# Comparing Models for Image Text Extraction in Automatic Chinese Car Plate Recognition System

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## 1 Introduction

Cars have become one of the most common means of transportation in China. From its initial invention, a sort of luxury, to its wide acceptance nowadays, the number of cars on road has been increasing on a daily basis. According to the statistics from China Association of Automobile Manufacturers (CAAM), approximately 25 million new cars were sold in 2020 nationwide. However, with the surging number of cars on the road, problems regarding traffic control also emerge, such as the increasing traffic violation rates. Taking Shanghai as an example, the total traffic fine for the year 2020 was ¥9.08 billion, meaning that every citizen has paid a fine of ¥363 on average in the past year.[1]

In order to take better control of cars on the road and more effectively handle traffic violations, the government has long been practicing the car plate registration system: a vehicle is only permitted to drive on roads with a legal car plate. However, we find that car plates only provide a static record of the vehicle, and may not be able to locate the real-time location of the car. In other words, whenever a specific vehicle violates a traffic rule, it is impossible for the traffic police to obtain the information instantly unless they can check through numerous images taken by the CCTV cameras on streets, which can be done by computers. The traditional process heavily reduces the efficiency of post-accident procedures and poses negative effects on fostering good driving habits.

Therefore, this project will lay emphasis on the comparison of several mainstream models for image text recognition and extraction in identifying car plates. A typical Chinese car plate mainly consists of two parts: a Chinese character indicating the province (i.e. the character "沪" stands for the city of Shanghai), and a string combination of both numbers and alphabets. We assume that our data set only consists of car plates of this pattern, meaning that those special car plates such as car plates on police cars or ambulances will not be taken into consideration. Through the comparison of applying those models, we will then evaluate the models from several criterion and then come up with the conclusion of an optimal model for car plate detection with the highest accuracy.

## 2 Dataset and Pre-processing

The data set we will be using in the project is from a GitHub open source project, which mainly consists of images that were taken by digital cameras, with various dimensions, in different places and times. As a standard Chinese car plate consists of one character and a string of alphabets and numbers, below is an illustration of a sample image in the data set we found:


Figure 2.1 Sample image

Potential problems that we may encounter regarding the data set are: some car plates are skewed due to the weird shooting angle; the outer metal of the car plates may cause identification difficulties when segmenting car

plates.

# 3 Methods

The methods will be divided into three parts: license plate detection, character segmentation and character recognition.[2]

- License plate detection
  We will train and use YOLOv5 object detection to locate the bounding box coordinates and take the sub-image that contains the license plate.
- Character segmentation
  We will first conduct preprocessing on the sub-image: we will pre-scale the image to make it easier to read, for example, we will threshold the image to white texts on the black ground to help find the contours of the image.
  For character segmentation, we propose two methods: First, we will apply OpenCv to find the rectangular-shaped contours of each character on the image. Second, we will use pixel detection for assistance.
- Character recognition
  For character recognition algorithms, we plan to perform the OCR task of recognizing characters using SVM(Support Vector Machine) or ANN(Artificial Neural Networks) and test their performance. [3]

# 4 Objectives

We expect to yield a summary of results from the models we selected by calculating the accuracy of the models respectively and the optimal model for car plate detection will be the one with the highest accuracy. The optimal model may serve as an effective approach to improve the efficiency under the scenario of a car-oriented traffic accident as well as a powerful tool to detect potential criminality such as providing the location of a stolen vehicle as well as tracking the suspect vehicle.

Finally, further application and improvement of the model involve the real-time car plate detection in motion as well as the prediction of the behavior of a specific vehicle, which can all be part of the rapid development of self-driving cars as well as connecting the vehicle into the digital world to maximize the efficiency.

# 5 Appendix

- Structure of the dataset:

| Images set | Number of images | Number of provinces appeared |
|---|---|---|
| Training set | 194[1] | 18 |
| Testing set | 50 | 2 |

# References


[1] 中国汽车工业协会. www.caam.org.cn. Accessed 8 Apr. 2021.

[2] theAIGuysCode. "TheAIGuysCode/Yolov4-Custom-Functions." *GitHub*, 2020, https://github.com/theAIGuysCode/yolov4-custom-functions.

[3] Erdinc Kocer, H., and K. Kursat Cevik. "Artificial Neural Networks Based Vehicle License Plate Recognition." *Procedia Computer Science*, vol. 3, 2011, pp. 1033–37. Crossref, https://doi.org/10.1016/j.procs.2010.12.169.


[1] We dropped 2 car plates with ending character 学 indicating that it is a student car