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Research on Mining Platform Scale License Plate Based on Deep Learning

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Abstract. Weighbridge is a mechanically operated large weighing instrument widely used in the coal industry. In order to effectively improve the vehicle automation management level of coal mines and accelerate the circulation of coal in coal mines, this paper studies the automatic identification technology of mining platform scale license plates. This paper studies the traditional license plate recognition process, namely: license plate detection, license plate location, character segmentation and character recognition. The shortcomings of the traditional license plate recognition process are analyzed. It is found that the traditional license plate recognition process has many processes, and the connection between each algorithm module is not tight enough. The accuracy problems existing in each step are accumulated, which will eventually cause serious loss of speed and accuracy. In this regard, this paper proposes an end-to-end license plate recognition method, using the deep learning AlexNet model for end-to-end license plate recognition training, overcoming the problems caused by the traditional license plate recognition process for license plate recognition.

1. Introduction

Coal is one of the important resources of the country. The mining platform scale bears the heavy task of the sales measurement of coal enterprises. The efficiency of measurement management directly affects the production order and efficiency of enterprises. It is of great practical significance to study the management of mining scales.

The license plate is an important way to identify the identity of the vehicle, so it can be one of the fundamental bases for the management of mining scales. In the traditional mine scale vehicle management, the vehicle information, weighing information, etc. are completely recorded manually, and the vehicle is instructed to enter and exit the pound room by hand. This way of relying on manpower for recording is not only a large workload, labor-intensive, and prone to security incidents, but also easy to miss, and the probability of error is high. Secondly, due to the poor supervision of people, the possibility of human cheating is greater, which will result in the loss of funds from coal mining enterprises. In addition, the real-time transmission of human-operated networks is poor. By manually filling in the documents and handing them over to the departments of finance and sales, it is difficult to understand the dynamics of the operations in the mines in time, and it is not convenient to conduct effective management in a timely manner. Therefore, it is of great significance to study the mining platform license plate recognition technology. And because the traditional license plate recognition technology has the bottleneck problem of algorithm connection, it leads to serious loss of speed and accuracy. This paper proposes a mining platform weighing license plate recognition method



based on deep learning, which solves the serious problems caused by multi-process step-by-step identification by using an end-to-end method.

2. End-to-end algorithm

The end-to-end algorithm, which refers to the input to the output, is a solution to the problem, and corresponds to a multi-step solution. Solving the problem in multiple steps is to break down a large problem into multiple sub-problems to solve, and end-to-end is the result of the output directly from the input data. For the traditional license plate recognition technology, most of the license plate recognition is divided into license plate detection, license plate location, character segmentation and character recognition. However, due to the accumulation of precision in the method of dividing large problems into sub-problems, the accuracy of the final recognition results is not high enough and the efficiency is low. The end-to-end algorithm proposed in this paper solves this problem. In this paper, the traditional process multi-step identification license plate is used for optimization. The deep learning is easy to realize the end-to-end algorithm. The AlexNet network is used for end-to-end license plate recognition, input license plate, and direct output license plate number.

This paper uses an end-to-end deep neural network to directly predict the license plate number. On the one hand, this method avoids the errors caused by the positioning, segmentation and recognition of the interdependence of this process. On the other hand, the characteristics of the text are more obvious than the vertices of the license plate, better capture, and can achieve better results. This method is more in line with the habit of people to judge the license plate number. The person judges the license plate number, instead of precisely locating the four vertices of the license plate object, and then dividing the characters one by one, one by one, but after detecting the license plate, directly passing the characteristics of the text are to be identified. In this paper, LSTM is used for character recognition. It takes an array of images as input and then outputs the recognized characters. The limitation of this is that this end-to-end model, while avoiding the errors caused by segmentation, still requires accurate positioning of the license plate. Due to the above analysis in this paper, the bottleneck in the traditional identification process is that the positioning is not accurate enough. We abandoned the LSTM after trying some experiments of LSTM and adopted the improved AlexNet network model solution described below.

3. Model design

In the choice of model, this paper uses AlexNet's deep network model. Since the license plate contains seven characters, the last layer of the network model is seven softmax layers that can output seven labels representing the seven characters of the license plate.

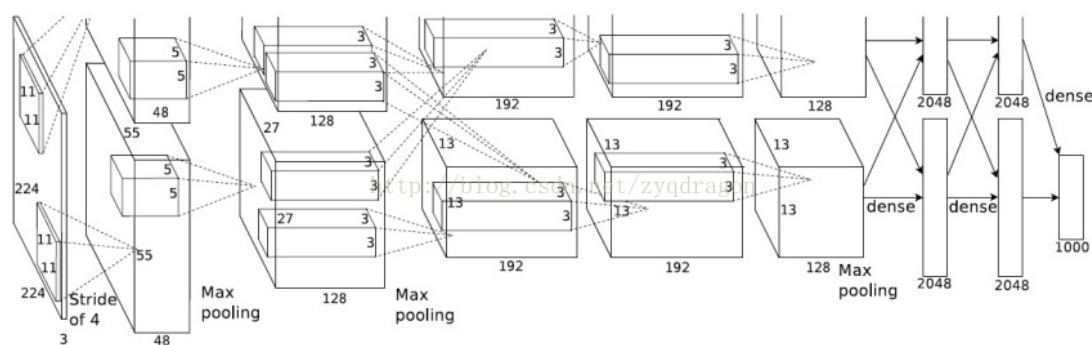


Fig.1 AlexNet's deep network model

Apply the model to the mining platform license plate recognition, the corresponding model is as follows:

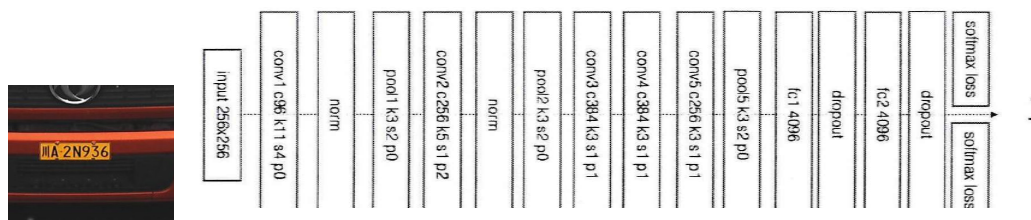


Fig.2 Mining platform scale license plate recognition network model

Since Loss comes from seven Softmax, the gradient of the neural network is reduced by about seven times that of the classic image classification problem. Therefore, the reverse transmission text training process also reduces the learning rate appropriately. After "pool5", for each picture, a 6x6 feature of 256 channels is calculated, this feature contains characters with position information, for example, on the 6x6 feature, the feature on the left is from the character on the left, and the feature on the right is from the character on the right. The feature of the positional relationship is selected by the full layer of the latter two layers. For example, the first Softmax selects the feature on the left, and the last Softmax selects the feature on the right.

4. Experimental results and analysis

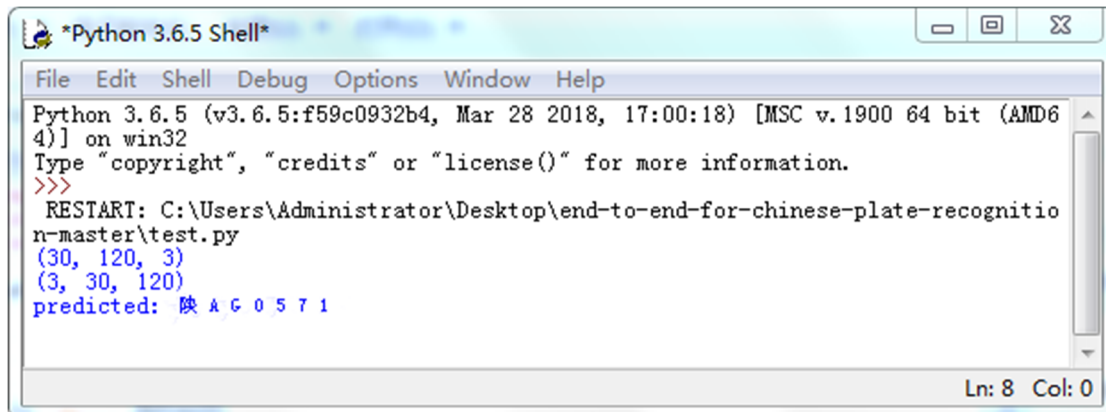
The following is a set of results for the recognition of the license plate using the end-to-end method of deep learning: Figure 3 is the original image of the license plate used for license plate recognition, Figure 4 is the test data for identification, and Figure 5 is the test result.



Fig.3 Original license plate image of test data



Fig.4 test data



```

Python 3.6.5 (v3.6.5:f59c0932b4, Mar 28 2018, 17:00:18) [MSC v.1900 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
RESTART: C:\Users\Administrator\Desktop\end-to-end-for-chinese-plate-recognition-master\test.py
(30, 120, 3)
(3, 30, 120)
predicted: 陕AG0571
Ln: 8 Col: 0

```

Fig.5 Recognition result

5. Conclusion

Since the data set used in this experiment was created by itself, there is no comparison with the experimental results obtained by other algorithms. This paper studies the mining platform license plate recognition, which is only for the identification of the license plate. During the training process, the input data is a single license plate, not the truck image containing the license plate image. Therefore, in comparison with the traditional license plate recognition process, the positioning process of the conventional license plate recognition is eliminated, and only character segmentation and character recognition are performed. Test experiments on 300 test data, the comparison results are as follows:

method	Precision
Traditional method	98.2%
Deep learning recognition method	93%

Fig.6 Recognition effect comparison

Some of the test data sets are shown below:



Fig.7 Partial test data

Through the test results on the test set, the end-to-end license plate recognition method based on deep learning is more accurate than the traditional license plate recognition method.

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