Automatic Indian Number Plate Recognition System

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Abstract— Over the years information technology has been used to develop applications that aim to simplify the human task, to execute various human tasks efficiently, faster and with quality. From last few decades computer and communications technology has been advanced and new techniques are being developed which helps in simplifying the human approach and doing different tasks considered only human efficiently, faster and with good quality. The License plate detection can be applied for toll processing, at parking areas and for traffic monitoring purpose. Toll processing or parking system need to make an entry of the vehicle license plate number, the type of vehicle whether it is private commercial or government owned and size and accordingly bill the vehicle. In this research paper we have proposed a system for vehicle plate recognition using Support Vector Machine (SVM) technique.

Key words: License Plate Detection, SVM, Binary Classifiers

I. INTRODUCTION

From last few decades computer and communications technology has been advanced and new techniques are being developed which helps in simplifying the human approach and doing different tasks considered only human efficiently, faster and with good quality. Many such types of applications have certainly revolutionized the way we operate many of our daily activities. Still there are many fields which requires quality applications that can assist in enhancing the quality of services in those fields. One such type of application is the license plate detection system. The License plate detection can be applied for toll processing, at parking areas and for traffic monitoring purpose. Foremost challenge in building such applications is that these application requires to process the input image of the license plate in very quick time and be very precise. Earlier, many researches have been carried out various research to detect and recognize the embossed characters of the license plate. Most of these techniques have their own set of merits and demerits. A Vehicle License Plate Recognition is an image processing system whereby it is applied to recognize the vehicles by identifying their license plate. It is generally used for traffic and security purposes. Besides, the Vehicle License Plate Recognition also provide an advantage by keeping the image of the vehicle in which it will be useful for crime fighting. Camera can also focus on the face of the driver and save it for security reason. There are difficulties for Vehicle License Plate Recognition in which it will affect the efficiency and accuracy of the system. It is essential and important to determine the facts which will able to influence the operations and recognition proficiency.

Toll processing or parking system need to make an entry of the vehicle license plate number, the type of vehicle whether it is private commercial or government owned and size and accordingly bill the vehicle. Usually a manual entry takes time and the processing of the vehicle billing thus takes more time. To avoid such delays many toll systems have started to adopt an automatic application. But most of these applications make use of a camera to capture the image of the license plate and store it in the data base. There after a manual entry is made in the application for the vehicle number, plate recognition and billing. Thus, still the system is not fully automatic. The main challenge lies in detecting the license plate and recognizing the characters of the license plate accurately [2]. Over the years many such systems have been proposed most making using of optical character recognition. These methods failed to address the accuracy issue due to the fact that the character recognized varied due to difference in fonts [4]. More over many methods failed to accurately detect the license plate, classify the images, etc. generally the license plate recognition system is classified as template base methods and feature extraction methods. In template based methods a standard template for the car license plate is chosen and the system is trained for that template image.

Considering the license plate detection system literature the techniques can be divided as template dependent technique and the feature extraction techniques. The feature extraction techniques are more generic and hence it is implemented in this research work. Support vector machines are chosen for feature extraction of the car license plates for a given dataset. The key challenge in utilizing SVM is that it is a binary classifier. The usage of a multiclass SVM for the feature extraction of the license plate is proposed in this thesis. The implementation of the car license plate detection and recognition system using SVM and OCR are integrated with the optical character recognition.

II. LITERATURE SURVEY

Basically, the license plate recognition process can be classified into three steps as shown in Figure 2.1 ,i.e. Plate Localization, Character Segmentation and Character Recognition. Each step will be processed by an independent module. An input image provided to the system is first examined and then processed to obtain the vehicle license plate region, then the plate region is process to locate each individual digit and character, these are then provided to the Optical Character Recognition (OCR) process to determine the vehicle identification.

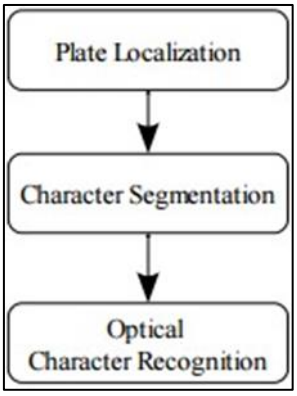

Figure 1: Automatic car license plate detection system

A. Plate Localization

This is the process of extracting the license plate region out from an image. It involves general image processing methods mixed with some decision making which depends on deterministic threshold. Without any advance knowledge on how large the plate is, or where it is located or fixed, the entire image must be inspected and examined in order to extract the candidate regions.

Fig. 2: Framed plate

B. Character Segmentation

Once the candidate region is detected from an input image, the next step is to segment the plate to extract individual digit/character for the recognition purpose. This procedure is highly dependent on the format of the plate being provided. Because every country and regions have their own measures regarding sizes and shapes of the plate, the color utilized as plate background and foreground are totally different and their content changes both in length and combination of the digit and characters.

C. Character Recognition

Once each individual digit or character is extracted from an image, it must be identified in some way. This step is called Optical Character Recognition, and there are some different solution to this problem. There are two approaches that are immensely popular among many different researches on vehicle license plate recognition. In this method, a set of of slightly different templates of all glyphs are stored in a database. Once an image is provided for recognition, existing templates are compared to the new image, and the best fit would determine its identity. This method needs the template database to be large enough to cover most glyph variations, and it should also have an efficient algorithm to process large set of templates.

1) Support Vector Machine

The Support Vector Machine is an application used to classify dataset. It is a binary classifier binary classifier which computes a hyper plane that acts like a decision function. SVM is trained and then tested. In the case of images it can be trained on image dataset which may be containing some particular object or feature, and then the SVM classifier can make decisions regarding the presence of an object or a feature in the tested image. Thus it can be used in identifying features like car license, in additional test images. [1]

A support vector machine (SVMs) is a situated of related supervised learning systems utilized for classification and regression. In straightforward words, given an arrangement of training illustrations, every checked as fitting in with one of two classifications, SVMs preparing calculation assembles a model that predicts whether another case falls into one class or the other. Naturally, SVMs model is a representation of the illustrations as focuses in space, mapped so that the samples of the different classifications are separated by an unmistakable hole that is as wide as could reasonably be expected. SVMs is compelling on high dimensional information in light of the fact that the many-sided quality of prepared classifier is portrayed by the quantity of bolster vectors instead of the dimensionality of the information, the bolster vectors are the fundamental or discriminating preparing cases, they lie nearest to the choice limit, If all other preparing samples are evacuated and the preparation is rehashed, the same dividing hyper plane would be found.

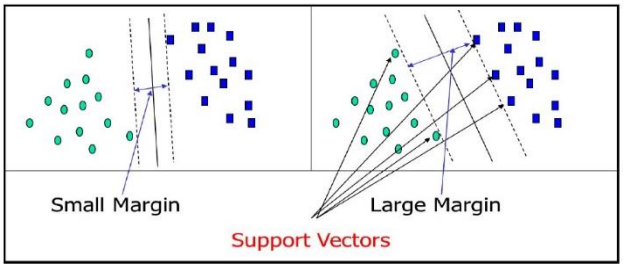

Fig. 3: Support vectors

The conceptual structure of SVM is shown in Figure 3 SVM calculates the hyper planes that separate a positive example from a negative example in hyper space.

2) Binary Classification

it is defined as follows Given training data (x_i , yen) for i = 1. . . N, within∈ Rd and $y_i \in \{-1, 1\}$, learn a classifier f(x) such that i.e. f (xi) > 0 for a correct classification.

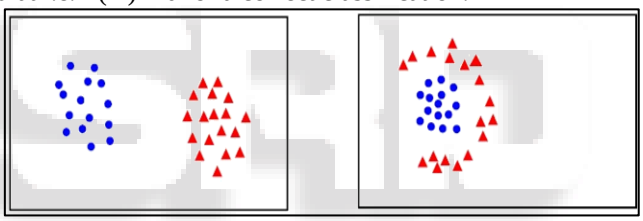

Fig. 4: Showing binary classification

III. METHODOLOGY

The proposed methodology consists from different fields such as an input image from camera, pre-processing, number plate localization, character segmentation, character recognition using SVM. The different methods like blob coloring [7], peak-to-valley technique [8] are proposed for character segmentation. However, these techniques are not suitable for Indian number plates as they do not gives best output in cases where the characters are overlapping and they are also time consuming.

The next step is to make use of SVM and OCR for classification and character segmentation. The introduced method of car license plate detection and recognition system makes use of a variant of multi class SVM and makes use of the algorithm 2 for multi class SVM. The generic algorithm for the whole system is given below:

1) Step 1. Preparation of data set of car license plate system.
   Step 1.1 Make one set of dataset as training set.
   Step 1.2 makes another set as testing set use 70-30 ratio for training and testing.
2) Step 2: Read all the images from the prepared dataset.
3) Step 3: histograms are normalized for L1 norm.

4) Step 4: Multiclass SVM is trained for the obtained histogram and the classification process is carried out as one vs. all schemes using histogram intersection kernel.
5) Step 5: the training is carried out for one model for each action class in a 1-vs-all fashion. Positive training results in return of car license images of a particular category like personal car or commercial car and the negative training return other parts of images.
6) Step 6: Testing is performed with action detection at maximum similarity score is selected or it should be more than 50%. In some cases where rectangular boxes are absent the similarity score for entire image is taken.
7) Step 7: Display the result of matching performed over test images.
8) Step 8: Once the classes of images are formed OCR is called in for image template matching and finding the characters of the license plate.

A. Algorithm Classification of Dataset using SVM

SVM Classifier is set for one vs. all comparison using multi-class function.

1) Step 1: SVM designed in here is trained using the images from the databases using histogram intersection kernels.
2) Step 2: Histogram for the images are visual histogram and object histogram. These histograms are normalized at L1 norm.
3) Step 3: Multi class SVM is set to as the function given above.
4) Step 4: Training of SVM is carried out
5) Step 5: After training takes place successfully testing is carried out for the images.
6) Step 6: Similarity score is calculated for each image.
7) Step 7: Score greater than 50% similarity measure is selected.
8) Step 8: Images are classified into six action set as labeled.
9) Step 9: The result with test images mapped to car class labeled is returned.

IV. RESULTS & ANALYSIS

All the alphabets and numerical characters are used for training the SVM and the OCR for character recognition. These are all images in the bitmap format. Each image is stored in 24 *42 size bitmap image. The GUI is designed in the MATLAB using the MATLAB GUI tools. The GUI has following push buttons:

1) Enter the image push button: this push button is used for entering the input image to the GUI for the processing and detection.
2) Clear Push button: this push button is used to clear and reset the whole GUI screen.
3) Exit push button: this push button is used to exit the whole GUI.

The GUI has two text boxes which are used to display the result of the processing of the input image. The text boxes and their uses are follows:

a. Number text box: It displays the license plate number.
b. Category text box: it displays the category of the license plate detected. The category can be private vehicle, commercial vehicle, presidential or governmental vehicle. The GUI also has axes to display the image which is given as the input to the given system.

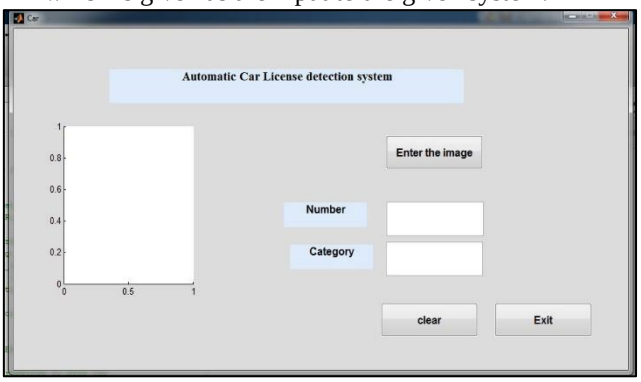

Fig. 5: GUI of the System

Fig. 6: Input number Plate

Fig. 6: Extracted Number Plate

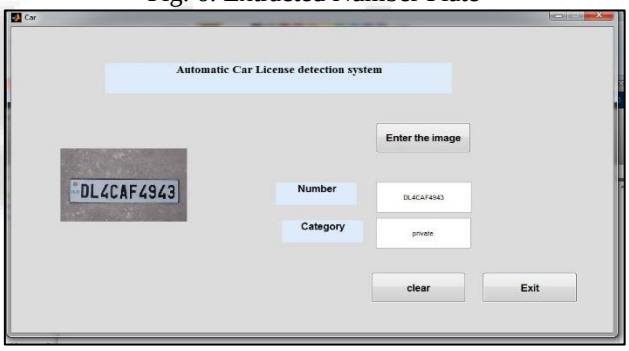

Fig. 7: Final Output

And the number recognized is as DL4CAF4943 and the category is Private.

Thus, SVM and OCR integrated together are able to successfully classify, detect and recognize the car license plate system. The above designed system was validated for many images of the car license plate and following findings were observed: The system was able to successfully detect the license plate the system is successfully capable of classifying the license plate based on their category. The system is able to recognize the characters of the license plate with an accuracy of 96%. Some of the major limitations of the given system are as follows: The system is creating error in some characters like

•'O', '0'
•'3', 'B'
•'T', '1'

These errors can be to some extend be controlled by further enhancing the program where in a condition check is placed like given below:

If the character count is <=2 then the character is 'O' or ' B' or 'T' as for Indian car license plate the first two

characters of the license plate are characters and not numeric digits. Upon performing such enhancement the given system accuracy got enhanced by 1 %.

V. CONCLUSION

An Automatic car license plate recognition system is an integrated application of artificial intelligence and image processing. Many such systems have been proposed and implemented over the past few years. Car plate recognition systems are broadly categorized as template matching based systems and feature extraction based systems. In template matching the system is trained over certain templates which further help in recognition of the new inputs. But it is prone to error because different font sizes are used for car license numbers. In feature extraction system a database of images is formed through which certain unique features are selected and stored. Now the input image features are matched with the database image features and on the basis of the matching the outcome is displayed. This system is an efficient one if proper features of the images are selected. Thus, the challenge lies in the selection of these features. The research work proposed an idea of the car license plate detection and recognition system using integrated approach of SVM and OCR. The algorithm shows an accuracy of almost 96% on Indian number plate.

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