Engineering Machinery Parts Inspection System Based on AI Intelligent Inspection Technology

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Abstract: The development of intelligent robot technology in today's society has become more and more mature, and has become a new industry. Among them, intelligent tools, including detection systems, are also improving with the level of science and technology. As one of the products of the new era, artificial intelligence is widely used in industrial production, military and other aspects. Based on AI computing, this paper studies and implements the design and verification process of an autonomous product sensor and signal processing module in an automatic deployment environment based on similar rules. At the same time, for the key part of robot technology, namely, the information acquisition unit, a corresponding algorithm is proposed to fuse and analyze its detection data and finally get the results. The test results show that the system can achieve 90% accuracy in detecting parts, and the detection time is fast, which can meet the user requirements.

1. Introduction

Intelligent detection technology is a frontier product rising in recent years, and its development plays an important role in social life. With the continuous improvement of the integration of sensors and computer related chips, as well as the in-depth exploration and practice of AI system in the field of artificial intelligence theory research [1-2]. At present, based on embedded, integrated, networked and other features, many intelligent detection tools have been developed that integrate functions and are suitable for real-time monitoring, data analysis and processing, information interaction and other aspects of the production site to provide users with convenient services, and the product performance stability has also been significantly improved.

Many scholars have done some research on intelligent detection technology. The research on robot detection technology in developed countries started early, and has formed a relatively complete and mature industrial system. However, the research and development work in relevant fields in China is relatively late and is still in the stage of introduction, digestion and absorption. At

present, our country is committed to applying artificial intelligence algorithms to robot systems to improve the degree of intelligence to achieve high-precision detection functions. In sensor technology, many scholars have also developed flexible accelerometers and piezoresistive pressure sensors. The research on integrated AI technology in China started late and is still in the initial stage of development, but many scholars have explored and applied related fields [3-4]. Some scholars have proposed three methods based on neural network algorithm, particle swarm intelligence computing platform and artificial neural network method to detect the feature parameters contained in robot parts. Among them, co evolution is a new idea. This model can consider multiple target objects or different types of target information and task functions at the same time, and determine the state change rule and location distribution of each functional unit in the system environment through self-learning. Therefore, based on intelligent inspection technology, this paper studies and designs the inspection system of construction machinery parts.

The development of intelligent detection technology has been widely used in industrial production. With the continuous improvement of relevant theories and methods such as artificial intelligence, information automation and embedded systems, intelligent products have increasingly become a research hotspot. This paper deeply discusses and analyzes AI automatic detection technology for current domestic enterprises and scientific research institutions, and proposes an improvement scheme to meet market demand. At the same time, it designs a supply chain based fusion AI detection platform to achieve test data collection, combining the application status and existing problems of existing mature products at home and abroad, as well as the future research and development direction, to provide a reference for subsequent work.

2. Discussion on the Engineering Machinery Parts Inspection System Based on AI Intelligent Inspection Technology

2.1. Engineering Machinery Parts

The inspection system of construction machinery parts is an intelligent product, which is mainly composed of three parts, namely sensor, actuator and control unit. The sensing device is able to sense the external information and convert the sensed signal into electrical signal. In the traditional detection methods, multi-channel transmission is usually used for data acquisition and transmission. With the integration of artificial intelligence technology, multi-channel sensors can analyze and process the input before outputting it to the microcontroller, which can realize real-time monitoring and control [5-6]. The actuator is small in size and light in weight, suitable for high-speed, heavy load and heavy load detection. In addition, the control unit has high accuracy. In engineering, due to the large size difference between different types of products. Therefore, it is particularly important to control the accuracy of each type of parts. In addition, for the same type of parts, their working environment and processing requirements are also different. For example, for some precision equipment such as driving motor, more sensors are needed to collect data and transmit it, while for some detection systems with special functions or with specific use requirements, they must be installed and debugged with higher accuracy and lighter weight. The part inspection of construction machinery needs to be carried out in large quantities and for a long time to determine the part parameters. Traditional manual testing methods are inefficient due to high cost, long cycle and other reasons. And intelligent products have better fault tolerance, anti-interference performance, fast response and reliability characteristics. At the same time, sensor technology can also greatly reduce the problem of measurement accuracy decline caused by error or damage caused by external factors. Figure 1 is the frame diagram of sensing technology for engineering machinery parts.
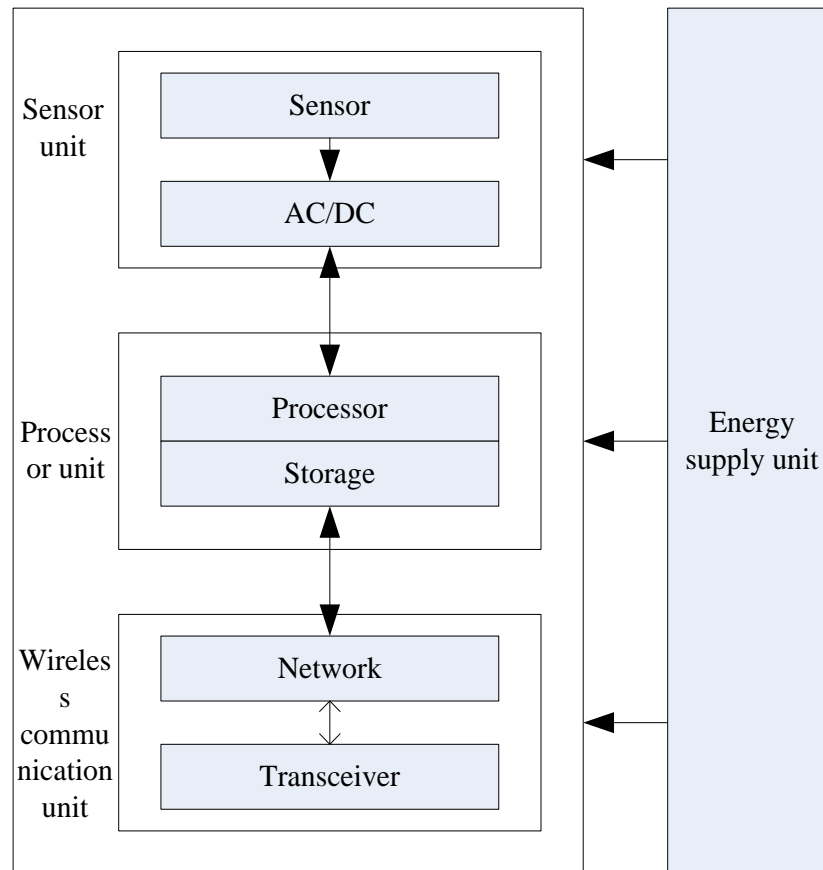
Figure 1. Construction machinery parts sensor flow

2.2. Parts Inspection Problems

The problems of parts detection are as follows. Due to the wide variety of products and different materials required for each type of equipment, it is difficult to achieve automation by using traditional methods when testing parts. In addition, there may be differences in quality control after production by different manufacturers. Therefore, standards, specifications and relevant regulations should be formulated according to the actual situation for new technologies, new processes and new packaging forms. There are a lot of repetitive work contents and complex data acquisition processes in the detection system, which are places where traditional manual detection cannot meet the needs. In addition, the cost of intelligent detection system is high. Due to the low efficiency and poor accuracy of traditional detection methods, it cannot meet the needs of enterprises, so it needs to be improved on the basis of existing technologies [7-8]. At this stage, due to the product development and production of major companies, there is a certain gap in materials, processes and equipment, so it is impossible to achieve accurate detection of all parts, nor can it guarantee that the data information collected is consistent or identical. Therefore, at present, there is no complete, perfect, mature and reliable intelligent product quality monitoring system in China. This makes it difficult for enterprises to accurately grasp the changes in the relationship between various links in the supply chain process and the production progress, thus reducing the overall benefit and efficiency of the entire industry and even the whole society. On the other hand, compared with foreign advanced products, the products independently developed in China still have a certain gap and the

problem of high price remains to be solved [9-10]. At present, some domestic companies have realized real-time collection, analysis and processing of parts' status parameters and working conditions based on artificial intelligence algorithms. However, this method is still in the research stage and is not yet mature. The detection and analysis of intelligent products need to be completed on the computer platform, including the collection of target objects and the realization through relevant software. At the same time, the types of sensors used the testing environment and the system stability need to be considered. After segmentation for different types of users, set the corresponding parameter indicators and weights. When there is a large demand for key technologies and data in multiple fields involved in intelligent products, you can choose to conduct integrated processing first to reduce the difficulty of work, improve the detection efficiency, and reduce resource waste [11-12].

2.3. AI Intelligent Detection Technology

The development of AI has entered a new stage, and it has also been widely used in the detection field, such as robot positioning, navigation and environment awareness. Sensor technology is an indispensable part of modern industrial automation process control and automatic test system, and AI can achieve different functional requirements by classifying and processing information. In addition, it can also complete the corresponding tasks according to the user's instructions, and has real-time and accurate eigenvalues, making it suitable for the detection of complex and uncertain objects in the working environment. In the process of working, the intelligent robot obtains data information through sensor acquisition, and analyzes and processes these data. The obtained results are comprehensively judged by computer technology. This algorithm is based on images and uses feature parameters as reference values to realize automatic recognition [13-14]. The optimal path tracking scheme of intelligent robot is selected according to its own characteristics and detection requirements. The artificial intelligence optimization model is established through training set, expert system, etc., and the best motion track and state are simulated on the computer. The data to be tested are processed, and the pre-test results are automatically generated in the machine, and then transmitted to the robot. The following kinematic geometric relationships can be obtained from the all-wheel steering model of the inspection robot:

$$\begin{cases} \cot\delta_1 = \mathrm{L}_3 \\ \cot\delta_2 = \mathrm{N} + \mathrm{M}_1 \\ \cot\delta_3 = L_4 \end{cases} \tag{1}$$

When the robot turns, the extension lines of the front and rear wheel axes intersect at a point O ', which shall meet the following requirements:

$$\cot\delta_4 - \cot\delta_2 = \mathrm{N} + \mathrm{M}_2 \_ \mathrm{N} + \mathrm{M}_1 \tag{2}$$

Artificial intelligence technology is more and more widely used in industry. The combination of sensors and robots realizes complex multi task interaction between sensors and machines. Through the fusion of multiple targets, the cooperative work with a certain precision is formed. At the same time, you can control its status according to different objects [15-16]. Therefore, the system designed based on AI algorithm can meet various work requirements (such as environmental parameters), and because of its powerful function, simplicity and practicality, it is widely used in the field of detection, which makes intelligent products more humanized, highly automated and

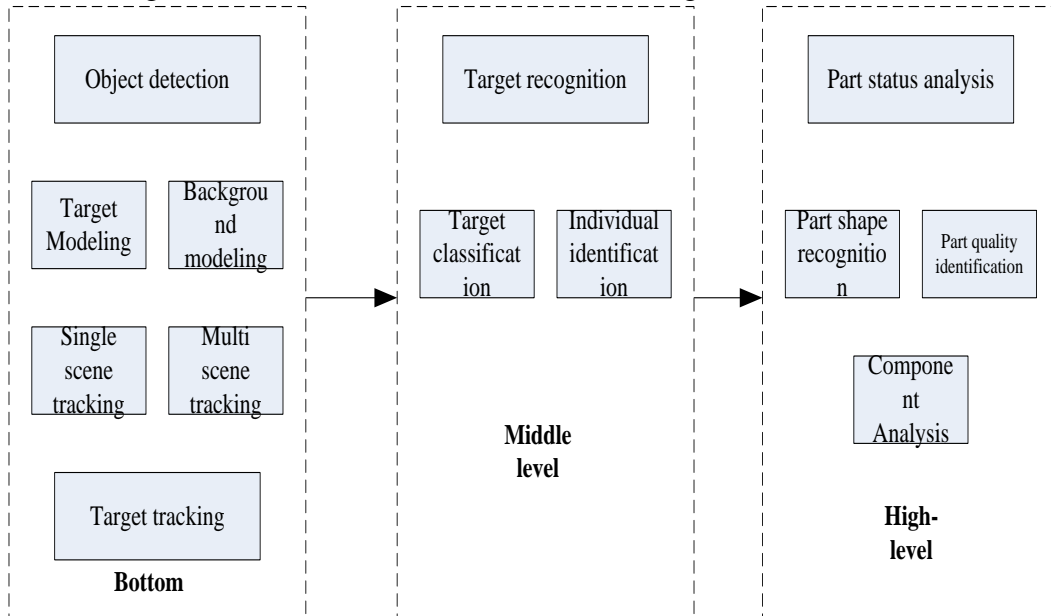accurate [17-18]. Figure 2 is the detection framework of AI algorithm.

Figure 2. Intelligent detection momoxi

3. Experimental Process of Engineering Machinery Parts Inspection System Based on AI Intelligent Inspection Technology

3.1. Construction Machinery Parts Detection System Based on AI Intelligent Detection Technology
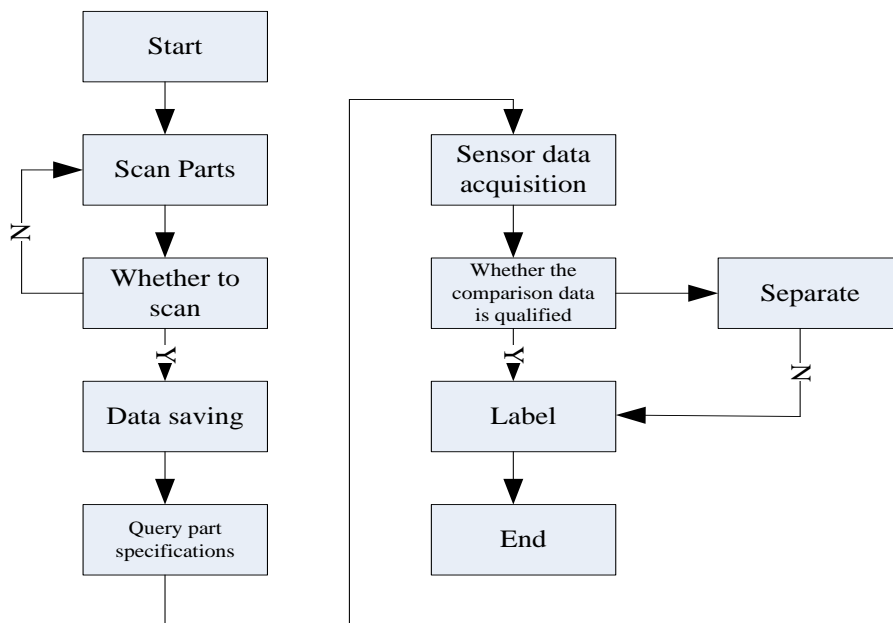

Figure 3. System detection process

The functions of the intelligent detection system (as shown in Figure 3) mainly include obtaining

target information, selecting test parameters, executing control commands, etc. The working principle of the detection system for construction machinery parts is that after receiving the information sent by the sensor, the parts to be inspected need to conduct data processing first, and then transmit the collected signal to the microcontroller, calculate the corresponding parameter values and get the final results after setting. Then, the preliminary identification and positioning of the obtained target parts shall be carried out according to the procedure. In this paper, an integrated detection algorithm library system is designed based on the modular structure to realize this function. The sensor receives instructions and executes relevant commands to process information.

3.2. Performance Inspection of Construction Machinery Parts Detection System Based on AI Intelligent Detection Technology

The performance test of the system is mainly to analyze the template, including size and location. Firstly, the required parameters of the target image to be measured need to be obtained through feature extraction technology. Then calculate the corresponding eigenvalue according to the preprocessing data, and finally use the AI algorithm to obtain the attribute information of the object to be tested and the corresponding instruction sequence to determine whether it is a qualified or unqualified product, and finally realize the real-time automatic control function and status display function of the system in the entire intelligent detection process, as well as the performance indicators of the relevant interface circuit such as the output and storage of the detection results, and then complete the analysis of the target template Judgment.

4. Experimental Analysis of Engineering Machinery Parts Inspection System Based on AI Intelligent Inspection Technology

4.1. Performance Inspection and Analysis of Construction Machinery Parts Detection System Based on AI Intelligent Detection Technology

Table 1 shows the performance test data of the inspection system for construction machinery parts.

Table 1. System performance detection data

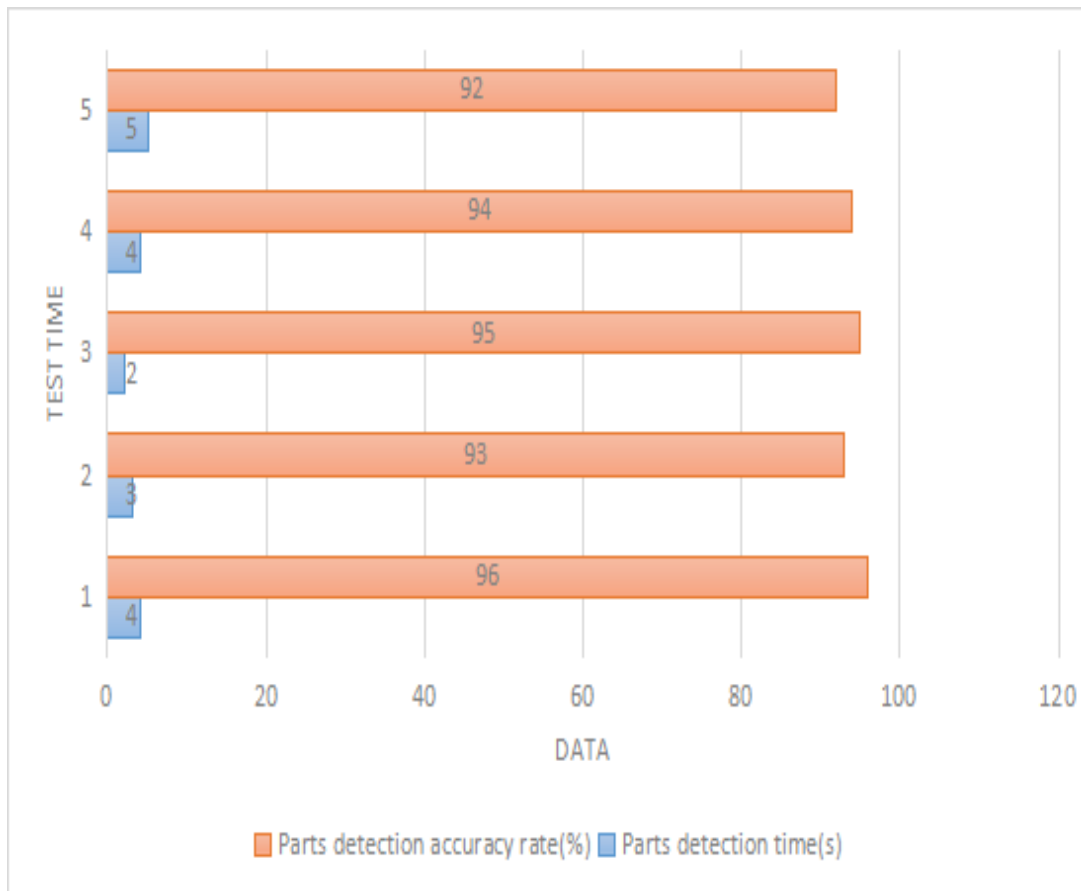| Test times	Parts detection time(s)	Parts detection accuracy rate(%)	Auto controls whether the unit is triggered
1	4	96	Yes
2	3	93	Yes
3	2	95	Yes
4	4	94	Yes
5	5	92	Yes

Figure 4. Detection of the system accuracy rate

The system adopts AI technology based on AI algorithm in the process of inspecting construction machinery parts. This method obtains the corresponding results by processing and analyzing the information collected by the sensor. Because the motion state data of the target object cannot be directly obtained under the traditional test environment, in order to obtain more accurate position parameter values and other relevant characteristic information, it is necessary to use robot technology to realize the automatic tracking and identification function. At the same time, combined with the principle of artificial intelligence, a closed-loop feedback control system is designed to replace all processes in the manual operation detection system (such as walking, moving, etc.), improve work efficiency and reduce cost investment. It can be seen from Figure 4 that the system can achieve 90% accuracy in detecting parts, and the detection time is fast, which can meet user requirements.

5. Conclusion

The application and development of AI technology in the detection field has brought great convenience to human life, but there are also many problems in its practical application. This paper will study the current intelligent robots and related products. First, the main work content and functional requirements are introduced, and then the overall design of the system, hardware modules and specific implementation methods of software are described. Finally, it summarizes and looks forward to the improvement measures that should be taken when new situations or similar

situations may occur in the future, so as to make a preliminary plan and assumption to deal with challenges and risks, with a view to providing reference for the subsequent application of AI detection technology in practice.

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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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