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Deep Learning Technology for Vehicle Recognition in Intelligent Security

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Abstract: Nowadays, people have entered the era of big data for security. The scale of data generated by security systems every day is very large. The importance of artificial intelligence for security lies in its ability to quickly obtain valuable information from massive data through the use of deep learning, feature extraction, object recognition and other technologies, thus transforming the monitoring system from traditional post investigation processing into in-process control, and even proactive pre-warning, At the same time, the staff are also free from heavy monitoring tasks. The security system is widely used in all walks of life. Therefore, this paper combines the general deep learning to build the technical research on vehicle recognition in intelligent security. The purpose of this paper is to study the technology of vehicle recognition in intelligent security. Analysis of experimental results from the above results, we can see that ResNet-50 can solve the task well, and it has achieved higher accuracy and better robustness.

1. Introduction

With the development of social economy, people's demand for security is rising. However, technological progress makes the means of endangering public security diversified and hidden [1]. The early security system completely relied on people to obtain and process information. In this case, the security system had high requirements for the attention and vigilance of security personnel, especially for the ability to respond to and deal with abnormal situations. When security personnel had omissions or their own level was insufficient, security problems would be induced. To solve this dilemma, a large number of security equipment have been developed and put into use in the front line of security, such as cameras, security detectors, scanners, etc. These devices can be roughly divided into fixed type and hand-held type. Handheld security equipment requires continuous operation of security personnel, and the labor intensity of security personnel is high. For

fixed security equipment, the monitoring range is limited. If you want to monitor an area, you need to deploy a large number of security equipment. It is easy to create monitoring blind spots between the monitoring areas of adjacent security equipment.

With the development of social economy and the continuous improvement of living standards, people pay more and more attention to the security field. At the same time, artificial intelligence technology and deep learning technology have developed rapidly. Gupta A believes that we are witnessing how technology has changed everything in the past, and how the automotive industry has changed itself using the Internet of Things, artificial intelligence and machine learning technologies. The company has changed its products and utilities in different ways. Now they want to acquire and introduce autonomous cars to the future generation. Large auto companies are working hard to achieve autonomous cars. They have studied models that help to assist autonomous cars and strive to achieve this goal. This model will be developed with the help of artificial intelligence, machine learning, deep learning and other technologies. In the near future, driverless cars will become a reality on our roads. However, the lack of manual driving requires technical solutions to a series of problems, which are still being developed and optimized. This has made great contributions to the innovation and economic growth of the automobile industry [2]. Eoa B studies that multi-scale design can stimulate greater intelligence in computer aided design. Based on the concept of style holography, a computational method for multi-scale style recognition of automobiles is proposed. Style holon is not only a whole, it contains substyles that make up it, but also a part of a broader style. Firstly, the method based on variable precision rough set is applied to vehicle evaluation and ranking. Secondly, the characteristic lines of each vehicle are extracted from the computer aided design model and then calculated. Finally, we use the properties of double headed holograms to identify type holograms. Style holon must be included in the typical vertical arrangement and gradually accumulated to form a nested hierarchical order, which is called style holon. Interactive clustering analysis is used to identify style holograms. The results show that the car style depends on the personal strategy of each brand: the car is a form with some structural stability [3]. At present, the security monitoring industry is further changing to the direction of modernization, digitalization and intelligence.

Based on the research background and significance, this paper expounds the relationship between deep learning and convolutional neural network, and designs the overall architecture of intelligent security system for vehicle recognition technology. In the experiment, the database of vehicle type recognition technology is constructed, and the experimental parameters are set using the SE Net algorithm, so as to investigate and analyze the vehicle recognition technology in the intelligent security.

2. Research on the Technology of Vehicle Recognition in Intelligent Security by Deep Learning

2.1. Research Background and Significance

In recent years, the construction of China's video surveillance system has expanded from the field of public security to all walks of life, and has gradually become an important means to maintain national security and social stability, playing an important role in traffic safety, combating crime, public security prevention and control, social management, etc. [4]. The security cameras deployed in the city are used to identify pedestrians in the coverage area, and target detection and tracking are used to determine whether the pedestrians pose a threat, so as to ensure the safety of urban residents. This paper discusses the design and implementation of automatic parking system from the perspective of computer vision algorithm, and uses cameras and sensors to realize parking space identification, free space and vehicle/pedestrian detection. The parking of vehicles in the

monitoring is analyzed by computer vision to assist the staff in handling the problem of illegal parking of vehicles. The hydropower intelligent security system designed includes electronic fence, vehicle access management and automatic patrol inspection through resource integration; Through data interaction between access control and monitoring systems, scholars have designed an intelligent access control system with one button alarm and automatic early warning [5].

All countries attach great importance to scientific and technological innovation and development. Science and technology have had a significant impact on the fate of the country. The resurgence of artificial intelligence is a rare historical opportunity for China. Grasping this strategic opportunity is of great significance to enhance China's competitive advantage and promote technological innovation. As the main foothold of AI, security has become the focus of enterprises, governments and universities. The practical significance of this paper is that it has identified the basic research that promotes the development of intelligent security technology, combined with its own advantages, to promote the development of automobile identification technology towards intelligent security system, and accelerate innovation to grasp the initiative in international game relations [6].

2.2. Deep Learning

(1) Deep learning

Deep learning is a deep algorithm model containing multiple hidden layers of artificial neural networks. "Depth" refers to a large number of network layers. After a large amount of data training, more effective feature information can be learned. It simulates the human brain in a layer by layer way for analysis and learning. It can interpret images, texts and sounds. It is a new field of machine learning. With the continuous optimization of GPU performance and the increasing availability of large amounts of data, it only takes a shorter time to obtain a better fitting training model for the deep learning model, and the performance is excellent [7-8].

(2) Convolutional neural network

When studying cat cortex, convolutional neural network found that cat's visual system has a hierarchical structure similar to human cerebral cortex, while convolutional neural network is a hierarchical network, which has levels not found in traditional networks, and the functions and forms of layers have changed [9-10]. CNN is a kind of deep learning network structure widely used in image processing. In view of the many advantages of convolutional neural network, it has become a popular direction of deep learning. When extracting features, multiple features can be extracted at one time, which is highly functional and has strong pertinence for sample classification or recognition. CNN adds convolution operation and down sampling operation to the basic structure of the artificial neural network. The convolution neural network does not need to manually select features. It trains the weights of the network. The convolution layer and the sampling layer appear alternately. The extracted features are dimensionally reduced. The neurons in the same layer can share the weights and process high-dimensional data without pressure, effectively avoiding over fitting [11-12].

(3) The relationship between convolutional neural network and deep learning

Convolutional neural network has received more and more attention with the deep learning. It is used to learn high-dimensional data of complex structures and large samples, and has made great achievements in the fields of portrait recognition and automatic driving [13-14]. The representative algorithm of deep learning is convolutional neural network, which obtains multi-layer features of images through continuous convolution calculation and is a feedforward neural network with depth structure. The relationship between convolutional neural network, machine learning and deep learning is shown in Figure 1:

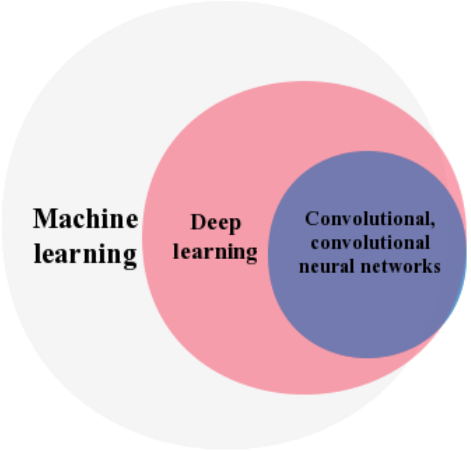

Figure 1. Relationship diagram

As a representative algorithm of deep learning, CNN has different characteristics from other deep learning algorithms, for example, it has two advantages: local connection and weight sharing. This advantage can greatly reduce the network parameters and computational complexity, and improve the speed of detection and recognition. Therefore, convolutional neural network has good performance in speech recognition and image processing. In recent years, Most researchers use this network as the basis for improving the algorithm [15-16].

2.3. Overall Architecture Design of Intelligent Security System for Vehicle Identification Technology

The intelligent security system can be divided into data visualization module and data processing module according to functions. The data visualization module mainly includes functions such as browsing the real-time vehicle detection screen, viewing event information, exporting event statistical reports, and managing cameras [17-18]. The data processing module in the intelligent security system is designed based on the target detection algorithm in deep learning, which is divided into RPC (remote method call) service, video stream processing module, calculation and analysis module, and Web server according to the function. Data processing module the data processing module cooperates with each other in the actual function operation according to the function. The data processing module mainly includes six modules: intelligent analysis module, load balancing service, target detection service, hardware encoder, abnormal video storage module, and data visualization module. The design ideas and performance optimization process of each module are described below.

3. Investigation and Research on Vehicle Recognition Technology in Intelligent Security by Deep Learning

3.1. Vehicle Model Identification Technology Database

In the field of deep learning, it is recognized that the more data, the better the performance of the model. However, the increase of data will bring costs such as computing time and computing resources. If we can use as few training samples as possible to achieve a good recognition effect, we

can effectively reduce the calculation cost. At the same time, the quality of the data set should be improved as much as possible. The data set should have "timeliness". Only by updating the data set in real time can we better solve the practical problems. In order to better solve the above two problems, this paper has established two new databases MTV-1638s and ASMTV120s. In this chapter, MTV Cars, a subset of the Compcars dataset, uses ResNet-50 network to conduct an empirical study on the two data set attributes that affect vehicle type recognition: the number of training samples and vehicle angle, and summarizes a useful conclusion on the basis of ASMTV120Ss to build a reasonable compact data set.

3.2. Processing of SENet Algorithm

SENet is a famous attention mechanism network based on image channel design. Its design principle is to train a weight distribution network to assign weight to each channel, so as to suppress or strengthen the features of different channels, strengthen the important features, and weaken the unimportant features,

Where X represents the input image F_{tr} is a convolutional neural network and U is a feature map of X extracted by F_{tr} network:

$$U = F_{tr}(X) \tag{1}$$

The latter branch network is to assign weights to multiple channels of the extracted feature graph U. The branch network first performs the squeeze (F_{sq}) compression operation:

$$z = F_{sq}(u) = \frac{1}{H \times W} \sum_{i=1}^{H} \sum_{j=1}^{W} u(i, j) \tag{2}$$

It compresses the two-dimensional image of each channel of the feature graph into a real number to generate a 1 * 1 * C one-dimensional feature z. The compression operation of each two-dimensional image uses a global pooling operation, which is usually average pooling or maximum pooling.

4. Analysis and Research on the Technology of Vehicle Recognition by Deep Learning in Intelligent Security

4.1. Experimental Parameter Setting

The experimental parameter settings also have a great impact on the final experimental results, including several important parameters involved: batch size, number of iterations, and learning rate. The batch size cannot be too large or too small. If the batch size is set too large, the number of iterations used to train iteration will be reduced. It will take more time to achieve the same accuracy, and the speed of parameter correction will be slower. In addition, the memory required will be larger as the batch size increases, which may lead to insufficient memory. On the contrary, if the batch size is set too small, the network model is difficult to converge. The batch size of this experiment is set according to different datasets. It is 73 on Stanford datasets and 42 on Compcars and VMMRdb. In this paper, ADAM neural network optimization algorithm is selected because it is more suitable for big data, has fast convergence speed and more effective learning effect. The initial learning rate is set to 0.0001, and then the learning rate is adjusted according to the training effect. The following are the parameter settings of the three data sets in ResNet-50, as shown in Table 1

and Figure 2:

Table 1. ResNet 50 parameter sttings

Dataset	Batchsize	Learming rate	Learning rate Decay	Iteration
Stanford	73	0.0003	0.11	40
VMMRdb	73	0.0003	0.12	30
MTV-Cars	42	0.0003	0.14	20

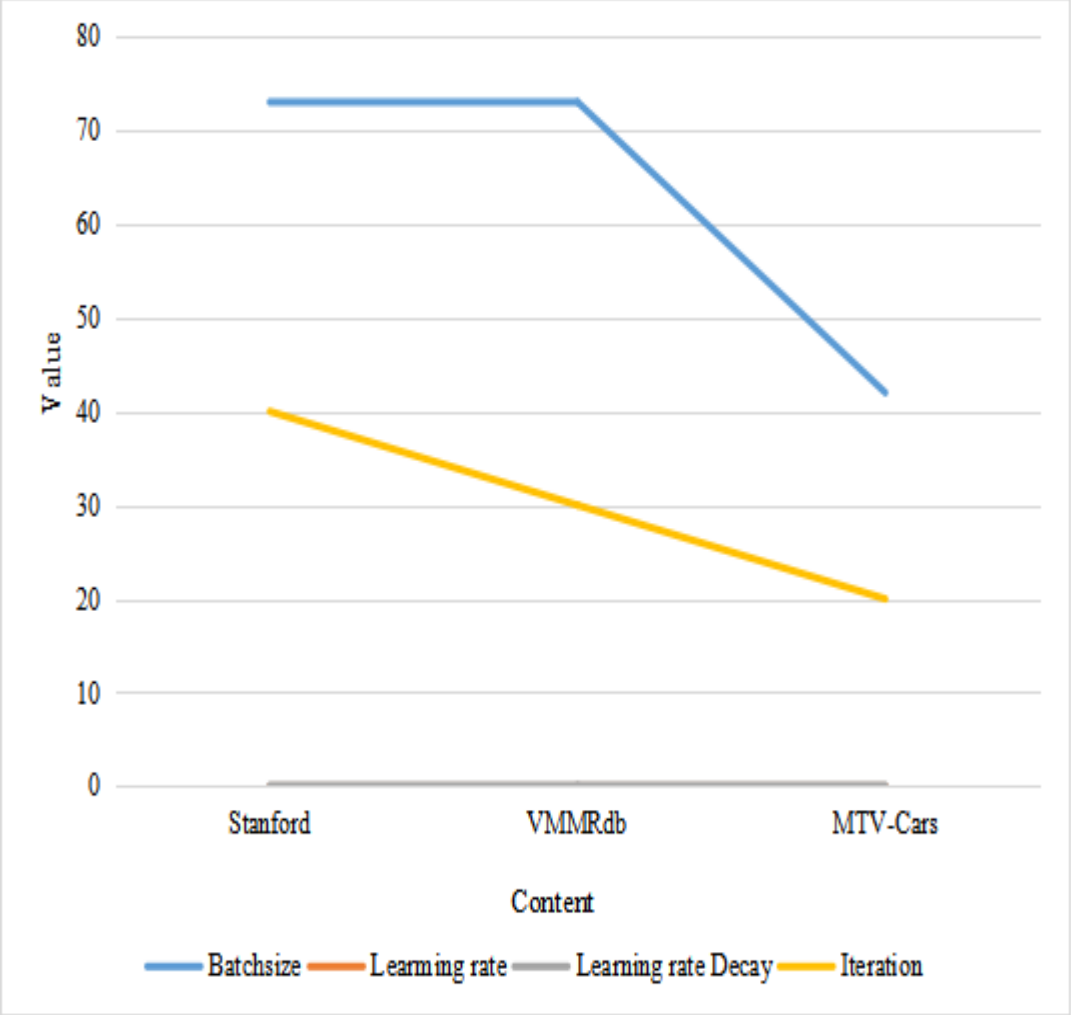

Figure 2. Experimental parameters comparison diagram

One of the advantages of using adaptive learning rate is that it is unnecessary to adjust the learning rate manually. However, this paper finds that if a fixed learning rate is used to train the model, the accuracy will not improve after the model converges. If the learning rate is changed at this time, the loss will continue to decline. Therefore, this experiment uses a learning rate attenuation factor, and each experiment uses 0.1 times the learning rate for training.

4.2. Experimental Results

Using the above parameter settings, based on three network models VGGNet-16, Resnet-50, and B-CNNs, the experimental results obtained on Stanford Cars, VMMRdb, and MTV Cars are shown in Table 2 and Figure 3:

Table 1. Accuracy comparison of three VMR algorithms

Experimental benchmark	Stanford Cars	VMMRdb	MTV-Cars
Classification label	Manufacturers-Model-Year	Manufacturer-Model	Manufacturer-Model
Category number	204	761	1596
Number of experimental pictures	17654	296540	153584
VGGNet- 16	53.52%	77.31%	71.21%
ResNet-50	87.32%	93.24%	97.36%
B-CNNs	87.21%	87.36%	87.18%

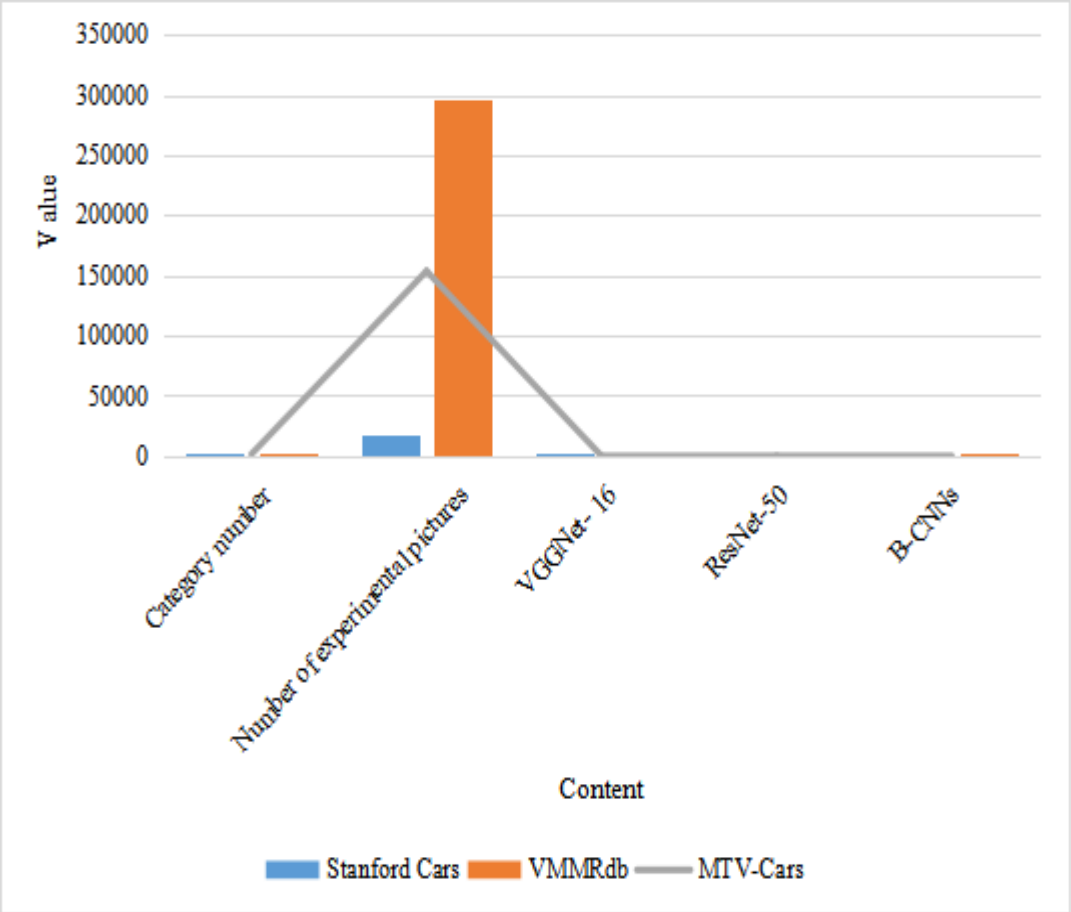

Figure 1. Vehicle identification algorithm data diagram

Analysis of experimental results from the above results, we can see that ResNet-50 can well solve the tasks proposed in this paper, and it has achieved higher accuracy and better robustness. The reason for analysis may be that ResNet-50, compared with the other two networks, further deepens the network and can extract more abstract features. Whether to use a deeper network will result in higher accuracy. For this reason, this paper also uses another deep neural network ResNet-100 to conduct experiments, using the same parameter settings and data enhancement methods. However, the accuracy of vehicle recognition test is low, which shows that simply deepening the network, It will not improve the recognition accuracy, which may require the "cooperation" between the network model and the data. For the 100 layer neural network, the network is further deepened, but the experimental data during the experiment is not increased at this time, making the model achieve good experimental accuracy on the training set, but the accuracy on the test set is very low, which causes over fitting.

5. Conclusion

In recent years, with the rapid development of China's economy, people's living standards have begun to improve. They are also increasingly concerned about personal and property safety, and the requirements for family and community safety have become higher and higher. At the same time, with the continuous development and progress of the society, malignant public emergencies caused by social contradictions are also increasing. The rapid development of the economy has led to the increase of urban migrant workers, which has led to the rapid increase of urban floating population, and the difficulty of social security issues has further increased. On the other hand, for terrorist activities that affect social stability, governments of all countries have taken active measures to strengthen prevention and attack, which has also led to the growing demand for security and the growing market. The traditional form of security can no longer meet people's needs. Compared with the ex post verification emphasized by security in the past, the security field now hopes to achieve prevention in advance and intervention in the event. Therefore, actively carrying out the research, development, integration and application of security and related technologies has a major strategic significance for China to promote the development of basic technologies, product application technologies, Xueliang Project, smart cities, safe cities, etc., and guide Chinese security enterprises to the world.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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