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Vehicle Number Plate Recognition

Mayur Kamble, Shubham Jagtap, Aditya Pahilwan, Jayshree Zerkunte, Prof. Prashant Dike
Student, Department of Electronics and Telecommunication
Sinhgad Institute of Technology, Lonavala Kusgaon, Pune, Maharastra, India

Abstract: *Recognizing vehicle number plates is a difficult but much needed system. This is very useful for automating toll booths, automated signal breakers identification, finding out traffic rule breakers and to detect stolen vehicles. The developed system consist of a Raspberry Pi based vehicle number plate recognition system that automatically recognizes vehicle's number plate using image processing. The system uses a digital camera interfaced to a Raspberry pi processor. A rear image of vehicle is captured and processed using various algorithms. The system constantly processes incoming camera footage to detect any trace of number plates. On sensing a number plate in front of the camera, it processes the camera input and extracts the number plate part from the image. The image is extracted using OCR. And by using CNN techniques, the number is extracted from the image. The system then displays the extracted number. The implemented system consist of a fully functional vehicle number plate recognition system using Raspberry Pi considering success rate and processing time as parameters. The developed system can be used for security purpose in housing societies to monitor the entry/exit of authorized vehicles. It is observed that the developed system successfully detects and recognizes the vehicle number plate on real time images. The system accuracy is about 80%*

Keywords: CNN, Number place , Dataset, Rpi

I. INTRODUCTION

System proposed smart toll collection which reduces the time-consuming long queue of vehicles. The product works for automatic vehicle number detection and toll tax collection using IoT and deep learning technique. Each vehicle owner having an E-wallet where he can refill amount from any bank account. Whenever transaction has done system automatically deduct tax amount from available wallet balance. System can give penalty to vehicle owner if he did not pay the minus amount within given time. The plate detection stage predicts the presence of numbering plates in the question picture (classification) and the respective positions. The test image is transformed at the time of training by the mean and standard deviation values measured. Optical Character recognition (OCR) is a technology that is mainly used for recognizing machine printed or human written text in scanned documents, images and then converting into editable form. This system about how we detect the number plate of different vehicles and storing them in the database. The ideology of the project had originated up with the difficulties faced by the security to record the numbers of various vehicles at the gate way of the campus. Sometimes the user might not be situated able to record the data due to various inferences such as bad vision, Light factor, bad interpretation, and failure to record the data when there are multiple buses at an instance. This might not be well thought-out as a serious issue but in case of failure of recording the data at gate ways where there is large scrutiny and high security it may lead to some serious security issues. Image pre-processing is an important step in any image analyzing system. Without a proper pre-processing, the recognition will be ineffective or may give improper results in later stages. The main motive of pre-processing is to enhance the quality of the image that will be processed for recognition. Various processes that we are going to apply are converting RGB image to Grayscale, noise reduction and binarization of image.

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II. SYSTEM ARCHITECTURE

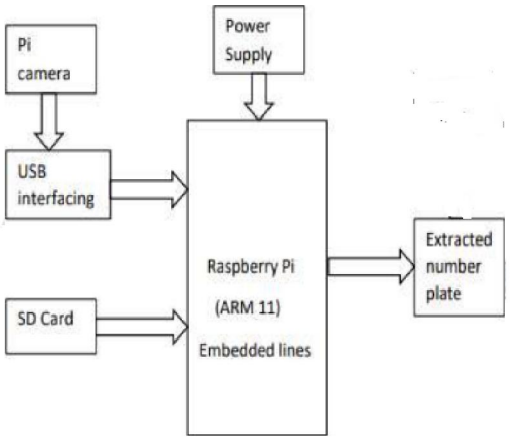

Fig: - System Architecture

The central database is the main part of the database system. This database contains all registered vehicles with details of owner. When the registered vehicle passes through toll plaza then automatically toll amount is deducted from user's linked wallet. Database is updated with this information at a same time and the system notify user via SMS.

Data Collection: We collect data from flicker image dataset.

The following are the steps involved in this train and test:

Step 1: Pass the data (both train and test) as input to Agamogenetic model.

Step 2: Store the activations from second-to-last fully connected layer of the network as feature vectors.

Step 3: Train with CNN classifier for each emotion category.

Step 4: For each of the test image, find the maximum of the scores from each CNN to get its predicted category label.

Algorithm

CNN (Convolutional Neural Network)

CONVOLUTION LAYER

Basis of CNN is convolutional layers. In CNN, every image is represented in the form of an array of pixel values. More precisely convolutional layers are able to detect patterns in images. Fig Pattern Matching With each convolutional layer we need to specify the number of filters the layer should have. These filters are actually what detect the patterns. Filter detect could be edges, corners, circles, squares, etc (objects). These kind of geometric filters are what we'd see at the start of our network the deeper our network goes the more sophisticated these filters become.

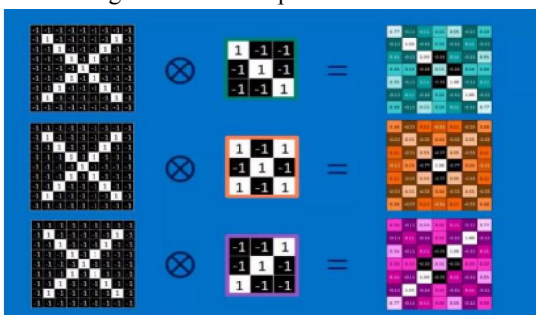

Fig: Filters for character.

So in later layers rather than edges in simple shapes our filter may be able to detect specific objects like eyes, ears, hair or fur feathers, scales and beaks. Even deeper layers filters are able to detect more sophisticated objects like full dogs, cats, birds, etc. When adding a convolutional layer to a model we also have to specify how many filters we want the layer to have, a filter can technically just be thought of as a relatively small matrix for which we decide number of rows and columns that this matrix has and the values within the matrix are initialized with random numbers. We will slide

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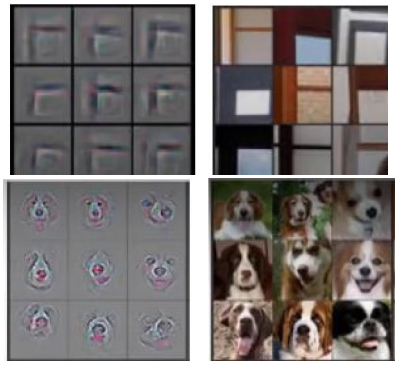
this matrix over the every m*n block of pixels from the entire image, this sliding is actually referred to as convolving. These filters are called as pattern detectors. Consider an example of more complex filter for pattern detection in dogs, edges, corners.



Zero Padding: During convolving the convolved image is smaller than original image and there are chances we may lose some data for that we use padding. Convolution reduces the image dimension. Zero padding is a technique that allows us to preserve the original input size. Zero padding occurs when we add a border of pixels all with value zero around the edges of our input this kind of adds a padding of zeroes around the outside of the image.

RECTIFIED LINEAR UNIT(ReLU)

There are many types of activation functions like sigmoid, ReLU for activation of pixels in the convolved layers of the image. Once the feature maps are extracted, the next step is to move them to a ReLU layer. ReLU performs an elementwise operation and sets all the negative pixels to 0. It introduces non-linearity to the network, and the generated output is a rectified feature map. Below is the graph of a ReLU function. The original image is scanned with multiple convolutions and ReLU layers for locating the features.

$$f(x) = \max(0, x)$$

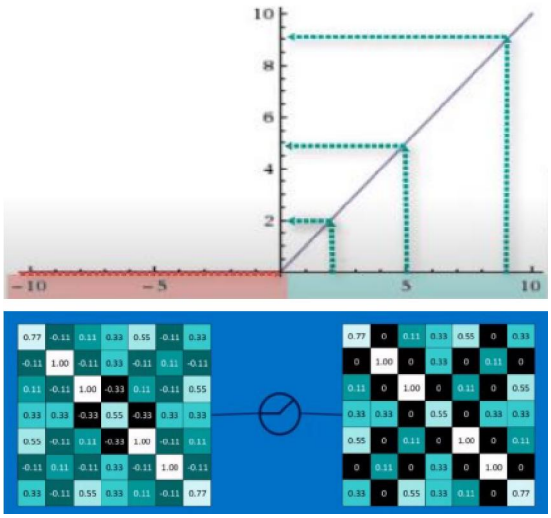


Fig: Rectified image map and rectified image

A stack of images become a stack of images with no negative values. This rectification is done with all the convolved images of the layer.

POOLING LAYER

Pooling is performed after non-linear activation, where the pooling layer helps reduce the number of parameters and avoids overfitting, and it also serves as a smoothing measure to eliminate unwanted noise. Pooling is also of many types

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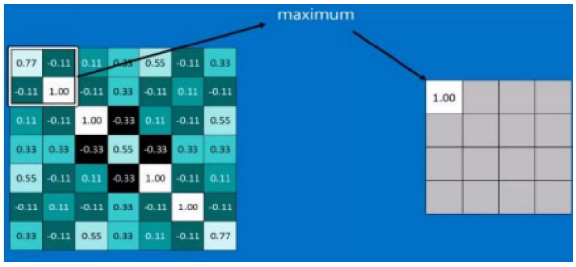
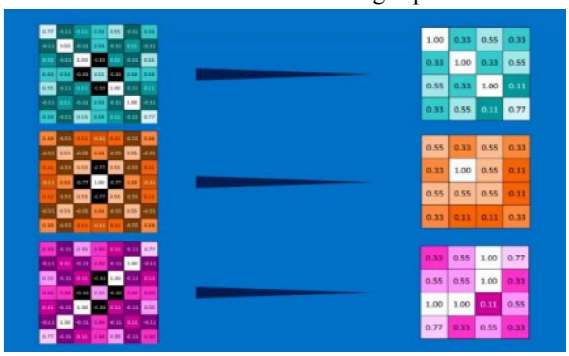
like min pooling, max pooling, average pooling, etc. Pooling mainly used to reduce the image size using the filter and stride. Max pooling is reducing the resolution of the given output of a convolutional layer, the network will be looking at larger areas of the image at a time going forward which reduces the amount of parameters in the network and consequently reduces computational load additionally, max pooling may also help to reduce overfitting. It mainly focuses on the higher valued pixels which have the values for edges, curves, etc and ignoring the lower value pixels.



Just like rectification pooling is also done with all the convolved images present in the layer[Fig: Pooling every image].

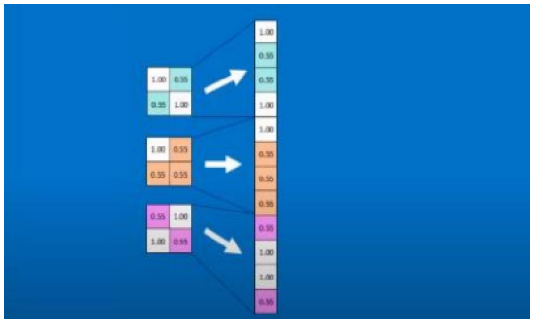


Deep stacking: These three layers can be repeated several(or many) times. This process of layering is known as deep stacking. This process in turn helps in more precise detection of details in images [Fig: Deep stacking

FULLY CONNECTED LAYER

Fully Connected Layer is simply, feed forward neural networks. Fully Connected Layers form the last few layers in the network[9]. The fully connected layer (FC) layers are usually found towards the end of CNN architectures and can be used to optimize objectives such as class store. Neurons in a fully connected layer have full connections to all activations in the previous layer, as seen in regular Neural Networks.

In fully connected layer every value(neuron) gets a vote.



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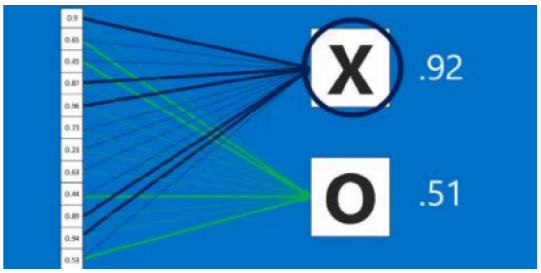

OVERALL EXPLANATION

Here's how exactly CNN recognizes any image:

- ❖ The pixels from the image are fed to the convolutional layer that performs the convolution operation.
- ❖ It results in a convolved map.
- ❖ The convolved map is applied to a ReLU function to generate a rectified feature map.
- ❖ The image is processed with multiple convolutions and ReLU layers for locating the features.
- ❖ Different pooling layers with various filters are used to identify specific parts of the image.
- ❖ The pooled feature map is flattened and fed to a fully connected layer to get the final output.
- ❖ The output will have the value ranging from (0 to 1) showing probability of match.

III. CONCLUSION

System improves the accuracy of number plate recognition even if images contain different noises. Proposed model also improves the transaction time which very less than classical image processing and recognition algorithms. It can reduce traffic congestion at toll plazas which leads to avoid fuel loss. It can be removed all disadvantages of current manual toll collection system like time and human efforts. It does not require any tag only required best quality camera

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