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Research on Machine Vision Image Processing

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Abstract:

This paper studies the key technology of machine vision system image processing, and analyzes how to improve the accuracy of image recognition. Improving the recognition accuracy of the image, the image can be preprocessed, and extract the features of the image, then process the image marginalization algorithm that identifies accurately the appearance and contour of the image in order to improve the accuracy of the image recognition processing accurately.

Keywords — **machine vision; camera image; image preprocessing; marginalization processing.**

I. Introduction

The visual system emphasizes the accuracy and speed, so the image acquisition part is needed to provide a clear image in a timely and accurate manner. Only in this way can the image processing section produce the correct result in a relatively short period of time. It can be seen that the performance of the image acquisition part will directly affect the performance of the whole machine vision system. The image acquisition section is generally composed of a light source, a lens, a digital camera, an image acquisition card and a computer. The acquisition process can be described simply as the digital camera captures the target object and converts it into an image signal under the condition that the light source provides illumination, and finally transmits it to the image processing section through the image capture card.The acquired image is the color image, but the subsequent algorithms only need the gray image to be completed, so graying. The usual images are subject to various noise effects, so they also remove the noise, after the previous pre-processing getting better quality images. After the preprocessing is the edge detection of the workpiece image, and extract the edge features of the workpiece getting ready for the third chapter. Therefore, this chapter mainly studies the image acquisition, the graying of the image and the preprocessing of the image (including contrast enhancement, noise processing), and finally the edge feature of the preprocessed image.

II. Image acquisition

Image acquisition is the digital process of the image, that is, the process which the image acquisition is captured to the computer. Mainly related to the image and analog-digital converter (A / D Converter) technology. With the rapid development of computers and microelectronics, especially solid-state image devices (optocoupler devices, CCDs), the cost of image acquisition equipments have been significantly reduced.

In the natural form, the image cannot be directly analyzed by the computer. Because the computer can only handle numbers rather than pictures, an image must be converted to a digital form before being processed by the computer. The method of converting an image into a digital form is to divide the physical images into small areas called image pixels. The most common division scheme is the square sampling grid,

where the images are divided into a number of horizontal lines composed of adjacent pixels. The sampled images are not the digital images because the graying value on these pixels are still a continuous quantity and must be quantized. the so-called quantification is make each pixel's brightness level with an integer value manifest, that is, the gray scale of the pixel discretization. After the above transformation completing, the image is represented as an integer matrix. Each pixel has two attributes: position and grayscale, which are treated as objects of computer processing. After sampling and quantization, a digitized image can be generated.

III. Workpiece image preprocessing

In general, the images acquired by the visual system (ie, the original image) cannot directly used in the visual system due to various condition limits and random interferences which often containing a variety of noise and distortion. Therefore, we must take the image preprocessing such as grayscale correction and noise filtering before image analyzation and recognition, then remove the factors that deteriorate the image quality and enhance the image to make the image easier to view or make the useful information in the images easier to extract. For the machine vision system, all the image preprocessing methods do not consider factors of the image degradation, only the interested features in the images are selectively highlighted and the features that are not needed are attenuated. The image preprocessing methods mainly include contrast enhancement, smoothing and image enhancement (sharpening).

A. contrast enhancement

There is often a case where the contrast does not always match in the picture, which may be due to the dynamic range of the picture recording device, or may also be due to the lack of the original exposure during the shooting. Image enhancement refers to some features of the images, such as edges, contours, contrasts, etc. emphasizing or sharpening, in order to manifest, observe or further analyze and process. Contrast enhancement is a simpler but more importantly method of enhancing technology. This processing is only to modify point by point each pixel graying of the input image, the location of each pixel in the images does not change, which is an input and output pixels of the one-to-one operation. Contrast enhancement is also called a point operation, generally used to expand the graying range of the image.

B. image smoothing

As the images taken in this experiment are under the natural light, the images are subject to some interferences; at the same time, the images in the process of generating, transmitting or changing, often due to all kinds of noise caused by the optical system distortion, system noise, light changes and other factors, in this case, the image must be smoothly processed. The common noise in the images are salt-pepper noise, Gaussian noise and so on. The purpose of image smoothing is to eliminate or minimize the effect of noise and improve the image quality. Under the condition that the noise is distributed independently at random, using the average or weighted average of the neighborhood can effectively suppress the noise interference. Image smoothing is actually low-pass filtering, letting the low-frequency part of the signal through and blocking the high-frequency part of the noise signal. Obviously, since the edge information of the image also belongs to the high frequency information, the smoothing process will cause the edge to blur while reducing the random noise. Because the edge information of the image contains the most featured information of the measured objects, or in the next image processing,

the information need to be extracted.therefore, the purpose of the filtering process is to filter out the unwanted noise signals in the image but remaining the edge information in the image. So a good smoothing method should not only eliminate the noise in the image but also without blurring the edges and lines of the image, which is the main purpose of image smoothing. The main methods of image smoothing filter are spatial and frequency domain methods. Commonly used smoothing methods are low-pass filtering, neighborhood averaging, median filtering, etc. Using the linear smoothing filter to remove the Gaussian noise is very good, and in most cases, also have a good effect on other types of noise. The linear filtering uses pixel weighting in the continuous window functions to achieve filtering. The same mode of weight factor can be applied in each window, which means that the linear filtering is space unchanged, so you can use the convolution template to achieve filtering. If different parts of the image use different filtering weighting factors, and still can use the filter to complete the weighted operation, then the linear filtering is space variable.

IV. Edge feature extraction

Edge detection is a very important basis for image analysis, such as image segmentation, target region segmentation and region shape extraction, also an important attribute of image feature extraction in image recognition. In the understanding and analysis of the image, edge detection is often a very important step. It has become one of the most active topics in the field of the machine vision research and has a very important position in engineering applications. The edge appears the local feature of the image in a discontinuous form that is, the most significant part of the local brightness changes in the images. It mainly exists between the target and the target, the goal and the background, the region and the area, is the important foundation of the image segmentation, the texture feature extraction and the shape characteristic extraction, etc. in the image analysis. In the one-dimensional case, the step edge is related to the first derivative of the image, and the gradient is a measure of the function change, and an image can be regarded as an array of sampling points for intensity continuous functions in the images. Thus, similar to the same dimension, a significant change in the graying value of the image can be detected by using a gradient discrete approximation function. Edge detection algorithms generally have four steps:

1) filtering: Edge detection algorithm is mainly based on the first and second derivative of the image intensity, but the calculation of the derivative is very sensitive to the noise, therefore, we must use filters to improve the performance of noise-related edge detectors;

2) Enhancement: The basis of the enhancement edge is to determine the change in the intensity of the neighborhood of the image points;

3) Detection: There are many points of the gradient amplitude in the image are relatively large, but these points in the specific application areas are not all edges, so some methods should be used to determine which points are edge points, and the simplest and effective edge detection criteria are gradient magnitude threshold decision;

4) Positioning: If an application requires to be determined the edge position, the position of the edge can be determined at sub-pixel resolution, the orientation of the edge also can be estimated.

There are many methods of edge detection at home and abroad, so are all kinds of mature algorithms, such as Sobel operator Prewitt

operator, Canny operator, etc., these operators have their own advantages and disadvantages.

V. Summary of this chapter

This chapter mainly describes the image preprocessing and edge feature extraction. The principle of average filtering and median filtering are analyzed, and their advantages and disadvantages are compared. The median filtering is better to keep the edge of the image while suppressing random noise, so taking it to remove noise,then using the Canny operator to extract the edge feature of the workpiece. Firstly, the mechanism of the edge feature is summarized. Then, the classical image edge detection operator is introduced. Finally, the workpiece image is detected, the effect of detecting the workpiece is analyzed, and finally the edge feature extraction operator of this paper is determined. The experiments show that the Canny operator can achieve good results.

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