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Research on Intelligent Safety Supervision System of Chemical Industry Park Based on Neural Network

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Abstract: With the continuous development of society, video surveillance technology is widely used in many fields such as urban security, transportation, education safety training, and intelligent furniture. However, the traditional and backward monitoring methods can no longer meet the needs of modern urban development. In order to improve the monitoring ability of video and increase the speed of face recognition, it is particularly important to establish a smart security monitoring system based on artificial intelligence in this paper. This article uses the YOLO algorithm as the basis for neural network model building, training and prediction. A smart security monitoring system based on the chemical industry park has been designed. Through intelligent monitoring, it can effectively identify faces and analyze people's unsafe factors and behaviors to ensure the safety of people's lives and property.

Keywords: YOLO, Neural Networks, Chemical Industry Park, Smart safety supervision.

1. Introduction

At present, most of the domestic video surveillance technologies require manual viewing, which not only wastes a lot of manpower and material resources, but also often leads to failure to detect hidden dangers in time due to human factors, resulting in accidents. Therefore, how to transmit the monitored safety information to safety inspectors in real time and accurately is particularly important. The research of intelligent monitoring system can be applied to many industries such as mines, ports, oil fields, chemical industry, and electric power [1-5]. The AI algorithm of computer can automatically identify unsafe behaviors and factors in these scenes, send out alarms and make these dangers The factors are transmitted to the safety officer, so that the safety officer can respond in time to avoid accidents.

The chemical industry has always been the pillar industry of China's economic development, and the country also pays special attention to the development of the chemical industry. In the new era, a series of new clean energy such as nuclear energy, solar energy, and wind energy have been well developed. The development of chemical industry-related infrastructure and basic equipment has an unattainable position in the process of my country's economic development. However, due to the particularity of the environment in the chemical industry, most engineering operations are carried out in a complex environment, the operating conditions are dangerous and very difficult, and the risk factor is very high. In order to ensure the safety of the chemical industry, the state has issued a series of related policies to promote the development of the chemical industry towards mechanization and intelligence, guiding relevant enterprises to increase investment in technology through continuous technological innovation, and to develop a series of advanced and effective products. Advanced technology and equipment to continuously improve the level of intelligence and informatization in the chemical industry.

The key technology of intelligent video surveillance lies in image content recognition and analysis technology. The core of image recognition lies in the identification of target individuals, such as knowing a certain person, finding a dog, a cat or a bicycle. Changan Zhang[6] analyzed the workflow and system structure of the UAV inspection system in view of the low matching degree and poor accuracy of current UAV inspection image recognition, and used the fast UAV scene matching algorithm to identify the Check the image. In order to promote the intelligent management of urban forestry, Xiaobo Sun[7] combined Channel Attention Module (CAM) with Spatial Pyramid Pooling (SPP), mixed depth expansion convolution kernel and other algorithms to establish an automatic image recognition model for urban greening tree species . In order to quickly identify rice drought tolerance gene resources and drought tolerance candidate genes, Enxi Li[8] and others established a method based on image recognition technology to measure rice under PEG-6000 (polyethylene glycol) simulated drought stress and H2O2 stress treatment conditions. Method of reflecting drought tolerance of rice under green leaf rate. In order to protect birds, Xian Chen[9] proposed a wetland bird monitoring method based on target detection and multi-target tracking network. Yutong Liu [10] aimed at the problem of plant disease image recognition, introduced a Transformer-based fine-grained recognition method to solve the problem of difficult identification between different diseases of the same plant.

2. Object Detection

The previous target detection algorithm needs to reuse the classifier for detection, and needs to be evaluated at different positions and scales on a picture. The DPM algorithm is based on traditional computer vision features, a set of artificially designed templates, and the DPM template Use the sliding window method to traverse the image to be detected, so as to match the objects that conform to the template characteristics. However, the DPM algorithm needs to manually design the template and the matching speed is slow. Another algorithm target detection algorithm is the R-CNN algorithm, which is a region detection algorithm. The R-CNN algorithm first divides the image to be detected into several candidate frames, and then uses a classifier on these candidate frames to perform one-by-one filter categories. Post-classification processing

eliminates heavy and repeated prediction boxes, and fine-tunes each prediction box. And scoring the predicted object based on other objects in the image is very tedious and difficult to optimize because each step needs to be trained separately. YOLO is a new type of network architecture model. Compared with the previous two algorithms, YOLO is very simple. YOLO only needs one convolutional neural network, which can predict multiple prediction boxes and categories at the same time. YOLO is able to train on the entire image and directly optimize its performance. This end-to-end training method has many advantages. First of all, the training speed of this algorithm is very fast, because YOLO defines the target detection problem as a regression problem, so the whole working process is not complicated, just input the image to YOLO The model is tested. Secondly, YOLO can completely analyze the entire image information, and can accurately interpret the relationship information of the image.

3. Design and Implementation

The data used in this article comes from open source data sets, web crawlers and on-site collection. The data sets include different operating environments and different resolutions in different construction scenarios for the training of neural network models. A total of more than 2,000 pictures were collected. Since 2,000 pictures are slightly insufficient for sample training, methods such as rotation, cropping, and graying were used to expand the data set. The data set was expanded to more than 8,000 pictures. The data set includes Different working environments and different resolutions in different construction scenarios are used for training the neural network model, and the training is carried out according to the ratio of 10 to 1 for training and testing. After uniformly numbering the pictures in the data set, use the Labelimg labeling tool to label the data set, mark the data set in VOC format, and generate an xml label file. The data is uniformly cleaned into two types: face and noface, and the accuracy, recall, and average precision are calculated as the evaluation indicators for the quality of the model. The research shows that the neural network model has been trained in large quantities. Compared with other algorithm models, the detection of the YOLO model The speed is faster, the effect is more obvious, and the face recognition results can be clearly analyzed.

This paper adopts C# language, takes the Web as the framework, and builds a decision-making support platform for the management of a chemical industry park in Sichuan through field investigation, so as to realize the comprehensive one-stop dynamic interactive display of the data of the chemical industry park. It supports the daily operation monitoring and management of the chemical park in terms of infrastructure, transportation, smart security, smart environmental protection, etc., and provides users with a multi-dimensional platform integrating production, operation and decision-making. Through the use of intelligent video behavior analysis and Internet of Things related technologies, it is possible to intelligently identify risk factors in the chemical industry park operation site, classify each type of risk into different levels, and push them to relevant personnel, so that early warning information can reach management personnel accurately and effectively. Reduce the occurrence of accidents and disasters. The system consists of several subsystems as shown in Figure 1, mainly including the basic safety management system, emergency rescue subsystem, video surveillance subsystem, training and education subsystem, etc. At the same time, video surveillance technology collects and uploads some data required by the platform through technologies such as Internet of Things data perception and video surveillance perception, mainly including major hazard sources, toxic and combustible detection, and video surveillance perception.

Figure 1. System home page

It can be seen from Figure 1 that the system can carry out integrated management of the chemical park, collect all the information in the park, and fully share the park resources to achieve safety, double prevention, major hazards, toxic and flammable detection, and environmental protection in the park. Unified management and visual management requirements for inspection and other services.

This system builds a unified map application support platform based on GIS, extracts the data parameters of various businesses such as chemical industry park operation, safety production, data monitoring, safety behavior identification, environmental detection, emergency management, etc., and communicates business data in the chemical industry park. The managers in the park provide support for comprehensive decision-making. The system displays information such as enterprises in the chemical park, video surveillance in public roads, and the surrounding environment, as shown in Figure 2. Through the GIS map, the basic information of the enterprises in the park, the risk and hidden danger information of various enterprises, the real-time detection data, and the information of emergency rescue resources are displayed, so as to realize the visual management of the safety information of the enterprises in the park and the safety rescue resources of the park. Based on the GIS map, it can visually display the distribution of emergency rescue resources in the park, integrate the emergency rescue resources in the park through the platform, the situation of emergency drills in the park, and the construction of emergency plans of each company. It can

not only help park managers understand the basic park rescue information, but also help managers understand the weaknesses of rescue management in the park and improve the rescue capabilities in the park.

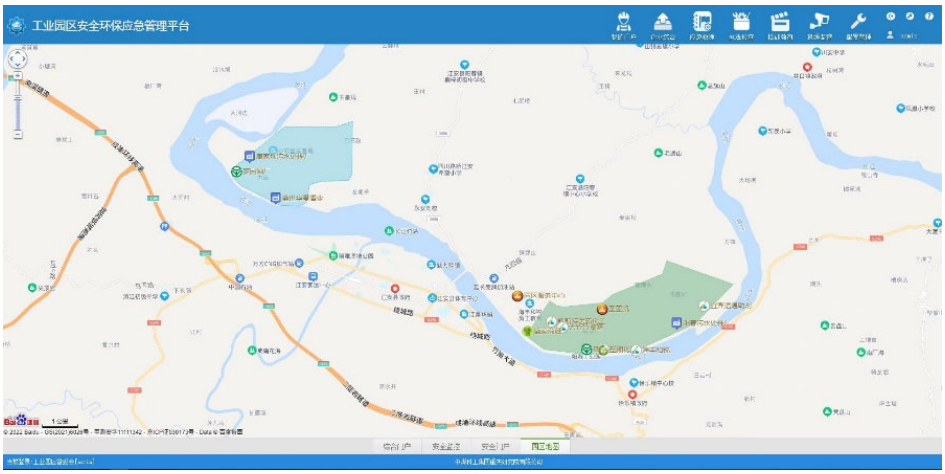

Figure 2. Using GIS to visualize the park management

After the completion of the system, on the one hand, it can solve the disadvantages of poor information association and lack of intelligence in the traditional digital management model for the regulatory authorities. Through information management, it can realize the automatic association of key information and improve data utilization and comprehensive management capabilities; At the same time, the system solves the problems of insufficient online and offline supervision, unclear enterprise safety risks, and enterprises not paying attention to safety for the supervision department. Through the "Internet + supervision" model, the overall safety supervision level of the Economic Development Zone is improved. On the other hand, it can provide enterprises with effective means of safety production management, thereby improving the level of enterprise information management, and providing strong support for implementing the main responsibility of enterprise safety production and improving safety awareness.

4. Conclusion

With the continuous development of China's economy, the development of the chemical industry will also be faster and faster. Therefore, the safety of chemical parks has attracted more and more attention. However, traditional chemical parks have fallen behind, and the construction of smart chemical parks is imminent. Based on this, this paper proposes the construction of a smart chemical industrial park system based on this neural network. Through video surveillance, identify unsafe behaviors and hidden dangers in the park. Studies have shown that smart security monitoring technology has been well applied in complex scenarios such as chemical industry parks, and the recognition efficiency has also been improved by building artificial neural networks through computers. In addition, based on the research of Jiang'an County, Sichuan Province, this paper has developed a security inspection system for smart chemical parks. According to the national requirements for the construction of chemical parks, combined with the actual needs of Jiang'an County, based on advanced technology theories such as big data analysis and data and video integration, the collection of Jiang'an An County's basic information or related system data breaks through information islands and data barriers between different business scenarios and systems, and builds an intelligent video surveillance platform for safe production. Through the construction of the platform, a complete supporting environment support system will be provided for enterprises in Jiang'an County, the economic operation management ability and office collaboration efficiency of Jiang'an County will be improved, the management and control of production and operation in Jiang'an County will be strengthened, the analysis and decision-making of Jiang'an County will be supported, and the standardization of Jiang'an County will be effectively improved, intelligent management service level, promote the transformation and upgrading of chemical industry safety production and high-quality development, and further enhance the comprehensive competitiveness of Jiang'an County.

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