

## Design of a Character Recognition System Based on LabVIEW

Tao Zhang<sup>1, a</sup>, Yanqiu Cui<sup>2, b\*</sup> and Yaning Yang<sup>2, c</sup>

<sup>1</sup>College of Mechanical and Electronic Engineering, Dalian Nationalities University, Dalian, China

<sup>2</sup> College of Information and Communication Engineering, Dalian Nationalities University, Dalian, China

<sup>a</sup>zhangtao@dlnu.edu.cn, <sup>b</sup>cyq@dlnu.edu.cn, <sup>c</sup>yyn@dlnu.edu.cn, \*Corresponding author

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**Abstract.** In this paper, a character recognition system is designed by using and the machine vision function of IMAQ Vision module in LabVIEW. The whole system includes four parts: image acquisition, image preprocessing, image segmentation and character recognition. Image preprocessing includes image gray and low-pass filter processing, Image segmentation is obtained by threshold segmentation and morphological processing. Finally, characters were recognized by compared with the training sample sets. The system can accurately realize the recognition of characters on the RMB.

### Introduction

Image is the main information for human to access and exchange. Therefore, image processing is involved with all aspects of human life and work. Optical character recognition technology (referred to as OCR), that is, to convert the scanned print or handwritten documents into images, and then recognized as computer characters [1.2]. Image processing based on LabVIEW development can meet the actual production needs of industrial visual inspection system and replace the human eye to do measurement and judgment [3.4]. Compared with the manual method, this can reduce the huge labor costs and management costs, and the detection speed can meet the large-scale production [5]. In this paper a character recognition system based on LabVIEW is designed.

### Implementation of the System

The system chart of OCR processing was shown in figure 1. The structure of the system can be summarized as four parts: image acquisition for recognition, pre-processing by using image grayscale and low pass filtering, image segmentation through the local threshold and morphology processing, character recognition with the training character sets. Next, we introduced the each part and its implementation in LabVIEW.

**Image Acquisition Module.** It is the key to obtain the appropriate image character information for character recognition. In the software package of the IMAQ Vision module in LabVIEW, more than 400 functions are integrated. First we called the image display in the front panel of the IMAQ module as the original image of the display page, as shown in figure 3.2. Then we called IMAQ Create functions from the NI Measurements Vision Utilities Image Management template and put it on the left side of the IMAQ ReadFile function. Then we clicked the right mouse button on the Image Tape interface at the bottom of the IMAQ Create function and chose create and clicked constant. So we can decide which type of the image to converse. This module was shown in figure 2.

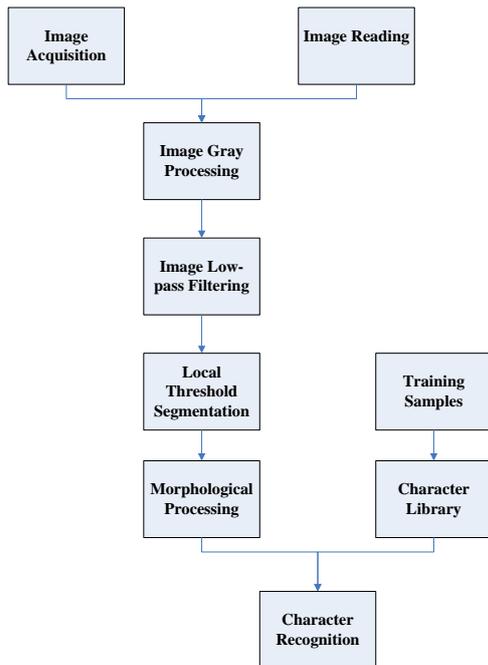


Figure 1 System Chart

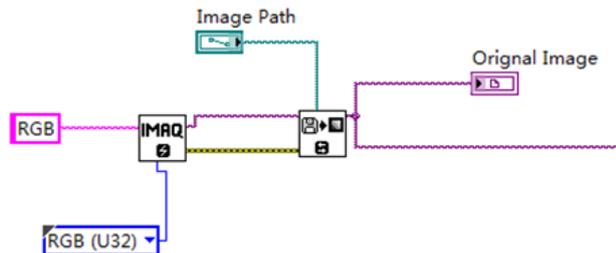


Figure 2 Image Acquisition Module

**Image pre-processing Module.** Image preprocessing mainly includes image format conversion, binarization, feature location, character segmentation, etc.. Image binarization is the process to change the gray image into the image including only black and white two colors. The two value image has the advantages of small storage space, easy data compression, prominent feature, and simple processing. The simplest method of gray scale is to change the value of the image into its gray value(usually 8, from 0 to 255). In this paper we used the G channel component to change the RGB image into grayscale image. It can be realized by using the IMAQ ExtractSingleColorPlane function. The program was shown in figure 3. By the low pass filter, we filtered out the high frequency noise of the image, blurred the character edge and bridged the lack of resolution hard character. The program was shown in figure 4.

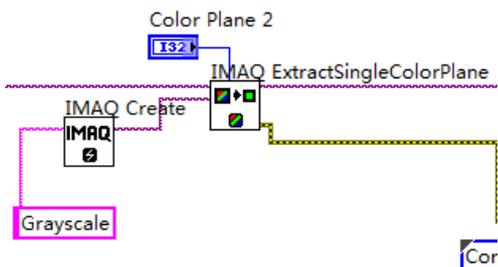


Figure 3 Image Gray Processing

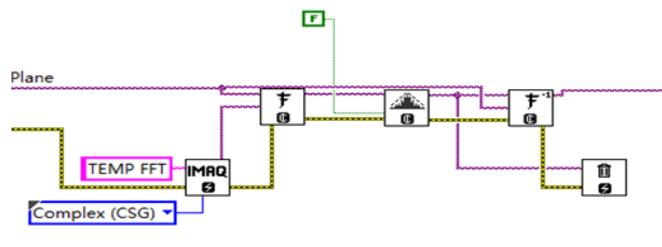


Figure 4 Image Low-pass Filtering

**Image Segmentation Module.** Image segmentation mainly consists of three methods: threshold, edge detection, and region growing. The threshold method is the most basic and widely used binarization technology because of its simple realization, small calculation and stable performance. In this paper we chose the threshold segmentation method. We combined IMAQ AutoBThreshold function with IMAQ UserLookup function of NI Measurements Vision Image Processing template to optimize the threshold operation. It was shown in figure 5.

In order to obtain the better effect of the character recognition, we have to carry out the morphological processing of the character to make the character contour smooth, cut off the narrow gap and eliminate fine highlights. It can be realized by calling IMAQ Gray Morphology function in LabVIEW, which is shown in figure 6.

**Character Recognition Module.** In LabVIEW there are four functions to be used in the Character Recognition Module. The four parts consists of reading the digital image, opening the character template address, character recognition and the release of memory.

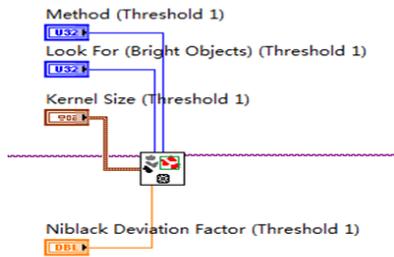


Figure 5 Image Segmentation

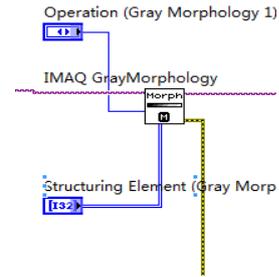


Figure 6 Morphological Processing

In the first function IMAQ OCR Create Session we connected the "Error in" of it with the "Error Out" of IMAQ Win Draw to import the image and transfer to the IMAQ OCR Session of IMAQ OCR Read Character Set File. In the second function IMAQ OCR Read Character Set File, the Read Options was set up with Read All. Its role is to open the address of the character template and transfer to the third function IMAQ OCR Read Text. The Third function IMAQ OCR Read Text is the most important function. It is to match the image and identify the character from the image passed by the IMAQ OCR Create Session and the images from IMAQ IMAQ OCR Read Character Set File. Its two parameters ROI Descriptor and Character Reports were displayed on the front panel. String is to full display the recognized characters in the front panel. The fourth function is to remove the current digital image and release the memory. The "Error in" and "Error Out" of the four functions were laid end to end. It was shown in figure 7.

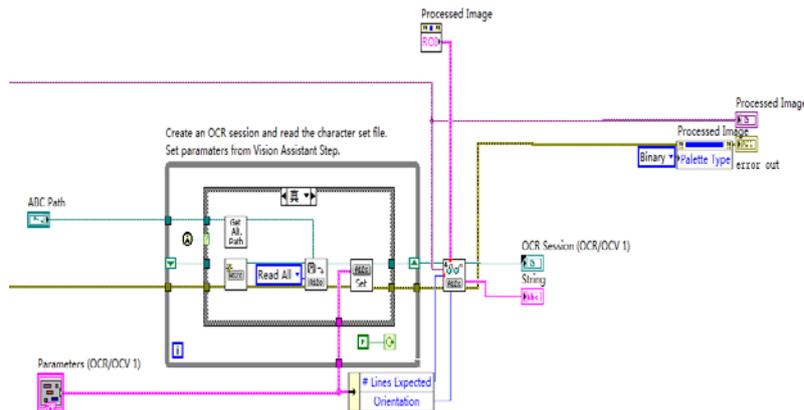


Figure 7 Character Recognition Module

## Experimental Results and Analysis

**Character Training.** We used NI Vision Assistant to train character sample sets by extracting features of all the letters and numbers. The training results was shown in figure 8. We chose the similar characters on RMB to form a picture, and then trained it by using the assistant software.

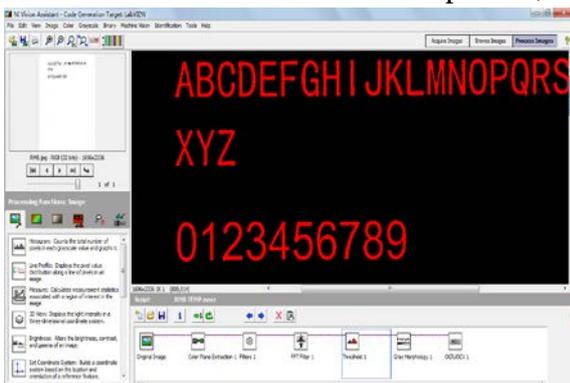


Figure 8 Character Sample

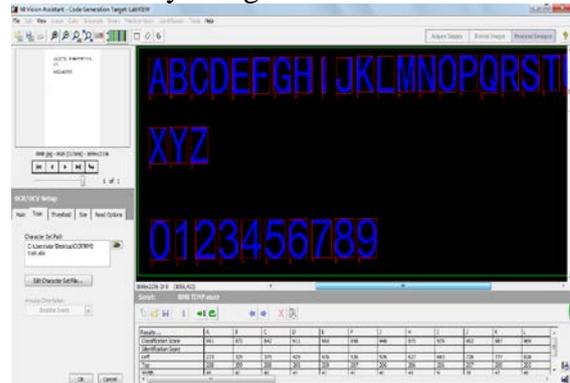


Figure 9 Character Training

**Experimental Results.** Here we directly used the photograph of the RMB, added the training file and then selected the recognized area to read the characters. The experimental results were shown in Figure 10.

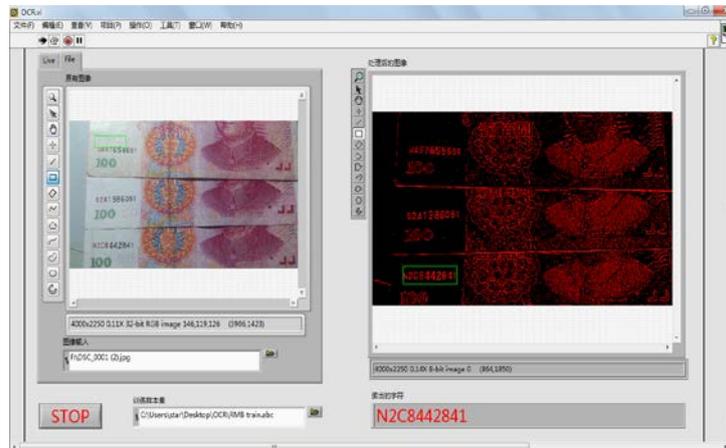


Figure 10 Character Recognition Results

**Experimental Results Analysis.** The system can directly identify and display the characters on the RMB. The statistical results of the recognition show the recognition rate is more than 80%, which indicates that the performance of the system is reliable.

## Conclusion

In this paper a character recognition system is developed by using LabVIEW software and its IMAQ VISION module. The system can recognize the characters on RMB. In this paper, a reasonable image preprocessing algorithm is designed based on the characteristics of characters on RMB. The gray processing, low pass filtering, morphological processing, image and character segmentation algorithms were studied. In this paper, the virtual instrument technology is applied in the field of image processing, which has the advantages of short development cycle, simple programming, saving the system cost and improving the efficiency.

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