Research on Machine Vision Technology of High Speed Robot Sorting System based on Deep Learning

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Abstract: Workpiece sorting is an important link in industrial production and transportation, which will directly affect the accuracy and speed of the workpiece. In the traditional manual sorting, we will be affected by the environment and subjective factors, which will cause visual fatigue error. With the rapid development of computer technology, the intelligence of robot is higher and higher, which has been applied to many fields. Robot sorting has many advantages, such as high speed, small inertia, high positioning accuracy, which has become an important part of industrial manufacturing and express transportation. For sorting system, we need to focus on machine vision technology and deep learning algorithm. Through image recognition and target tracking, we can provide accurate basic data. Through deep learning algorithm, we can intelligent sorting, which needs our in-depth study.

1. Introduction
Machine vision technology is a kind of technology that simulates the vision function of human eyes through camera. Through image acquisition, we can measure and judge objective things [1]. Machine vision technology has become an indispensable function of robot, which has been used to realize intelligent production and rapid transportation. Sorting robot is a kind of digital control equipment with wide application range and high technology added value [2]. With the increasing popularity of automatic production in the industrial field, robots are widely used in various industrial assembly lines to complete a variety of work. Robot sorting is an important part of industrial production, which has gradually replaced manual sorting. With the development of industry, the motion of robot will be more accurate, which will reduce the artificial error. The robot sorting system is realized by off-line programming, which requires all actions to be preset in advance [3]. For different parts, the high-speed robot will adopt different ways to adjust accordingly, which can complete intelligent sorting. Compared with traditional mechanical sorting, machine vision technology is applied to industrial sorting system, which can significantly increase the flexibility of the whole sorting system.

2. Machine vision technology of high speed robot sorting system

2.1. Concept of machine vision
Machine vision technology is a new subject involving computer science, computer image processing, machine learning, deep learning and many other fields, including computer, camera, lens, digital signal transmission line, etc. Cameras and lenses are used to simulate the human eye, which can be used to perceive the real world [4]. The computer is used to run image processing algorithm and feature extraction. Machine vision technology can be used in product quality inspection, size measurement, robot motion control, etc., which can reduce the human factors in the production process of enterprises. By ensuring
the stability of products, we can improve the production efficiency of enterprises. With the development of fieldbus technology, the application of machine vision technology is becoming more and more popular. Machine vision technology has been widely used in express transportation, retail, photogrammetry and remote sensing [5].

2.2. Composition of robot sorting system
The robot sorting system is composed of robot, vision module, pneumatic module and computer. The pneumatic module is composed of pneumatic sucker, air compressor, solenoid valve, control circuit and vacuum generator [6]. Through computer programming, we can combine these modules, which will form a robot sorting system based on vision. The robot sorting system based on vision is shown in Figure 1.

![Robot sorting system composition.](image1)

2.3. Construction of visual sorting system
The robot sorting system based on machine vision needs to focus on machine vision. The main components of machine vision system include sorting and grabbing subsystem and image acquisition and analysis subsystem. Among them, the camera and optical lens are the most important visual systems, as shown in Figure 2.

![Schematic diagram of visual sorting robot system.](image2)

3. Deep learning algorithm

3.1. Overview of deep learning
With the improvement of computing power, the number of hidden layers of artificial neural network is increasing, which will gradually strengthen the learning of complex problems. There are four types of
deep learning methods: supervised learning, semi supervised learning, unsupervised learning and reinforcement learning.

3.2. CNN principle
CNN is a data-driven model training, which is a multilayer neural network. CNN is composed of convolution, pool, full connection and recognition, as shown in Figure 3.

3.3. Basic model
The basic model of Alexnet is the most classic one. In this paper, the size of convolution kernel is $2 \times 2$ and the step size is 2. By inputting the original image, we can extract the features of the image, as shown in Figure 4.

3.4. Training process of the model
Training model is an important way of deep learning, which belongs to supervised learning. After determining the input, output and diagnosis rules of the model, we need to design a set of training methods for the model, as shown in Figure 5.

3.5. Workflow of robot sorting system based on deep learning
By comparing the vision system with the robot motion system, we can get the classification of the workpiece with different quality, which will determine the corresponding coordinate position of the vision system. By sending the workpiece information to the motion control system, we can guide the robot to grasp the workpiece in real time according to the motion controller information. The workflow of sorting system is shown in Figure 6.
4. Conclusion
Through the integration of machine vision technology and robot, we can build a robot sorting system based on machine vision, which is a fast hand eye calibration algorithm. Deep learning algorithm has the characteristics of fast computing speed. The whole system can sort the workpiece placed in any
position within the scope of camera vision, which will have high sorting stability and good sorting effect, which provides a practical scheme for automation.

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