types of number plates usually seen in India. Even though there are acknowledged limitations, it is unquestionably superior than existing proprietary solutions. This was developed in Jupiter notebook using python language by taking images as input from the system. After 80 epochs it gives a f1 score accuracy of 94.94% [7].

VI. FUTURE ENHANCEMENTS

The automatic vehicle identification system will play a signif- icant role in identifying threats to defense in the future. It can also boost women's security since they can readily recognize the number plate before utilizing cabs or other services. If a bright and crisp camera is employed, the system's resilience can be increased. The government should take an interest in improving this technology because it is both cost-effective and environmentally benign when used efficiently in a variety of settings.

Sensors at the entry can be used to improve the system. When a car enters the gate, the image of its license plate is captured. The image is then transferred to MATLAB and subsequentlyto a database, where it is classified. If the license plate match- es, the gate will open; otherwise, an alarm will besent.

The precision of the recognition is obviously the most signifi- cant aspect of this technology. As a result, in order to over- come the accuracy constraints, this program needs be im-proved and updated. To improve the precision of the recogni- tion, we need include certain preprocessing steps to eliminate interferences. Furthermore, we would continue our research into license plate identification in more difficult settings, such as cars at night or in severe weather, and so on. If we were to achieve all of our goals, our application would have a very bright future.

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