Image Edge Detection Based On Opencv

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***Abstract*—Image processing is one of most growing research area these days and now it is very much integrated with the industrial production. Generally speaking, It is very difficult for us to distinguish the exact number of the copper core in the tiny wire, However, in order to ensure that the wire meets the requirements of production, we have to know the accurate number of copper core in the wire. Here the paper will introduce a method of image edge detection to determine the exact number of the copper core in the tiny wire based on OpenCV with rich computer vision and image processing algorithms and functions. Firstly, we use high-resolution camera to take picture of the internal structure of the wire. Secondly, we use OpenCV image processing functions to implement image preprocessing. Thirdly we use morphological opening and closing operations to segment image because of their blur image edges. Finally the exact number of copper core can be clearly distinguished through contour tracking. By using of Borland C++ Builder 6.0, experimental results show that OpenCV based image edge detection methods are simple, high code integration, and high image edge positioning accuracy.**

***Index Terms*—OpenCV, image edge detection, morphology, contour tracking.**

I. Introduction

The rapid development of computer industry production and computer intelligence, as well as the corresponding developments in computer-aided image analysis, has made industrial image processing to be a very important branch of scientific image processing. Image processing plays a very important role in industrial production, which can visualize the anatomical structure of the product, therefore, we can check and judge the merits of the product in time and to some extent reduce the unnecessary losses, so it is necessary for us to avoid the traditional off-line manual detection methods which may easily result in error detection.

OpenCV is one of the most extended software libraries used in computer vision applications. OpenCV as an open source library [1].constituted by a series of C / C ++ functions and classes, offers many common algorithms to realize image processing and computer vision computing, which can be used to achieve powerful image processing, and to develop real-time applications system. [2]

In the tiny wire industrial production process, it is very necessary for us to determine whether the wire meets specific quantity of copper. However due to the small size of the copper core and the defects, which to some extent increases the difficulty to distinguish. So we use the digital image processing to determine the exact quantity of the copper core. This paper describes how efficiently image processing applications can be used to check and judge the merits of the industrial product. In section 2 it describes previous work on the image before processing. In section 3 it states Morphological image processing. In section 4 it introduces the effect of the contour tracking theory. Section 5 consists of the conclusion.

II. Previous Works on Image

A. Capture Image

In OpenCV, the data type of image is usual IplImage. IplImage comes from Intel Image Processing Library. Image Processing Library is inheritance from the actual OpenCV versions which may require IplImage data type is defined in CXCORE [3]. IplImage is the main image structure used in OpenCV. IplImage has been in OpenCV since the very beginning. It is a part of the C interface for OpenCV. You need to allocate and deallocate memory for Iplmage structures yourself. OpenCV has many powerful image processing functions. In order to capture and show an image we should use cvLoadImage cvNamedWindow, and cvShowImage functions. The function cvLoadImage loads the specified image file and return IplImage pointer to the file. CvNameWindown defines a window for displaying. The function cvShowImage display the image in the specified window. By using the above three functions, we can successfully display the image that we will deal with. The source image is as Fig. 1 which edge is not clear.

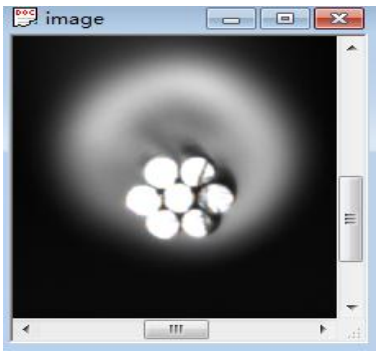

Figure 1. Source image edge is not clear

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B. Color_to_Gray

Source images obtained are generally color but as we know grayscale images are very common and entirely sufficient for the task discussed in the paper. So there is no need to use more complicated and harder-to-process color images. For facilitating processing, color image will be usually converted to grayscale [4]. A grayscale digital image is a single sample, that is, it carries only intensity information. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest. Often, the gray scale intensity is stored as an 8-bit integer giving 256 possible different shades of gray from black to white. If the levels are evenly spaced then the difference between successive graylevels is significantly better than the graylevel resolving power of the human eye. Opencv offers us cvCvtColor function to convert the color image to grayscale image. The effect of RGB to GrayScale image is well demonstrated in the Fig. 2.

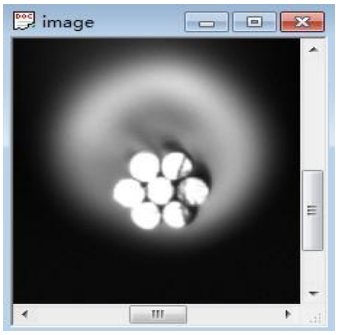

Figure 2. RGB to GrayScale image

C. Median Filter

At the same time, because of the noise interfering to the detection accuracy, it is necessary for us to do denoising for the captured images. Blurring image is the modest process in image processing [5]. Blur, is a process done to reduce noise. As this can be achieved in different ways, this paper demonstrates a basic filter method-median filter. Median filtering method is a kind of nonlinear smoothing technique, and the gray value of its every pixel is set to a middle value of all the gray value of the pixel in a neighboring window. Median filtering is very effective to remove salt and pepper noise. OpenCV includes a Median filter that can be applied to an image by calling the cvSmooth function. The image after smooth processing is as Fig. 3.

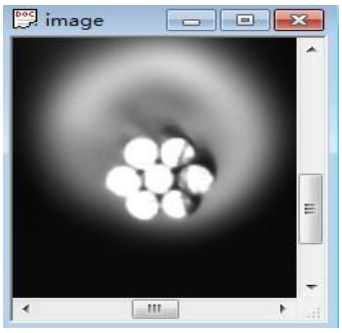

Figure 3. Image after smooth processing

D. Thresholding

Thresholding or binarization is a conversion from a color image to a bi-level one. This is the first step in several image processing applications. This process can be understood as a classification between objects and background in an image. It does not identify objects; just separate them from the background [6]. In order to obtain the information that we have to deal as much as possible, we use the image binarization processing [7]. In the process of thresholding, it is very important for us to set the correct threshold value which will determine a pixel as object or background, that is to say the binarization image presents pixels whose gray level of 0 indicates the value of the pixels is less than the set threshold value and a gray level of 1 denotes the value of the pixels is more than the predefined threshold value. In the paper, for a micro wire picture, the object can be seen as the copper core, and the other is the background. The results of thresholding can retain structural characteristics of copper core information. For the target of separating copper core from background as much as possible, we use Opencv's cvThreshold function to segment copper core. We can see the result of image after thresholding in Fig. 4.

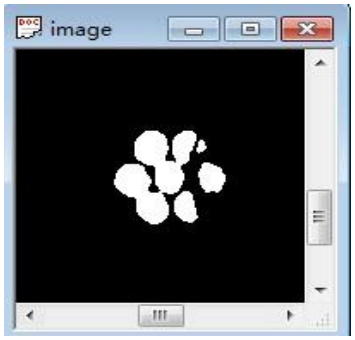

Figure 4. The image after thresholding

III. MORPHOLOGICAL PROCESSING

Mathematical morphology examines the geometrical structure of an image by probing it with small patters, called ‘structuring elements’ of varying size and shape. This procedure results in nonlinear image operators which are well-suited to exploring geometrical and topological structures. A succession of such operators is applied to an image in order to make certain features apparent, and distinguish meaningful information from irrelevant distortions, by reducing it to a sort of caricature (skeletonization). Mathematical morphology [8] has four kinds of basic operations: expansion, corrosion, opening and closing operation. Expansion causes the goal pixels to increase, but, corrosion can reduce the target pixels. Corrosion has the specific role to eliminate boundary pixels in goal field, which causes image border to shrink into internal field. Opening can achieve corrode firstly, then expand. On the contrary, the first expansion, then, corrosion, will realize closing. According to the characteristics of image, firstly, we use corrosions to eliminate the boundary and separate the copper core clearly. Secondly, using expansion to expand, then target

information can be restored. Finally we use opening to smooth the target image contour and to sharper image border. Fig. 5 shows the effect of the image after morphological processing.

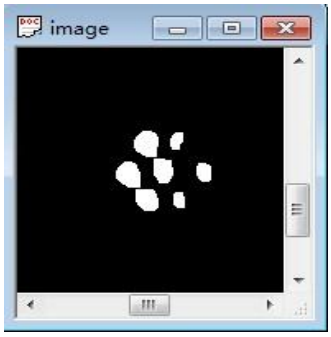

Figure 5. Morphological processing image

IV. Contour Tracking

The idea of contour tracking, also known as boundary following or edge tracking, is to traverse the border of a region completely and without repetition.The result of the contour tracking is to obtain a boundary points sequence [9]. Just as its name implies, contour tracking is through the order to find out the boundary of the edge points to track. The key of the contour tracking is to judge the next boundary point according to the adjacent points in binary image [10]. Contour tracking is widely used in the fields of image processing, image restoration and image recognition. In the image processing, there are a lot of contour tracking algorithms, some of them have high accuracy and efficiency. Opencv offers cvFindContours function to realize contour tracking, which retrives contour from the binary image, and return the number of the detected contour. By using this method, we can clearly distinguish the boundary of the copper core, so we can accurately determine the exact number of copper core. The effect of contour tracking is as Fig. 6 from which we can clearly distinguish the exact number of the copper core in the wire.

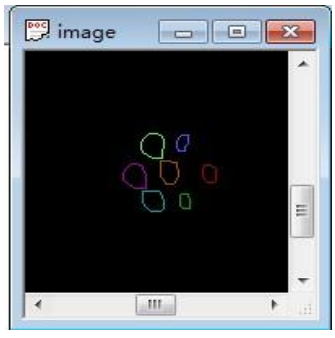

Figure 6. The effect of contour tracking

V. Conclusion

Computer vision technology has gradually been applied to the detection of industrial product specifications, which greatly improve the test efficiency of industry production. Opencv offers many image processing functions, which to some extent reduces the difficulty of detection and the programming code. With the help of Opencv, C++ Builder 6.0 and using image processing theory, firstly we use cvCvtColor, cvSmooth, and cvThreshold to preprocess the target image, secondly we use morphological method to process it to make the boundary of the copper core segment and clearly, finally by using of contour tracking we can clearly distinguish the exact number of the copper core, so we realize our goal. Through the practice test, we found that the method introduced in the paper has greately improved the accuracy of the product test and the work efficiency.

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