Lesson 1 Robot Vision and Image Recognition

1. How do the robot "see" ?

Human can see this colorful world by eyes because there are three types of cells in vision cells that are sensitive to red, green and blue. The Light-sensitive pigments are decomposed in different proportions according to different lights so that we can recognize different colors.

For AI, learning to "see" is a greatly crucial step. So how do robot "see" this world?   This involves an important branch of intelligent artificial--Machine vision.

Machine vision is that the robot instead of human to do measurement and determination. Convert the captured target into image signal through machine vision products (i.e image capture devices, CMOS and CCD.), and transmit the signal to specialized image processing system. Then convert them into digitized signal based on information, such as pixel distribution, brightness and color.

Image system performs various operations on theses signals to extract the characteristic of the target , which controls device's actions according to the result.

2. Common Application

With the advanced of artificial intelligent and the arrival of 5G era, China is becoming one of the most active regions in the world for machine vision development. The application scope of machine vision technology covers industry, agriculture, military, medicine, aerospace, transportation,   scientific

research, security, etc.

Let's take a look at the common application areas of this technology:

◆ Intelligent transportation

With the increasing seriousness of urban traffic congestion, how to detect the congestion state quickly and effectively is of great significance to solve this problem. The application of machine vision in the field of transportation is becoming more and more common, and it also plays an increasingly important role.

For example, the "city brain" artificial intelligence system piloted in Xiaoshan, Hangzhou in 2016 is a typical application. Through self-management of massive data generated by surveillance cameras and traffic lights every day, and the overall adjustment, the average time of vehicles on elevated roads is shortened by 5 minutes, and the speed of vehicles on highway is increased by 15%-20%.

◆ Smart home

The application of machine vision in smart home is closely related to our lives, AI technology makes our home appliance more more and more "smart". The vision module is equivalent to the "eyes", which is the most important core components of the perception layer.

The application of machine vision in smart homes is closely related to our lives. The application of artificial intelligence technology makes our home appliances more and more "smart". The vision module is equivalent to the "eyes" of smart home appliances, and is one of the most important core components of the perception layer.

Most of home appliances are mainly controlled by remote control and APP.

With the addition of perception modules such as cameras, speech recognition, and speech synthesis, home appliances can "read", "understand", and "speak" to communicate with users and meet their needs.

For example, the face recognition access control system can be connected with indoor air conditioners, water heaters, electric and etc, which can realize the identification and distinction of homeowner and stranger so as to control the door and home appliances.

3.   Image Recognition Introduction

Image recognition technology, an important field of artificial intelligence, use computer to process and analyze images to identify targets and objects in various patterns

As eyes recognize images, it tends to start from the place where there is the greatest and sudden change, from one feature the next. The brain controls the eyes to capture the main features of the image. Exclude redundant and unnecessary information first, and then integrate the information of main features into a complete visual image.

The principle of computer image recognition is the same as that of human eye recognition of images, and the recognition process is similar and can be roughly divided into four steps:

1) Information acquisition: convert light signals, sound signals, etc. into electrical signals through sensors, which is to acquire basic information.

2) Image preprocessing: mainly refers to the use of smoothing, denoising and other means to process the image to highlight the main features of the image.

3) Feature extraction and selection: In pattern recognition, image features are

extracted and selected. This is one of the key steps in the image recognition process.

4) Image classification: According to the training results, the recognition rules are formulated, that is, the classifier is designed to obtain the main types of features, so as to continuously improve the recognition rate of image recognition.

4. Common Application of Image Recognition

Image recognition technology plays a greatly important role in AI field. With the continuous development of computer technology and information technology, the application scope of image recognition technology is expanding.

◆　　　Recognition of remote sensing image

Aerial remote sensing and satellite remote sensing images are usually processed by image recognition technology to extract useful information. This technology is mainly used for topographic and geological exploration, meteorological satellite cloud image processing, environmental pollution detection, etc.

◆　　　Machine vision field

As an important part of artificial intelligence, image processing ,a hit research topic, is widely used and closely related to our lives. For example, express unmanned vehicles, home service intelligent robots, sweeping robots, toy robots, etc.