International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 02 Issue: 08 | Nov 2015 www.irjet.net p-ISSN: 2395-0072

Classification And Segmentation Method for The Number Plate Detection

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Abstract

Because of the industrial revolution and an expanding economy, there are more and more vehicles on the road. Because of the widespread use of automobiles, there is an increased risk of traffic rule violations, which can lead to unforeseen accidents and even criminal activity. Intelligent traffic monitoring systems are needed to solve these issues. The intelligent system can play an important role in traffic control through the identification of vehicle number plates. Utilizing recognition techniques, ANPR technology can identify and recognise vehicles based on their licence plates. Additional hardware may still be needed even with the greatest algorithms in the world for a successful ANPR system deployment. Conditions such as a dirty numberplate, non-standard formats, complicated scenes, camera-quality, camera mount position, distortion tolerance, motion blur, contrast issues, reflections, processing and memory limitations, environmental conditions, indoor/outdoor or day/night shots, software-tools or other hardware-based constraints can all detract from the device's performance. ANPR is a fascinating subject for researchers because of its unreliability, tough environments, and other complications. For ITS, the Internet of Things (IoT) is helping to shape the future of many businesses and pave the way for new avenues. RFID, GPS, and Android platforms can all be used in conjunction with ANPR to maximise its possibilities. A greater percentage of CVs may now be detected using Deep-Learning techniques, which are becoming incredibly common. ITS (ANPR) based on CV algorithms is the focus of this study, which references pertinent earlier work, analyses and presents an overview of extraction, segmentation, and saying the right while also making advice for the field's near future.

Keyword

Number plate, CNN, Machine learning, IoT

Introduction

Picture processing is being used to create a system that can recognise a car's unique number plate from an image, which can then be fed into an intelligent traffic or vehicle management system. People's interest in more advanced, efficient, and precise intelligent transportation systems has grown in tandem with the expansion of highways and the widespread adoption of vehicles (ITSs). Since car hulls and licence plates often have similar patterns and colors, as well as different plate styles and non-uniform lighting conditions, it might be difficult to perform ANPR from vehicle images [1]. The ANPR is widely used for speed detection, security control in restricted areas, unattended parking zones, traffic law enforcement, and electronic toll collecting, among other things. it.

Number Plate Recognition uses a camera to capture photos of the number plates in the target scene. Using either still photographs or a photographic video, a succession of image processing based recognition algorithms are used to transform the acquired images into a text entry. The robustness of an ANPR system's algorithms is what matters most once a high-quality image of the scene or vehicle has been captured. [2]

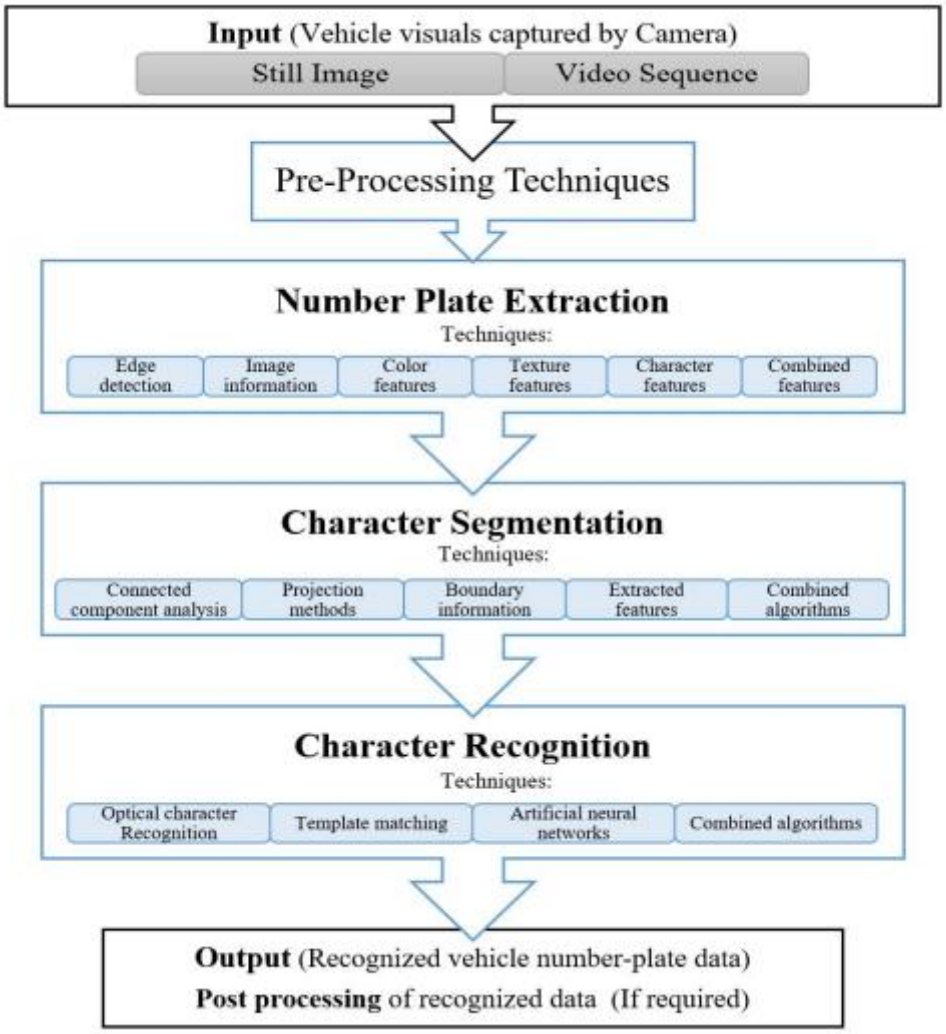


Fig. 1 illustrates the general workflow of a number plate recognition system.

It takes a lot of careful thought and code to produce the desired results and cover all system complexities with these techniques. Smart vehicle technologies like ANPR require a variety of fundamental algorithms in order to work. Figure 1 depicts the main steps in an ANPR system's operation.

Due to the following factors, identifying a vehicle's licence plate is a challenging task: 1) Typically, the number plate occupies a modest fraction of the overall image. 2) Different countries use a wide range of different number plate types and layouts. 3) Many other issues, such as blurry pictures, uneven illumination, vehicle motion, low resolution of the image, deformed characters, filthy plates, shadow and reflection, etc. might affect the extraction process. Many of the same issues arise when trying to segment characters, including the impact of picture noise, plate frame and rivet variations in lighting, as well as the space mark and plate rotation. Character segmentation can also be challenging when the number plate boundaries are close to the characters, or the characters are spaced close together, or the characters are fractured. It is impossible to accurately recognise characters if they are not properly split. [3] Characters that are incorrectly segmented will be recognized.

Employing Machine Learning (ML) and Deep Learning (DL) to identify licence plate characters. K-Nearest Neighbor (kNN) and Convolutional Neural Network (CNN) are the two methodologies that are employed in this study.

Review of Literature

Using the Template Matching Method, M.I.Khalil proposes car plate recognition [4]. A typical LPR system has four main components: an image acquisition module, an extraction module for extracting the licenced plate, and a segmentation and character recognition module. However, the "segmentation" of the input image is not required for the template matching approach. INFORMATION RECOGNITION PHASE (IPR) is then used following the licence plate extraction stage. The "moving window technique" is employed during this stage. The licence plate image is loaded as the main image in order to identify the country. The country image set's first image entry is then loaded as an object. Using the moving window technique, the image is searched for that object. In this case, the country's name is fetched from the country names table if the answer is "YES". This process is continued until all characters have been used up, and if "NO" is selected, the next country's name picture is loaded as the object.

Kaushik Deba, Md. Ibrahim Khana, Anik Sahaa, and KangHyun Job [5] have suggested an efficient method of vehicle licence plate recognition based on sliding concentric windows and artificial neural networks. Sliding concentric windows are the segmentation technique employed in this system (scw). Using this technology, we can examine the many photos of automobiles on the road. Using the vehicle's region as a guide, locate the vertical and horizontal edges to extract the licence plate. Based on a novel adaptive image segmentation technique, candidate regions are detected and colour verification is performed for each candidate region using the HSI colour model, which verifies green and yellow LP and white LP using hue and intensity, respectively, in the HSI colour model. There is a lot of attention paid to the new artificial neural network (AAN) algorithm based on the Korean number plate system. You can get a sense of how this system works if you follow the diagram above. Grey image conversion and how candidate regions are selected are explained here.

It has been proposed that an SVM-based License Plate Recognition system [6] by Kumar Parasuraman. For the best generalisation, the statistical learning theory (SLT) and the structural risk minimization (SRM) are the theoretical foundations of SVM, a supervised learning technique. SVMs have been proposed for use in multiclass classification in two ways. " One against all" and one vs one is how they describe their situation. The mean shift approach is used to locate and extract a number plate region, and the histogram projection method in the horizontal direction is used simply for simple segmentation. Afterwards, it's rescaled to fit on a 140x36-inch screen. It's therefore possible to get 315 dimensional feature vectors from 4x4 windows of the normalised subimage values. SVMs using RBF kernels are trained using feature vectors.

Morphological operators were demonstrated by Cheokman et al. [7] as a pre-processing technique. Each character was then recognised using a template matching approach following preprocessing. It was issued as a Macao-style automobile registration plate. SVM (Support Vector Machine) was used in [5] to remove outliers and identify clear parameters by scaling and cross validation. The accuracy of character recognition using the SVM method was higher than that of the Neural Network (NN) system.

Objectives

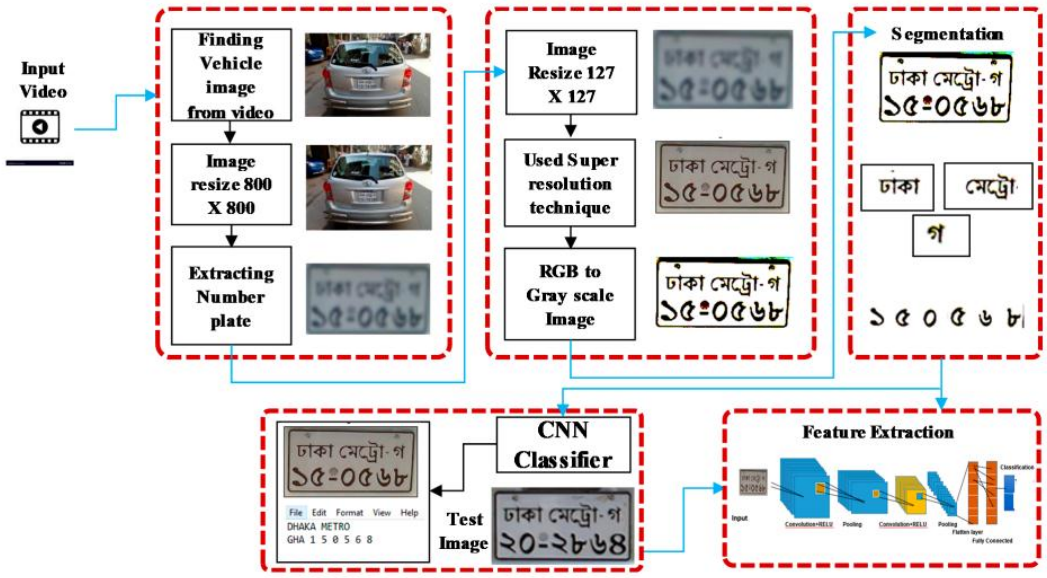
- To learn how to recognise licence plate numbers.
- The format of a vehicle's identification number should be studied.
- To learn more about how licence plate scanners work.
- kNN and CNN techniques for number plate identification are to be studied

Research Methodology

Regardless of the language used on the plate, our technology is capable of identifying it and recognising it. This method uses machine learning to learn the alphabetic letters of a number plate in order to identify each character. To make it easier to identify licence plates, most countries' number plate characters range from A to Z and 0 to 9.

Result and Discussion

(a) pre-processing; (b) localization of the number plate region; (c) super resolution techniques to acquire clear pictures; (d) segmentation of characters; (e) feature extraction; and (f) recognition of characters, as shown in fig 2[8].



Vehicle number plate identification is depicted in Fig. 2.

From country to country, the number plates are unique in their own right. For car number plates, there are certain laws and restrictions. (1) 2 letters (these refer to the region in the country where the vehicle was first registered) (2) 2 numbers (when it was issued) (3) Three random letters. There is some fundamental information about vehicle number plates including the dimensions, designs, and characters of number plates installed after September 1, 2001, in Fig 3. [9-12]

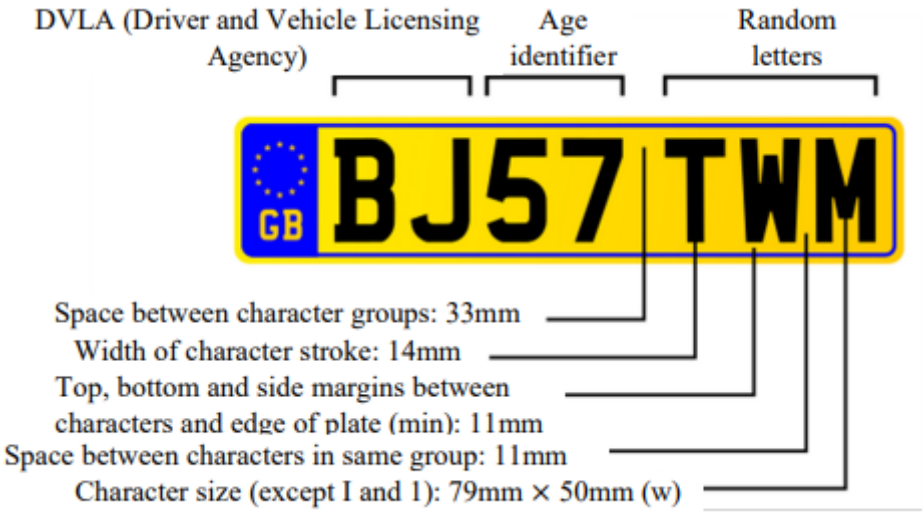
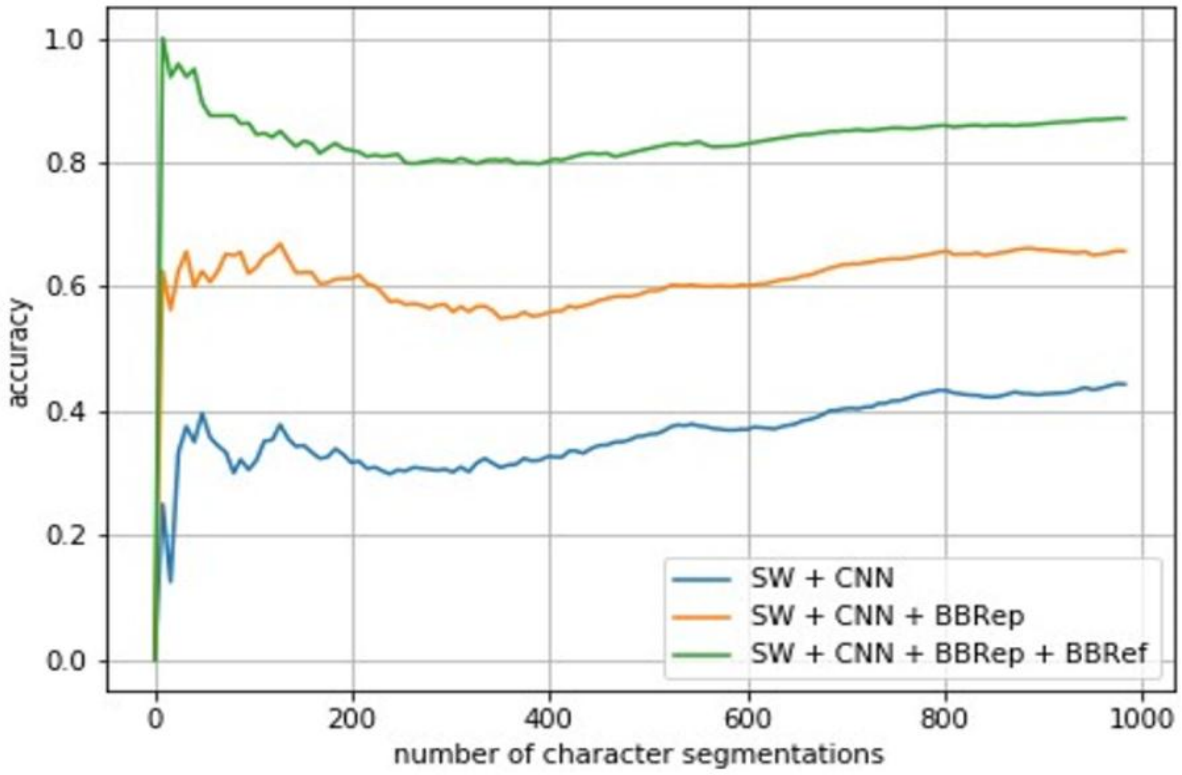


Fig. 3 shows the fonts and spacing of vehicle number plates.

KNN was utilised to classify the contours taken from a raster image. These data are compared by determining their Euclidean distance from the training and validation sets. The only thing in this data set was a pixel matrix from photographs that were given into the algorithm via the camera. [13] To begin, the plate image is divided into separate characters. Bounding boxes separate these characters.



License plate identification accuracy is depicted in Figure 4.

The kNN technique was used to classify these boxes using a template training data set. Furthermore, the precision of both systems is essentially the same. As a result, the kNN's accuracy was on par with that of previously used techniques. [14]

Sliding window (SW) and convolutional neural network (CNN) were evaluated in three different combinations, and the results showed a 44.29 % accuracy rate. However, accuracy rose to 65.68 % when bounding box repositioning (BBRep) was included. Finally, with 855 successful segmentations, accuracy was improved to 87.06 % after the addition of refinement (BBRef). After the repositioning and refinement, the Intersection over Union(IoU) has changed to higher values. [15]

Conclusion

With its complex optical, computing, and digitization capabilities at their core, ANPR systems have the potential to be cumbersome in their recognition of licence plates. All the countries in the globe don't have the same standard set of ANPR solutions available, so each organisation needs to be provided with a well-optimized system for different parts/regions, keeping all the influencing elements in mind. It's not uncommon for OCR engines to be tuned specifically for use in a certain country. It must be checked to see if the library or engine installed on the camera supports the required countries. Each vendor's ANPR solutions system has its own advantages and disadvantages. The best of these is the one that meets the needs of the region in terms of the established systemic conditions in that area.

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