Development Direction of Automation Based on Machine Vision

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Abstract: With the further maturity and wide application of robot technology, multi-information fusion technology and industrial fieldbus technology, automated production lines are also developing towards high automation, high intelligence and high integration. Machine vision is highly valued by engineering circles because of its fast, real-time and non-contact characteristics. It is too difficult to manually monitor the object recognition in workplaces which are significantly affected by the environment, but it is very convenient to use machine vision technology to recognize the object, which can also make up for various defects of manual monitoring, effectively improve work efficiency, reduce labor intensity and save human resources. In order to avoid the potential loss and harm caused by faults, it is necessary to carefully and closely monitor the status of the automatic production line, and give fault diagnosis quickly and accurately when faults occur. In this paper, the principle of machine vision and its application in automatic production line are analyzed on the basis of summarizing the current methods of state detection and fault diagnosis in automatic production line. Finally, the development direction of machine vision is introduced.

1. Introduction

With the further maturity and wide application of robot technology, multi-information fusion technology and industrial fieldbus technology, automated production lines are also developing towards high automation, high intelligence and high integration [1]. In the industrial production line of mass and low-value products, the efficiency and stability of human eye inspection are low, which can not meet the requirements of real-time online inspection in modern production. Affected by related environment, it is difficult to monitor objects manually in the workplace, but it is more convenient to apply machine vision to identify objects. Machine vision is a new technology in recent years, which integrates photoelectric, computer, automatic control, pattern recognition and other technologies, simulates the behavior of human visual information acquisition and processing, and judges and recognizes target objects by machines instead of human eyes [2]. As the template of the identified object is stored in the memory of the machine vision system, it should have the same shape and a certain stable position, and try to avoid identifying the shaking workpiece suspended by hooks [3]. The maturity of science and technology day and night has effectively improved the level of machinery manufacturing, and the introduction of infrared imaging technology and video screen technology in this industry has formed a certain scale, which also laid the foundation for the birth and continuous development of machine vision technology [4]. The use of machine vision technology can eliminate the manual recognition of objects and improve the precision of measurement.

With the rapid development of science and technology in China, the degree of automation and intelligence of machinery manufacturing industry is also increasing. At the same time, however, the complexity of automatic production line also increases, and the possibility of failure of the whole system also greatly increases [5]. Faults on these production lines may bring economic losses such as product quality decline and system downtime, or serious accidents such as casualties. With the increasing degree of intelligence and automation in machinery manufacturing industry, the dependence on machine vision technology is closer. In order to avoid the potential loss and harm caused by faults, it is necessary to closely monitor the status of automatic production lines, and give fault diagnosis quickly and accurately when faults occur [6]. It is too difficult to realize manual monitoring of object recognition in workplaces that are significantly affected by the environment, and it is very convenient to use machine vision technology to recognize objects, which can also

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make up for various defects of manual monitoring, effectively improve work efficiency, reduce labor intensity and save human resources [7]. In this paper, the principle of machine vision and its application in automatic production line are analyzed on the basis of summarizing the current methods of state detection and fault diagnosis in automatic production line. Finally, the development direction of machine vision is introduced.

2. Workpiece Inspection

Through the application of machine vision, various defects on the surface of parts can be detected. Taking the standard workpiece as a reference object, the machine vision technology is used to detect it, and the detection data is used as the data standard of the machine vision system. The gray binary light source and width value are set, and then the workpiece to be detected is started. The working principle of the machine vision system is just like the workers on the production line inspecting products by visual inspection or using measuring tools [8]. Machine vision is equal to human eyes, computer is equal to human brain, and actuator is equal to human hands. In the process of mass production in the machinery industry, through the application of machine vision technology, the errors in detection can be effectively reduced, and the accuracy of detection results and the quality of products can be improved. Image processing unit is the core of vision system, which is used to process images with various algorithms and control system motion logic. The processing system needs to comprehensively analyze and calculate the image obtained by LED diffuse reflection and the electrical signal formed by the converted image, so as to make the measurement result more accurate.

3. Workpiece Measurement

The application of machine vision technology can make the results of parts inspection more precise. The monitoring system is mainly composed of computer processing system, CCD camera head and optical system. It mainly irradiates the surface of relevant parts to be measured through parallel beam, and takes the reflected light as the light source. Through the use of optical microscope, the outline of the parts is magnified. Then, the CCD camera is used to image its contour, and the relevant data of imaging are input into the computer. In the welding construction, there are many operations can not be completed by manual, in part of the environment can not be done by manual welding. For example, welding operation in the environment with nuclear radiation and underwater environment. In the direct measurement and control level, the advanced digital image processing technology is applied to analyze the status of the production line in real time to realize the alarm of abnormal conditions. In the process supervision level, the accident can be handled in time, and the video storage, retrieval, synthesis and playback of the accident process video can be completed through the application of video compression storage technology, so as to realize the off-line analysis of accident or abnormal causes.

The accuracy and real-time of information are very important, so the design of multi-agent positioning system is an important problem. A more realistic wireless network channel model is constructed, and the connection weight is represented by the receiving probability to indicate the influence of the distance between the proxy nodes on the connection weight. As shown in Fig. 1 is a machine vision tracking system applied to automatic production.

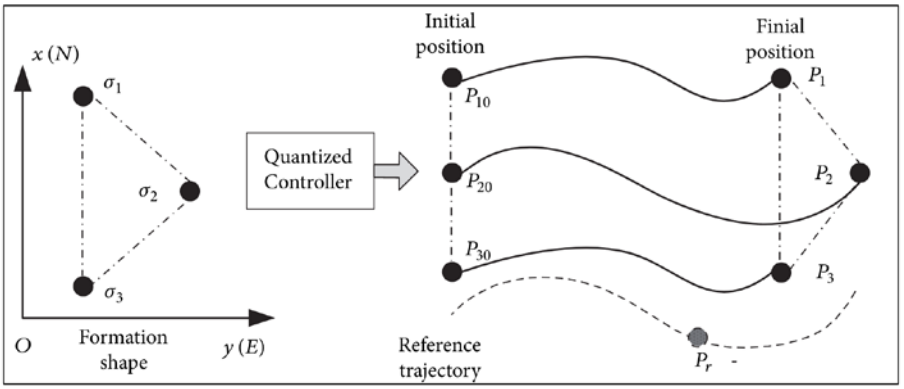

Fig.1 Machine Vision Tracking Applied to Automatic Production

When pre-adjustment of workpiece is measured, the workpiece can be measured by machine vision technology. When the workpiece was pre-measured, it was mainly located by optical projection, and the measurement data was obtained by raster display. Machine vision technology is used in welding field to avoid all kinds of problems in manual welding process, and the weld pool data is extracted and analyzed in real time to obtain weld image. The welding performance, structure and organization can be analyzed and processed in advance to ensure the welding quality. Through the application of machine vision technology, the actual wear degree of workpiece can be measured. When measuring its wear degree, it is often limited by many factors. Through the application of machine vision technology, the actual wear degree of the tool is measured, so the tool does not need to be disassembled, which makes the measuring process more convenient.

4. State Detection and Fault Diagnosis of Automatic Production Line

4.1 Diagnostic Method

Traditional state detection and fault diagnosis usually adopt artificial detection and diagnosis methods, and workers use eyes to see and ears to do it on the spot. China's machine vision market is gradually becoming an important target market for international machine vision manufacturers. The industries with early application of machine vision are semiconductor and electronic industries, which mainly focus on PCB printed circuit assembly, component manufacturing and testing, semiconductor and integrated circuit equipment, etc. In some automatic production lines with complex structure, the faults may be caused by the interaction of multiple links, so it is difficult to find and diagnose directly. In view of this situation, people have adopted fault diagnosis expert system. The inspection system based on CCD camera automatically detects the dimensions of forgings by using image processing technology. The industrial camera continuously collects images of crankshaft forgings. The image processing software obtains the characteristic information of all parts of crankshaft through image mosaic and boundary processing, and quickly and accurately calculates the geometric dimensions and geometric tolerances of all parts of crankshaft [9]. At present, the machine vision technology based on image processing is developing rapidly. Because the machine vision system can quickly acquire a large amount of information and automatically process data, it is easy to integrate with design information and machining control information. Therefore, in the process of modern automated production, machine vision system is widely used in the fields of working condition monitoring, finished product inspection and quality control, and has great application prospects.

4.2 Diagnosis Principle

Machine vision, also known as computer vision, is a technology that uses computers to simulate people or reproduce some intelligent behaviors related to human vision. Information is extracted from the images of objective things, processed and understood, and finally used for actual

monitoring, measurement and control. For the sake of the universality of the system, it is necessary to learn the workpiece state of the system by itself before entering the normal working state. This self-learning process includes learning the position of the workpiece, the order of placing the workpiece and the speed of placing the workpiece, and saving these state parameters for reference and comparison in the working process [10]. Compared with other methods, the biggest advantage of using machine vision technology for state detection and fault diagnosis is that a large amount of information can be obtained at one time through images. When designing a high-precision machine vision system, we should not only improve the resolution of the camera to improve the accuracy, but also ensure the luminous stability of the illumination source and try to eliminate the interference of ambient light. Machine vision inspection system can quickly display images, output data and issue instructions according to its inspection results, and the executive mechanism can cooperate with it to complete automatic processes such as position adjustment, good or bad screening and data statistics. After learning, you can enter the normal working state. The workpiece detection is similar to the learning process. After getting the position of the workpiece, compare it with the parameters obtained in the learning process and analyze the state.

5. Conclusion

With the continuous improvement of automation and intelligence in the machinery manufacturing industry, the related requirements of machine vision technology are also increasing, which needs to promote the rapid development of machine vision technology. In the process of modern automatic production, machine vision system is widely used in the fields of working condition monitoring, finished product inspection and quality control, and has great application prospects. Compared with other methods, the biggest advantage of using machine vision technology for state detection and fault diagnosis is that a large amount of information can be obtained at one time through images. The research and development of machine vision equipment needs comprehensive application of optical, mechanical, sensor, computer and communication, motion control, database and other technologies. To make the system work harmoniously and stably, many technical problems need to be overcome. When designing a high-precision machine vision system, we should not only improve the resolution of the camera to improve the accuracy, but also ensure the luminous stability of the illumination source and try to eliminate the interference of ambient light. With the development of artificial intelligence research such as computer science, fuzzy technology, neural network technology and expert system, machine vision will be widely used in manufacturing and other fields.

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