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License Plate Recognition and Detection using Machine Learning

Mrs.J.Karthiyayini [*1], Dr. V. Hanuman kumar [2]

[*1] Department of ISE, New Horizon College of Engineering, Bangalore, India
[2] Computer Science and Engineering, New Horizon College of Engineering, Bangalore, India

ABSTRACT

Building an effective tactic to identify characters from images with fewer error rate is the big task. Aim of this paper is to furnish an algorithm to generate error free recognition of text from the given input image and also it help in document digitizing and prevention to the hand written text recognition. Optical Character Recognition is the intensive research topic for more than 4 decades, it is the time consuming and labor intensive work of inputting the data through keyboard. Hence this paper discusses about mechanical or electronic conversion of scanned images, text which contain graphics, image captured by camera, scanned images and the recognition of images where characters may be broken or smeared . The optical character recognition is the desktop based application developed using Java IDE and mysql as a database. The proposed algorithm gained 93.42% accuracy when applied on different data sets. In pre-processing and post processing neural network techniques are used to remove noise from the image and classification are used to recognized the characters. Back propagation algorithm are used for the training of neural network, feature extraction has performed by template matching and hamming distance.

Keywords : OCR, Classification, Propagation algorithm

I. INTRODUCTION

Automatic License Plate Recognition is an important problem in Computer Vision and Image processing. There are many applications ranging from complex security systems to common areas and from parking admission to traffic control. Automatic license plate recognition is a complexity task due to diverse effects such as of light and speed of the vehicle. In this work, we explore the methods to detect number plate in a frame using machine learning methods. Image processing techniques are applied to filter objects for number plate and trained model is used to detect number plates.

This makes the automatic License Plate (LP) detection and recognition crucial and inevitable in the system of LP extraction. There are two separate processes: LP detection and LP recognition. Different algorithms, system and techniques have worked out and applied to both of them. Moreover, the previously image processing developed concepts of or other concepts are applied in order to get more accuracy. However, there is still room for improvement. Although some studies have been performed on LP detection and recognition, this research work is different from the previous ones due to a number of reasons. Nevertheless, in major researches, a neural network or a deep learning system is used only in the detection or recognition

process. The novelty of this work is that our system uses a few pre-processing steps to classify LPs / non LPs utilizing a first Convolution Neural Network (CNN) model for LP detection.

The purpose of this paper is to explain the implementation of our project, "Advanced License Plate Recognition". This report will begin with sections on motivation, past projects, and constraints. It will then proceed to describe our system in broad terms to provide a general overview of our project to the reader. It will then describe each subsystem in detail. For each subsystem, we have included explanations for why we chose our methods, performance of our methods, under what conditions would our methods fail, and how can we improve our methods.

II. RELATED WORK

Belongie and al. [1] used shape descriptors, called "context shapes", to describe the distribution of the forms relative to a given point on the contour. Seeking the correspondence between two forms was then equivalent to finding the point on the other form that had a "shape context" similar to each point on a shape.

Carmichael et al. [2] showed the variation of the context shapes in order to differentiate between the form and the content. Another approach utilized morphological operations on gray-scale images [3]. On the other hand, the authors of [4,5] combined a contour detector with morphological operations to search the rectangles that were considered a candidate LP.

Kim and al. [6] proposed a method based on the extraction of the contour to localize an LP on images taken in low light conditions. In [7], the authors put forward a method for the detection of the LP of a vehicle image with a complex background. They used the histogram equalization to find the threshold in order to improve the quality of the image that contained the LP. Furthermore, the LP color can be different and few regions may have specific colors. For that reason, some authors used a color-based approach to extract LPs by localizing their colors in the image.

The authors [8] [9] checked a test image using a color-model classifier. In addition, the authors in [10] segmented color images by way of a shift algorithm into candidate regions. The latter were then classified as with or without an LP.

The authors put forward [11] a fuzzy logic method to recognize LP colors. The LP extraction utilizing color information detect inclined and deformed LPs. On the other hand, this method would be sensitive to some different illumination alteration and would suffer from false positives, mainly in case the other parts of testing images had similar colors of LPs.

The color based approach has diverse benefits such as detecting inclined and deformed LPs, but it is perceptive for multiple elucidation environments. However, this appears to be unproductive when the plate has different colors and patterns.

All the methods and techniques used in paste to automatically detect a number plate are obsolete and outdated. Techniques 'Morphology-based', 'Edge-detection' and 'Image saliency detection are prone to being affected adversely by common obstacles in recognizing a number plate such as bad weather, poor lighting, visual occlusion, orientation, placement of number plate, speed of vehicle, blur, damaged plates, angles of camera, color of number plate and different fonts used for the characters. This calls for the implementation of better and advanced techniques to develop a system which is more robust with higher accuracy.

III. PROPOSED SYSTEM

The proposed system is an automatic and mechanized license and number plate recognition

system which can extract the license plate number of the vehicles passing through a given location using image processing algorithms. Using special cameras, the system takes pictures from each passing vehicle and forwards the image to the computer for being processed by the LPR software. Plate recognition software uses different algorithms such as localization, orientation, normalization, segmentation and finally optical character recognition (OCR). The resulting data is applied to compare with the records on a database. Experimental results reveal that the presented system successfully detect and recognize the vehicle number plate on real images. This system can also be used for security and traffic control.

The paper also proposes an overview of the system for LP detection and recognition. This system is divided into three sub categories: (i) LP detection, (ii) character segmentation and (iii) recognition.
The main advantages are, reduced number of false positives compared to the right results,increased accuracy and efficiency, compared to the older models, removes irrelevant information and reduces noise and eliminates human interaction and makes system fully automatic.

IV. IMPLEMENTATION

The method being implemented has two main processes or separate modules – 'License Plate Detection' and 'License Plate Recognition'.Initially, the collection and training of data is implemented using various, sophisticated machine learning models to detect a license plate. Few pre-processing steps[1] are devised to classify License Plates and Non-License Plates utilizing a first Convolution Neural Network (CNN) model. The Region-of-interest (ROI) or the relevant region containing the license plate is then cropped for further processing. Segmentation and Optical character recognition(OCR) are used to classify and recognize the characters and digits from the License Plate. This stage also employs a secondary CNN for recognition of characters.The extracted characters are then used to get the particulars of the vehicle and the vendor which is used to implement various functionality in domains pertaining to parking management, traffic monitoring and security systems.

OBJECT DETECTION MODULE

The module used to detect the license plate from the live video feed or a footage. The module uses the Tensorflow and OpenCV to have a human eye perspective.The model used in object detection needs to be fast as system takes data in real time. The object detection models are usually heavy, so we are using One Stage method. SSD – Single Shot Multibox Detector is one of the One stage method used in the System.Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos. Well-researched domains of object detection include face detection and pedestrian detection. Object detection has applications in many areas of computer vision, including image retrieval and video surveillance.

SSD (SINGLE SHOT MULTIBOX DETECTOR)

SSD is designed for object detection in real-time. Faster R-CNN uses a region proposal network to create boundary boxes and utilizes those boxes to classify objects. While it is considered the start-of-the-art in accuracy, the whole process runs at 7 frames per second. Far below what a real- time processing needs. SSD speeds up the process by eliminating the need of the region proposal network. To recover the drop in accuracy, SSD applies a few improvements including multi-scale features and default boxes. These improvements allow SSD to match the Faster R-CNN's accuracy using lower resolution images, which further pushes the speed higher. According to the following comparison, it achieves the real-time processing speed and even beats the accuracy of the Faster R-CNN. (Accuracy is measured as the mean average precision mAP: the precision of the predictions.)

The SSD object detection composes of 2 parts:

- Extract feature maps, and
- Apply convolution filters to detect objects.

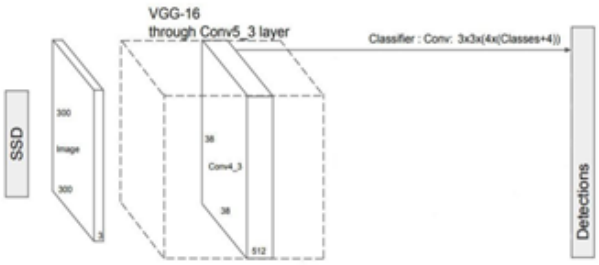

Fig-4.1: SSD: Single Shot Multi box Detector

SSD uses VGG16 to extract feature maps. Then it detects objects using the Conv4_3 layer. For illustration, we draw the Conv4_3 to be 8×8 spatially (it should be 38×38). For each cell (also called location), it makes 4 object predictions. Each prediction composes of a boundary box and 21 scores for each class (one extra class for no object), and we pick the highest score as the class for the bounded object. Conv4_3 makes a total of $38 \times 38 \times 4$ predictions: four predictions per cell regardless of the depth of the feature maps. As expected, many predictions contain no object. SSD reserves a class "0" to indicate it has no objects.

OCR – OPTICAL CHARACTER RECOGNITION MODULE

OCR, is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine encoded text, whether from a scanned document [7], a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image (for example from a television broadcast).Widely used as a form of information entry from printed paper of data records – whether passport documents, invoices, bank statements, computerised receipts, business cards, mail, printouts of static-data, or any suitable documentation – it is a common method of digitising. Printed texts can be electronically edited, searched, stored compactly, displayed on-line, and used in machine processes such as cognitive computing, machine translation, (extracted) text-to-speech, key data and text mining[9]. OCR is a field of research in pattern recognition, artificial intelligence and computer visions.

V. CONCLUSION

Developed a prototype of the working model as the initial milestone. Successfully compiled a robust , all-in-one dataset from merging various datasets to filter the relevant training examples. Trained our own model from scratch to detect number plates from an image given as an input. Used 'SSMD' based model for number plate detection after trying out with various other models like yolo v2,yolo and faster-rcnn. Implemented and experimented with new techniques to optimize the code and reach the end result. Created a database which stored the authorized users and their details to crosscheck the owners which is scalable and easy to modify. Achieved an average accuracy of > 95%, with the major problematic areas being with [8/B] , [0/O/D] , [5/S] .

Future Work

Will be able to achieve higher accuracy by training the model for specific font and characters, for example, specifically for Indian number plate dataset. Country wise configuration with a detailed approach about the specific scenarios would yield better results and accuracy. Improvement of detection and recognition accuracy can be done using a wide range of training data taken from a high quality source. Additional light and sound sensors can be implemented for greater impact and awareness of the vehicle owner and also the security/admin. Will be able to implement the project as a part of traffic surveillance system and also in the unmanned, restricted parking domain, once it has been made fully robust by using top notch hardware for recording the live feed and processing it.