Automatic License Plate Detection using Machine Learning

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Abstract— The aim is to develop a product that can be used in Industrial, Commercial or Educational Organizations /Premises to provide automated entry to the authorized cars without the use of any man power. When a car comes at an entry gate, the camera will take a snapshot of its license plate and convert all its characters in text form using the Image Processing in PYTHON software. Once the license plate number is extracted then this license number is compared with the list of allowable car numbers in the maintained database and then accordingly the car is authorized to enter the premises. In case a visitor's car tries to enter whose number is not in the database then that car is directed towards the Visitor's Parking Area and not into the campus.

Keywords: License Plate, Machine Learning, ANN, CNN

I. INTRODUCTION

In general, License plate recognition consists of four modules: image acquisition, license plate extraction, character segmentation and character recognition. Various license plate recognition algorithms had been developed in the past few years. Each of them has a different approach to the required processing. To date ALPR has be done using traditional methods which were inaccurate, machine learning was used to improvise upon this. TensorFlow object detection API was been trained for license plate localisation and extraction, Segmentation has been done using connected component analysis and for character recognition a CNN trained model

II. LITERATURE SURVEY

In general, License plate recognition consists of four modules: image acquisition, license plate extraction, character segmentation and character recognition. Various license plate recognition algorithms had been developed in the past few years. Each of them has a different approach to the required processing. To date, most ANPR research has been mostly software based, the commonly used platform for this purpose is high performance computer workstations located near the roadside connected to an ANPR camera.

Recently researchers have started to consider the use of compact embedded hardware devices in order to replace these expensive computer workstations that can also be placed within a complete ANPR camera housing The method of membership query synthesis in Active Learning, designed K-means based on Active Learning for Support Vector Machine Algorithm is used in [1]. The algorithm is based on a kind of cluster hypothesis: the instances in the same cluster may share the same kind of label, which means decision boundary may through the area where the instances are relatively sparse. In distance-based clustering algorithm, the more close to the center of clustering, the denser the instances are, and the more useful to reflect the distribution. K-means based on Active Learning for Support Vector Machine algorithm contains two parts: instance pre-selection based on K-means and SVM training with pre-selection instances, and the first part, how to deal with pre-selection is the kernel part in KA-SVM. Chapter 2: Literature Survey Automatic licence plate detection using ML 6 It is necessary to cope with the variations of the plates and environments for recognizing number plate images. Plates exist in different locations of an image. Plates may have different sizes due to the camera distance and the lens factor. The image background may contain patterns similar to plates, such as numbers stamped on a vehicle and bumper with vertical patterns. The variations of the plate types or environments cause challenges in the detection of number plates [2]. Conventional approaches to extract number plate are based on morphological image processing. A convolutional neural Network (CNN) is a powerful machine learning technique in the field of deep learning.

A neural network is a machine learning technique in the field of character recognition. A huge amount of labelled data is needed for training. An easy way to leverage the power of CNNs without investing time and effort into training is to use a pre-trained CNN as a feature extractor. The focus of this paper is on a region extraction technique combined with morphological image processing and deep learning. Region image classification is based on CNN and SVM. A pre-trained CNN is used for image feature extractor and SVM classifier is used for 2-class classification of candidate areas.

Optical Character Recognition (OCR) being a subject of intense research mainly deals with recognition of mutations of images of text. The training set consists of certain. Images from which relevant features are extracted. The OCR System is trained on these features. Once a new image is to be recognized, it is pre-processed and lent to feature extraction algorithms which extract the relevant features. The features are in turn fed to the classifier inside the OCR. A mutated image has a chance of being recognized. However, a new image has little chance of being recognized by the OCR System. In this paper, classifiers have been tested on digit-images using mutations found commonly in the physical world. These include dilation, skeletisation, noising and rotation. The performance of the K-Nearest Neighbour (K-NN) and Support Vector Machine (SVM) classifiers on image mutations has been compared vis-a-vis their performance on given mutations. The computation cost of classifier (time taken for training/classification and hardware memory required) increases exponentially with increase in training set size [3]. Chapter 2: Literature Survey Automatic licence plate detection using ML 7 In [4] the focus is on recognition problem of mixes between printed Thai and English characters, including numeric and other special characters. A list of characters is demonstrated and a character image

corpus is collected and provided by Thailand National Electronics and Computer Technology Center (NECTEC). The list of characters consists of 52 classes of English characters from 26 alphabets, including lower case and upper case letters, 69 characters of Thai alphabets, 20 classes of numeric characters from Arabic and Thai, and 23 special characters, totally 164 classes. Both traditional and convolutional neural network (CNN)-based methods are being used to solve the problem of car license plate detection. The traditional methods involve hand- crafted features such as color, edge and morphology, which are primarily confined by stringent conditions. For example, some of these systems need high resolution images as input, the acquisition of which requires expensive equipment, while others require strict device mounting free from translation and rotation. However, real world scenarios are quite different where car license plate detection becomes very challenging. Different kinds of cars and roads, changing weather conditions, camera-device rotation, and so on curtail the detection performance significantly. Thus, under the complex situation, it is relatively difficult to propose a robust method with hand-crafted features.

Although people can employ multiple independent features and incorporate some models together, as mentioned in, it is still hard to distinguish whether it is enough to meet the challenge with such limited features and models. To alleviate these problems, CNN-based methods have been devised, which automatically learn features from the acquired data. These kinds of detection methods have recently yielded very impressive results however their time consumption is significantly higher than those of the aforementioned techniques [5]. Further, despite the viability of both traditional and CNN-based methods, the problems associated with multi-directional (MD) car license plate detection have not yet been satisfactorily resolved to date, because of the difficulties due to the viewpoint variation of hand-held camera or the accidental rotation of mounted cameras. Chapter 2: Literature Survey Automatic licence plate detection using ML 8 Parameters not to mention in the unknown chaotic map. According to the statistical tests involving key space, histogram analysis, information entropy, correlation coefficient, and mean square errors, this type of cryptosystem will be proved to be theoretically unbreakable by common attacks. Furthermore, watermark technique and packet splitting strategy will be used together to embed ciphered image into several carrier images, which could make the ciphered image less conspicuous as well as more robust and meet the need of high efficient and robustness in covert packet networks.

According to our simulations, those methods can greatly improve cipher's anti-noise capability, PanTian-gong and Li Da-yong, A Novel Image Encryption using Arnold Cat", International Journal of Security & Its Applications, September 2013. [7] In this paper, an algorithm of image encryption using 3D Arnold Cat Map combined with logistical chaotic map to encrypt image. 3D Arnold cat map is applied in image encryption and it can provide more security. However, the drawback is that its period is fixed. The original image will be returned to itself after iterating some number of times. On the basis of Arnold cat map, an algorithm of image encryption is presented which separates the original image to several same blocks and no period. The security of this encryption system depends on the degree of approximation between the signal and the random numbers that are created by secret key stream generator.

Xingyuan Wang, Lin Teng, XueQin "A novel color image encryption algorithm based on chaos", Journal, Volume 92 Issue 4, April, 2012.[8] A colour image encryption algorithm based on chaos was proposed by cascading two position permutation operations and one substitution operation, which were all determined by some pseudo-random number sequences generated by iterating the logistic map. This paper evaluated the security level of this encryption algorithm and found that the position permutation-only part and the substitution part can be separately broken with only [(log2(3*M*N))/8] and 2 chosen plain-images, respectively, where MN is the size of the plain-image.

III. BLOCK DIAGRAM

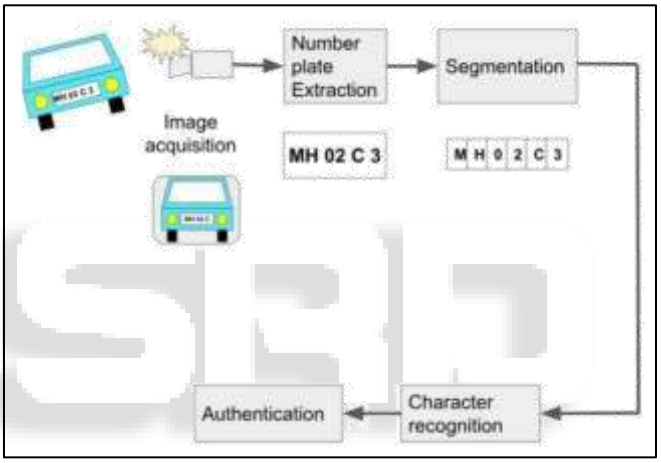

Fig 1: Block Diagram

IV. METHODOLOGY

A. Python

Python is an object oriented and high-level programming language. It was developed by Guido van Rossum in 1991. As compared to other languages, learning syntax of Python is easier. Python supports huge amount of libraries which make it much efficient. The cost of program maintenance is highly reduced. Since the application is based on image processing, which Python supports, Python is used as base environment for implementing our work. Also, one of the major advantages of using Python is that it is developed under an OSI-approved open source license. It is widely used while working with beginner-friendly devices like the Raspberry Pi. Operations on images are been done using highly optimized libraries like Numpy, matplotlib, SciPy, etc. which are supported by Python.

B. OpenCV

OpenCV (Open Source Computer Vision) is a library of programming functions used for real-time computer vision applications. Again, it is free to use under open-source BSD license. The OpenCV library has many optimized machine learning and computer vision algorithms. Image processing

library is also present including numerous functions related to image processing. Thus, OpenCV have been used with a library of Python bindings in the Python's working environment. Again, the use of Numpy makes the operation on images easy. For using OpenCV, OpenCV libraries are called in Python environment. Image Acquisition, Image pre-processing, Morphological operations and plate extraction have been performing very easily with the help of OpenCV - Python combination Chapter3: Design Methodology Automatic licence plate detection using ML.

C. TensorFlow

The TensorFlow is a free and open source software library for dataflow and differentiable programming across range of tasks. TensorFlow provides multiple levels of abstraction to build and train models by using the high-level Keras API, which makes getting started with TensorFlow and machine learning easy. The TensorFlow allows training and deploying the model easily, no matter what language or platform used. It's build and train state of the art models without sacrificing speed or performance. The TensorFlow gives the flexibility and control with features like the Keras Functional API. The TensorFlow also supports an ecosystem of powerful add-on libraries and models for experimenting. It is a symbolic math library, and is also used for machine learning applications such as neural networks. It is used for both research and production at Google. It is a standard expectation in the industry to have experience in TensorFlow to work in machine learning. It was developed by the Google Brain team for internal Google use and was released under the Apache 2.0 open-source license on November 9, 2015.

D. Database Management

After extracting the characters, there are numerous applications of this project. This can be used at toll plazas for keeping an account of all the vehicles passing through it. This can also be used for speed monitoring, military purposes, airport parking and many more applications. But it was decided to extend this project for parking application. Any commercial, industrial or educational premises have a number of cars entering and leaving the premises on a regular basis. Then it was decided to maintain a record of these cars with the help of our project. The number plate of the car is the only way to identify whose car it is. Among the cars which have entered the premises, the organization must know which cars are visiting. For security purposes, the organization must keep a track of the cars. They also need to differentiate between regular members and visitors. The best solution here is to maintain a database which keeps a track of all records. Once the above steps were completed obtaining the number plate characters, some databases were created and updated them. Databases are used for storing important information and retrieving it anytime when it is needed. As a general database, data is stored here in tables, rows and columns and is indexed so that it can be easily retrieved. The database management system that has been used here is MySQL using Python bindings.

V. ADVANTAGES

Automated attendance system is very fast and efficient system as compared to manual system. This system tracks the vehicles without any errors as the vehicles are identifies by scanning image for the respective number plates. Also the load on the person to track the vehicle will become less as the identification will be taken by system itself. This system is time efficient system as the time needed to track a vehicle and find their identity will be reduced. It will become more efficient to keep the record as the system will store the actions. This will help to keep better track of attendance.

This system records the exact time at which the vehicles arrive at a certain location.

VI. APPLICATIONS

The proposed idea can detect the license plate and characters on it at an accurate degree of rotation using effective machine learning. The obtained output will be searched in the database, if present then user is genuine else not.

VII. CONCLUSION

The Multi-Directional License Plate Recognition system is very helpful in detecting licence plates for certain degree of rotation angle. The system performs a series of Image Processing techniques on the image to extract the characters of license plate from it. The system then compares the extracted characters of the plate with the offline database maintained in the system to check whether the incoming car is authorized to enter the premises or not. The system is implemented on PYTHON programming language with required libraries for image processing. The system robustness and accuracy for detection characters is to be improved by using machine learning concept.

REFERENCES

[1] Lele Xie, Tasweer Ahmad, Lianwen Jin , Yuliang Liu, and Sheng Zhang,"A New CNN-Based Method for Multi-Directional Car License Plate Detection," IEEE Trans. on Intelligent Transportation System.,pp. 1524-9050,2018.
[2] Jie Gan and Ang Li, Qian-Lin Lei, and Hao Ren and Yun Yang,"K-means based on Active Learning for Support Vector Machine," IEEE Computer Society, pp. 5090-5507, 2017.
[3] Yoshihiro Shima, "Extraction of Number Plate Images Based on Image Category Classification Using Deep Learning," IEEE International Symposium on Robotics and Intelligent Sensors., pp. 5090- 6084,17-20 December 2016.
[4] A. M. Hafiz and G. M. Bhat, "Boosting OCR for Some Important Mutations," Second International Conference on Advances in Computing and Communication Engineering.,pp. 128-132, 2015.
[5] Chayut Wiwatcharakoses, Karn Patanukhom "Two-Stage Recognition for Printed Thai and English Characters Using Nearest Neighbour and Support Vector Machine," International Conference on Signal Image Technology & Internet–Based Systems., pp.71-78,2013.

