Research on Machine Vision Technology and its Application in Mechanical Manufacturing Automation

Ruishen Chen [a], Di Yang [b], Xianghui Zhan [c, *]

Mechanical Engineering College, Zhuhai College of Science and Technology, Zhuhai, Guangdong, 519040, China

[a] 942510677@qq.com, [b] 2093549099@qq.com, [c, *] zhanxianghui@zcst.edu.cn

* Corresponding author's Email: zhanxianghui@zcst.edu.cn

Abstract. Machine vision technology was also an important part in the modern intelligent technology, as its cooperation with mechanical engineering automation could achieve technical complementation, promote the effective completion of mechanical automation production goals, and bring significant positive effects. In this paper, the machine vision technology was introduced, and the specific applications of machine vision technology in measurement, mechanical positioning, welding robot as well as other aspects of the mechanical manufacturing automation were analyzed. Meanwhile, the applications of machine vision technology in optical projection technology and agricultural production were listed. All of these not only proved that machine vision technology was an important basis for the optimization and development of mechanical manufacturing technology; but also provided some references for the integrated application of machine vision technology in mechanical manufacturing automation.

Keywords: Machine Vision Technology; Mechanical Manufacturing Automation; Production; Technological Innovation.

1. Introduction

Different from traditional mechanical sensors, there were three kinds of sensing methods in the vision function of machine vision technology, namely, one-dimensional sensing, two-dimensional sensing and three-dimensional sensing, which were important breakthroughs for vision sensing technology. The application of machine vision technology in mechanical manufacturing automation was an important technological innovation and breakthrough in mechanical processing and an important opportunity for the development of mechanical processing industry. These changes were reflected in the machine vision technology and the detection of mechanical parts. With the continuous development and improvement of machine vision technology at this stage, its application in the automation of mechanical manufacturing were also involved in more fields, which were important for accelerating the development of automation and intelligence of mechanical manufacturing as well.

2. Overview of Machine Vision Technology

2.1 Machine Vision Technology

In fact, the related machines and machines were enabled to have the same functions as human eyes by machine vision technology, so as to collect, receive and process image information [1]. This vision technology was different from ordinary sensors. Instead of simply setting up a camera or other shooting machines, it converted the acquired picture information into image information, and then converted the image information into digital information. And machine vision technology also had other diversified capabilities, which could analyze image information, synthesize image information, make information judgments, and output processed image information. The machine vision technology took CCD camera as the main information collection and receiving channel. After internal simplification and digital conversion, the external image information was analyzed, so that the external image lines, colors and layout could be accurately analyzed. In the information analysis of

the end related images, the response time required by the machine vision component was very short, as the vision system needed to process a large number of simplified information, so the overall information processing efficiency was very high. In the process of mechanical production and manufacturing, the sensitivity of related elements was high and the overall working condition was relatively stable with the use of machine vision technology, which also had a broad application prospect in mechanical processing and manufacturing [2].

2.2 Technical Characteristics of Machine Vision

Machine vision technology was a technology, which was based on Internet technology, electronic technology, etc., and simulated human vision with the help of computer applications to obtain information data about related things. The effectiveness of related image recognition could be significantly improved with machine vision technology. Based on this, machine manufacturing, mechanical production, etc. could achieve the goal of intelligent monitoring, so that related scientific research might be more smooth [3]. With the application of machine vision technology, it was possible to formulate an effective detection scheme for enterprises, so as to obtain more accurate and comprehensive big data information. Rongguang developed perfect proofreading data information, so as to realize the practicability of machine vision technology. Users only needed to grasp the internal characteristics of remote production and processing workpieces, equipment, products, etc. at the computer terminal. After obtaining the inspection results, operators could provide effective basis for relevant inspection operations.

3. Specific Application of Machine Vision Technology in Mechanical Manufacturing Automation

3.1 Application of Machine Vision Technology in Measurement

With the help of machine vision technology to acquire, analyze and process information, machine vision technology could be applied to the appearance, shape and other detection of mechanical manufacturing products to determine whether there were problems in processing workpieces, products, etc. The principle of the application of machine vision technology in the detection was to compare the specifications, models and performance parameters of products as well as standard parts; design the product error in advance in the machine vision electronic system; and when the machine vision technology detected unqualified products, it could alarm and prompt the production personnel to pick out the unqualified products, so as to ensure that the quality of products entering the next link was all reliable.With the application of machine vision technology, it was possible to carry out the quality inspection of many large mechanical equipment parts. The application of relevant machine vision technology in detection was mainly to check and inspect the appearance and relevant parameters of the corresponding workpiece products with the help of measuring instruments, and build a three-dimensional coordinate model by combining the data information collected by measurement with the standard data information input. Then the image processing was carried out for the workpiece parameters through the CAD drawing tool, and the workpiece model processing was completed [4].

3.2 Application of Machine Vision Technology in Mechanical Positioning

Nowadays, the network was widely used in all walks of life, meanwhile related Internet technologies were also constantly developing and updating. Artificial intelligence technology had begun to penetrate into many areas of social production and life. As far as the development of machinery manufacturing was concerned, its automated and unmanned workshops were developing rapidly. Fully automatic and unmanned operation required intelligent processing equipment to ensure accurate positioning of relevant workpiece processing parts during processing, so it was necessary to do a good job of workpiece positioning, and ensure accurate mechanical positioning with the help of

machine vision technology. The positioning of machine vision technology was completed by the micro camera installed in the vision component [5].

At present, in the field of technology, the goal of developing multiple automatic machine tools with different models and functions as well as intelligent lathe processing equipment through the application of machine vision technology had been achieved. Relevant equipment could replace some manual operations in production and processing, such as mechanical loading and unloading, mechanical sorting and other operations, which could greatly liberate labor force and achieve automation in the production process. For example, in the current mechanical manufacturing process, some enterprises could use machine vision technology to accurately locate PCB boards in the cutting machine and automatically load and unload, greatly improving production efficiency. The key to the positioning ability of the visual component lay in the number of micro cameras and pixels installed on its upper end. Generally, 1 million pixel micro cameras could be used. The more cameras installed on this basis, the higher the positioning accuracy of the overall visual component to the workpiece [6].

3.3 Application of Machine Vision Technology in Welding Robot

Welding robots were used in many mechanical manufacturing production fields nowadays. The working environment was relatively bad because of the particularity of welding work. Therefore, on one hand, robot welding could avoid the related technicians from being in a bad working environment for a long time in manual welding; on the other hand, robot welding could achieve uninterrupted operation and high stability of welding quality. The application of machine vision technology in welding robots was an important guarantee to ensure the accuracy and efficiency of welding. With the help of X-ray flaw detector and CCD camera technology, the welding robot could have human visual function, which could improve the processing and production capacity of the welding robot as well as their welding technology level. The visual function included one-dimensional, two-dimensional and three-dimensional sensors. The inspection of one-dimensional sensor related components was one or more receiving photoelectric units, belonging to single photoelectric; two dimensional sensing was obtained by combining planar array imaging with electrical or scanning forms; three dimensional sensing was obtained by combining the above information and data processing. For the welding work had certain risks, some operations could not be realized manually, and there were the corresponding working environment limits, so it was impossible to ensure the level and efficiency of manual work [7]. The use of machine vision technology could effectively deal with relevant issues and achieve efficient data extraction. In the arc splattering welding environment, it was difficult to extract image information of the weld, which could be achieved with machine vision technology. It could also be used to grasp the welding performance and structure through the application of machine vision technology to ensure reliable welding quality.

At present, related technologies were widely used in the shape of weld pool and weld bead control, which played an important role in promoting the automation and intelligent development as well as optimization of welding robots. However, for the overall working process and specific operation of welding work are complicated and the cost was relatively high, the relevant technologies had not been effectively applied in welding robots at present. Therefore, it was necessary to actively carry out research to grasp the accuracy and reliability of the system [8]. The application of welding robot vision technology was constantly improving, making the relevant functions of the robot more and more powerful. Nowadays, in the automotive and aerospace fields, welding robots with machine vision technology were widely used, and the positive effect of practical application was also significant.

4. Effective Application of Machine Vision Technology in Mechanical Manufacturing Automation

4.1 Focus on Technology Optimization and Improvement, and Promote Continuous Improvement of Technology

Based on raster diffraction display technology, the combination of machine vision technology and optical projection technology could significantly improve the application accuracy of machine vision technology in product inspection [9]. In fact, the detection accuracy of machine vision components with optical projection technology could reach μ M level in specific technical applications, which was difficult to achieve by ordinary mechanical sensor detection and manual detection. In addition, X-ray technology, infrared technology and laser technology were also widely used in machine vision components[10]. The optimization of machine vision technology accuracy could optimize the relevant processing and measurement results, and realized the optimization of technology on production. For example, it was difficult to detect the bending degree of mechanical bearings, assess the wear degree of mechanical parts and detect the welding seam of robot only by relying on manual work and sensors, while the optimized high-precision micron machine vision technology could achieve this production and processing goal[11-12].

In addition, the current machine vision technology had also been applied to a certain extent in agricultural production, but there were also some problems in the application, which wee the main factors hindering the development and application of technology[13]. For example, machine vision technology was difficult to identify the difference changes of crops, and it was still in the static capture stage of crops[14]. In this regard, it was necessary to study the optimization strategy of automation and intelligent functions in the production of relevant agricultural machinery and equipment for the optimization of machine vision technology; promote the liberation of agricultural production labor; improve the data processing and analysis capabilities of machine vision technology in agricultural machinery and equipment, as well as the accuracy and efficiency of the application of vision technology in agricultural machinery and equipment; and use technology optimization to promote agricultural production optimization[15].

5. Conclusion

Through the analysis of the current application of machine vision technology in measurement, mechanical positioning and welding robots in this paper, it was known that machine vision technology had the advantages of high accuracy and efficiency, long operation time, etc. With the help of machine vision technology, the welding robots could even work in the environment that people could not tolerate. Meanwhile, welding robots with machine vision technology were widely used in the automotive and aerospace fields, and the positive effect of practical application was also significant. Besides that, the machine vision technology was applied well in optical projection technology and agricultural production. With the development of automation and intelligence of mechanical manufacturing, more attention might be paid to the continuous optimization and innovation of machine vision technology, so the achievements might be more and more significant in the future. In this regard, the training of professional and technical talents about machine vision technology was needed, and the level of talent training as well as industry connection might be improved.

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