Lesson 1 Computer Vision and OpenCV Introduction

1. How robots “see” the world

For artificial intelligence, the ability to see is essential. And how robots see the world involves machine vision, an important branch of artificial intelligence.

Machine vision is the idea that the robot takes human’s place to measure and make judgments. The captured target will be converted into image signal by image sensor, CMOS or CCD, and then the image signal will be transferred to the specialized image processing system which will convert the image signal into digitized signal according to the pixel distribution, brightness, color, etc.

Image system perform various operations on these signals to extract the features of the target, so as to control the device in the field based on the judgments.

Machine vision technology is commonly applied in intelligent transport system and intelligent housing system.

2. Image Recognition Introduction

Image recognition is a crucial technique that uses computer to process and analyze the image so as to recognize different targets.

Similar to human eyes, machine image recognition starts at the point where there is huge variance or sudden change, and the features will recognized one by one. Our brain controls our eyes to collect the major features of the image and filter the redundant information, and then integrate the major features into the complete visual image.

The process of computer image recognition is no different from that of human image recognition, which is divided into four steps.

1) Acquire information: the light signal, sound signal, etc., are converted

into electric signal by the sensors to acquire the information

2) Image preprocessing: perform smoothing, denoising, etc., on the image to highlight the major features of the image.

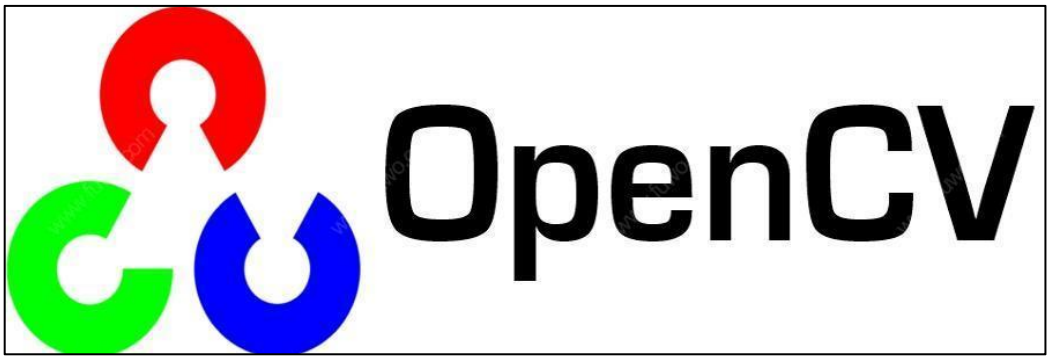
3) Feature extracting and selecting: extract and select the image features, which is the pivotal step.

4) Image classification: make the recognition rules that is design classifier based on the training result to get the main category of the features so as to improve the recognition accuracy.

Image recognition is mostly applied in remote sensing image recognition and robot vision.

3.OpenCV Introduction

OpenCV (Open Source Capture Vision) is a computer vision library for free handling various tasks about image and video, for example display the image collected by the camera and make the robot recognize the real object.



OpenCV is more eminent than PIL, the built-in image processing library in Python. OpenCV provides complete Python interfaces, and Python3.5 and opencv-python library file have been integrated in the provided image system.

4. How Images are Stored in Computer

How the images are stored in computer after they are recognized?

In general, a picture is composed of pixels and each pixel can be represented by R, G and B components within 0-255. OpenCV stores each pixel as a ternary array making it convenient to record all information of the image. In addition, OpenCV records the data of three color channels of RGB image in the order of BGR.

Besides, images of other standards (HSV) are stored as multivariate array. An OpenCV image is a two-dimensional or three-dimensional array. An 8-bit grayscale image (black-and-white images) is a two-dimensional array, and a 24-bit BGR image is a three-dimensional array.

For a BGR image, the first value of the element "**image[0,0,0]**" represents Y--axis coordinate or the row number(0 represents the top). The second value represents X-axis coordinate or column number (0 represents leftmost). And the third value represents the color channel.

Same as Python array, these array recording images can be accessed individually to obtain the data of some color channel or capture a region of the image.