

Application of face recognition technology based on deep learning in smart security construction

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Abstract: face recognition is a kind of biometric recognition technology, and it is also the most popular and widely used artificial intelligence technology. The data acquisition process of face recognition technology is covert, so it plays an irreplaceable role in the field of security. Deep learning is a high-order logic method under the background of the development of artificial intelligence. Thanks to the development of deep learning mode, artificial intelligence technology including face recognition has been continuously developed. The development of intelligent security needs the support of face recognition technology. This paper analyzes the face recognition technology in the deep learning mode, and then puts forward the application of face recognition technology in the construction of intelligent security, hoping that this paper can provide some reference for the development and application of face recognition technology.

Key words: deep learning; Face recognition technology; Intelligent security; Construction path

1. The concept of deep learning

The multi-layer structure of deep learning is similar to the cognitive process of human brain, which simulates the characteristics of human brain gradually abstracting high-level semantic information from low-level features. Deep learning is based on deep neural networks, which breaks through the limitations of traditional shallow neural networks and evolves into a “thin and deep” shape. The development of deep neural networks is mainly due to the fact that cloud space can store more and more data to support the training of deep neural networks. At the same time, deep neural networks have relatively high requirements for the computing power of computers. The development of big data and cloud computing provides sufficient computing power for deep neural networks, Furthermore, the solution of gradient dispersion problem also lays a foundation for the development of deep neural network.

Traditional machine learning methods need to be presented in the form of neural networks, but at that time, vector machines, subspaces and other methods were all corresponding to the “flat and flat” network structure. The most essential difference between the two neural networks with different characteristics of “flat and flat” and “thin and deep” was that there was a significant difference in the expression ability of the feature space. With the increase of the number of layers, The improvement of representation ability is exponential.

2. Application of deep learning in face recognition

2.1 Face acquisition

Face acquisition is to establish a human face database in the computer first, extract the face region from the image obtained by camera equipment or downloaded from the network, and then save the vector feature of the face through the feature region, and then store it in the computer database. In the field of intelligent security, the main way to obtain face images is the camera in the access control system and monitoring system.

2.2 Face detection

Face detection is the key step of face recognition. The position and size of the face in the image are measured through the algorithm model. In the current face detection algorithm, deep learning is the most accurate algorithm, and it is also the mainstream algorithm in the current market.

Taking the mtcnn model as an example, the mtcnn model forms a network structure through three convolutional neural networks. The three network structure layers of the proposed network, the refine network and the output network detect the face features. The input image is processed in a pyramid way, and then the processed image is processed through 12×The sliding window of 12 samples the image, generates the candidate frame of the face through the p-net network, and then removes the redundant frame through the non maximum suppression algorithm to classify and locate the data. R-Net uses border regression and facial key point locator to filter out candidate boxes that are significantly different from the expected ones from the candidate boxes obtained by p-net, and further optimizes the screened candidate boxes with bounding box progression adjustment window and NMS. After screening, the results are more accurate, and finally input the face areas that are more in line with the expectation into o-net. The structure of o-net is basically similar to that of R-Net, except that there is an additional convolution layer. It is to perform fine calculation on the output results of R-Net, and finally get the correct candidate face frame and the corresponding feature point position of the face after several corrections.

2.3 Face recognition

The current face recognition algorithms are mainly divided into two categories, one is the research method based on the whole, the other is the method based on feature analysis. In 2015, Google proposed the facenet model, which is a module dedicated to face recognition. The module uses CNN learning to map the most original data to the European space, and marks the face data through the distance of the European space. Under this marking method, the distance of the same person in space is very small, while the distance of different faces in space is large. Then, the error of sample distance is calculated by triplet loos. Facenet directly uses triplet loos function to train neural

network, and represents data through 128 dimensional eigenvector space. Triplet function forms a ternary function group (Xai, xpi, xNi) of two images representing the same face and another image representing the face in Chapter 2. The purpose of training is to make the intra class distance (Xai, xpi) as small as possible and the inter class distance (Xai, xNi) as large as possible. The loss function triplet loos is shown in Figure 1. The triplet loos function is used to ensure that the distance of the image representing the same face is smaller than the feature distance of another face.

$$\sum Ni [\|f(x_i^a) - (x_i^p)\|_2^2 - \|f(x_i^a) - (x_i^n)\|_2^2] + \alpha$$

Figure 1 Triplet loos function

3. Application of face recognition technology based on deep learning in smart security construction

3.1 Access control system

1. Campus access control system

Most of the university campuses in China are in an open state. How to record the data in and out of the campus is an important part of campus management. Campus access control system is the basic way to record personnel access data. With the support of access control system, data tracking becomes possible. Laboratory management and student dormitory management are important contents of smart campus construction. There are a large number of valuable instruments and equipment in the school laboratory. The safety management of the equipment is related to the development of teaching and scientific research in the school, so the laboratory access record is very important. Face recognition technology is one-to-one to effectively control the laboratory access. The entrance guard system of the student dormitory is an important means to ensure the personal and property safety of students. Foreign visitors need a grade to enter and exit the dormitory, and they also need a memory grade to carry large items and valuables into and out of the dormitory. With the help of face recognition technology, we can save the tedious registration work and realize the informatization and intelligent management of student dormitory.

2. Application of train gate opener

At present, China's railway system uses the real name ticket entry method, and more than 95% of passengers use the second-generation resident ID card to verify information. However, there is a time difference between the ID card photos and their own photos, and sometimes the problem that the face information cannot be checked is time-consuming and labor-consuming, which brings some difficulties to the identification of passengers. The ticket verification method based on face recognition technology is that passengers carry identity cards and paper tickets to independently verify their identity information, and determine that the ticket is consistent with the identity card, and the face is consistent with the identity card information. When the matching degree of identity card and face is greater than the set threshold, it means that passengers can enter the station after passing the verification and the entrance gate is opened. If it fails, it will be transferred to manual verification. The manual verification is carried out through the passenger photos and passenger ID card information captured by the face acquisition device. After passing the verification, the gate will be opened.

3.2 Video surveillance system

1. Campus video monitoring system

Campus video monitoring system is an important means to ensure campus security. Currently, most colleges and universities are equipped with access control systems. Access control systems and monitoring systems are independent systems of each group, forming two barriers to effectively ensure the overall security of the campus. The overall security of the campus can be further improved by managing the door lock system and the campus monitoring system and realizing data interconnection and mutual assistance. Face recognition technology relies on the face images collected by the video monitoring system in the smart campus, and then quickly identifies external visitors. The system can automatically pre-warning and tracking the illegal intruders, making the whole security system automated, intelligent and efficient, and making the campus security work more safe and reliable.

2. Prison video surveillance management

In addition to playing an important role in campus video security, face recognition technology can also play an important role in prison management. A video monitoring system with face recognition technology is installed at the entrance and exit of the prison to collect and recognize the faces of the people in and out of the prison all day, so as to prevent problems in prison management. It is suggested that The video monitoring system inside the prison equipped with face recognition technology can also track the abnormal behavior of prisoners. In terms of preventing fights and fights inside the prison, the video monitoring system with face recognition technology can collect the information of relevant personnel and send out an alarm when the fight and fight are monitored, and the prison guards can manage it in time to prevent further deterioration of the situation.

3. Traffic management of pedestrians running red lights

The monitoring system is also widely used in traffic management. In recent years, with the continuous expansion of China's traffic scale, it is very important to urge citizens to travel in a civilized way. Under the management of traffic laws and regulations, pedestrians still run red lights. It is very necessary to take some technical supervision on these behaviors. The monitoring system installed on the traffic road can capture and collect evidence of the passing of motor vehicles more conveniently, and then carry out effective management, but it is relatively difficult to obtain evidence for pedestrians and non motor vehicles. After the introduction of face recognition technology, evidence of pedestrians running red lights can be found through snapshot and recognition. In the future, face recognition technology will further

promote the development of intelligent transportation. At present, the transportation department has begun to apply the integrated pedestrian running red light detection machine, which can compare faces and carry out real-time warning through the large information screen, and has the characteristics of high accuracy and convenience in practical application.

Epilogue

The development of deep learning promotes the development of artificial intelligence and plays an important role in face recognition. The introduction of face recognition technology into intelligent security work can effectively enhance the intelligence and efficiency of security work through face recognition technology to recognize personnel's identity, record access data, and carry out targeted tracking and monitoring. Although the current face recognition technology still has some challenges in specific applications, such as how the system can recognize and track multiple faces at the same time when the traffic is large, and how to realize face acquisition and recognition in the environment with poor lighting conditions. In the future, to solve these problems, we need to further strengthen the application of deep learning in face recognition.

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