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Vehicle Number Plate Detection using Concolutional Neural Networks

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***Abstract*—Vehicle Number Plate Detection (VNPD) Security is one of the main concerns in today's world. Every residential and government premises takes logs of the cars which enter their compounds. The manual logging of visiting vehicles in residential, commercial, government premises is cumbersome and expensive. An automated process for the same will greatly increase efficiency and reduce costs. This paper describes a seamless method for the same. The developed system will first detect the vehicle and then captures the vehicle image. Vehicle number plate region is extracted using 2D convolution. From the number plate obtained from the convolution the image frame is masked into grey scale. After masking, the trained model detects the texts in the frame and prints it on the screen.**

Keywords—Image Processing, Convolution, Convolutional Neural Network, TensorFlow, OpenCV, Python

I. Introduction

The global spending on residential security solutions reached a staggering 91.4 billion dollars in the year 2018 which is a 10 percent increase from the year before. The crime rate in the world is ever increasing and the residential complexes in the cities are making sure every car which goes in or out of the complex is logged in. Watchmen are the ones writing down the number of each car which enters the premises. The average salary per watchman in an Indian city is around 8000 rupees. This system is not very efficient, and it also forces the car to stop at the gate which also makes it time consuming

Most of the Government, residential as well as corporate complexes have 24-hour CCTV surveillance to record any theft which might take place. Setting up such an extensive system with its own memory is expensive and cumbersome. On top of this system there is also a need to keep people to log in the vehicles which adds on to the cost. If the logging system was to be made automated it would greatly reduce the cost of security for any building complex. The video feed from the CCTV cameras which are already installed at the gates can be used to make this VNPD (Vehicular number plate detection) system which automatically logs in the number plate of the car which enters or exits the gate.

II. Objectiives

The main objectives of VNPD are:

A. Automate the entry system of vehicles

The entry of vehicles is presently done manually. VNPD aims to automate this manual task.

B. Reduce the security expenses

This system will reduce the cost to hire people to write down the number plates of the cars entering the complex.

C. Increase in speed of logging

The vehicles entering the gates will not have to stop which will save time and increase of the vehicles entering.

D. Increase efficiency

The manual logging of number plates can have human errors. The automation of the system will eliminate this problem.

E. No need for physical storage

The data can be stored on the cloud and the need to keep physical books won't remain anymore. This is more reliable as the chances of the data getting lost or corrupted is low compared to a physical book.

III. System Design

A. Python

Python is a high-level object-oriented, programming language with dynamic semantics. The reason behind using python for VNPD is its support for extensive number of libraries helpful in machine learning, deep learning and data preprocessing [1].

B. OpenCV

OpenCV is an open source computer vision library. It provides many functionalities which can be used to work

with images and videos in real time. The main function of OpenCV in VNPD is to ”read” image which is fed to the system. This library has in-built tools available to apply various algorithms [2].

C. *TensorFlow*

TensorFlow is an end-to-end open source platform for machine learning. It is one of the widely used libraries used to deploy machine learning models across various devices and platforms. The creation and deployment of TensorFlow has revolutionised the world of AI by providing a number of functionalities which a developer need not implement. For VNPD, TensorFlow has APIs to create deep convolutional neural networks along with the necessary activation functions and optimisers [3].

IV. METHODOLOGY

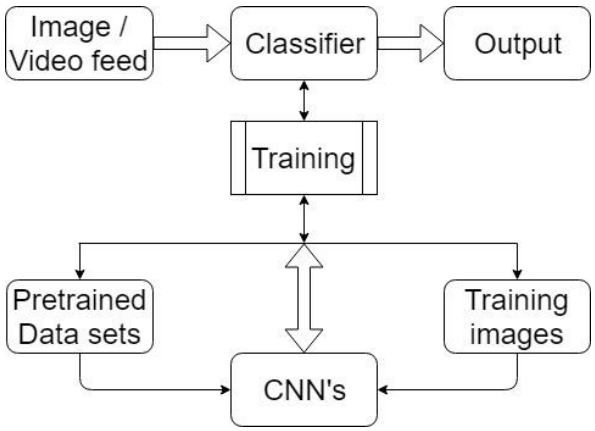

Figure 1. Block Diagram of VNPD

The block diagram of VNPD is shown in Fig 1. The following steps are followed for the overall working of the VNPD System:

A. *Image Capture*

An image of the vehicle showing the number plate is fed as input. The image is ”read” using OpenCV library. Since the feeding method is static, the image will be a static one and not a real time video feed [4][5].

B. *Training*

The classifier used will not be a pre-trained one, to reduce to the number of false positives. There will be 2 datasets used to train our classifier. One will have images of characters, and the other will have images of number plates. The type of classifier used will be a convolutional neural network (CNN), with the number of hidden layers depending on the time required for training along with final accuracy obtained. We have used a CNN classifier because by performing convolution on the images with the appropriate filters, we are able to reduce the size of the image while keeping the important factors which need to be processed [6][7].

An alternate classifier which can be used is an SVM classifier(support vector machine). This has not been implemented since it gives a lower accuracy on a large dataset, and the size of dataset used to train the model is more than 3 gigabytes.

1) Convolution: A virtual two dimensional frame will move across the image to predict the position of the number plate, by performing convolution. The point where the convolution is maximum, is the point where the classifier predicts the number plate’s position.

C. *Text Recognition*

From the number plate obtained from convolution, the sub image frame is masked into grey scale to minimize errors. After masking, the trained model detects the texts in the frame and prints it on the screen.

V. *RESULTS*

Fig. 2 and Fig. 4 show the results of the model when used for images of cars. Fig. 3 shows the result of the model when used for a bike.

Figure 2. Number Plate Detection of Vehicle 1

Figure 3. Number Plate Detection of Vehicle 2

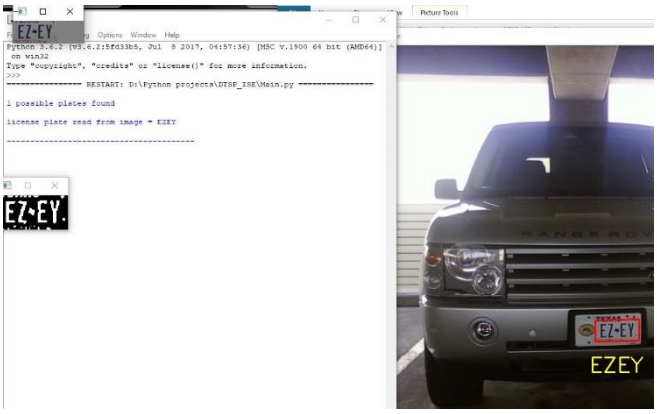

Figure 4. Number Plate Detection of Vehicle 3

VI. Conclusion

The VNPD system can greatly help the reduction of cost to a housing, government or a corporate complex. The reliance on manual labor will reduce and increase the efficiency and speed of entry of vehicles.

VII. Future Scope

The current system needs images containing number plates such that the number plate appears vertically. The classifier here overfits straight number plates and hence may not detect number plates in images which are tilted. To reduce this, augmentation of the training images may be done so as to improve accuracy and reduce overfitting. The system can be used in the CCTV cameras on every road in every major city in India. The system can keep a track of movements of all vehicles. Such a system if implemented with good security and firewalls can greatly help in crime reduction. Robberies and kidnapping can be greatly reduced as the vehicle can be tracked and found all over the city in a matter of seconds. The system can pinpoint the exact location of the car if need be.

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