Application of dual threshold image processing technology in the android Chinese font recognition system

Ming Xu1,a, Caikou Chen2,b, Chensheng Ji3,c

1,2,3College of Information Engineering Yangzhou University, 22527, China

aemail: xuming@yzu.edu.cn, bemail:yzcck@126.com, cemail: 530049276@qq.com

Abstract

This paper analyzes the design solutions and realization process of mobile phone font recognition software based on Android platform. The article mainly describes the key technology of font recognition, image processing technology, and how to use dual threshold technology automatic searches for the suitable threshold algorithm ideas, and the final code realization process. In addition, this paper also introduces the technology of noise reduction and image matching technology applying to the font recognition system.

Keywords: Font recognition; Image processing technology; Dual threshold image segmentation

Introduction

In this information age, characters have become the important carrier of transmitting messages. Beautiful fonts, make the surface of writing language more appreciated effect at the same time, more people concern about the contents of text. According to incomplete statistics, there are about 15000 kinds of Chinese fonts can be downloaded from web at present. For the font lovers and graphic designers, when they appreciate a font, how to identify the font category quickly from the numerous types of fonts, and then identify the font from the font library accurately, which is the goal for them to explore continuously. This is also the purpose for us to develop the font recognition applications.

The Android application development ideas

In today's internet era, smart phone has replaced computer become close-fitting assistant for people's living and work. All round the world for Android and iOS smart phone market, which Android has occupied 84.6% of the global market and rank first. Review Chinese font recognition field, although there have been many web sites provide font preview and download function for font recognition, but

poor flexibility and practicality[1][2]. Due to the popularity of smart phones, when people see a font, the first thought is whether the specific function can be used by the carrying phone, such as take the font, edit the font picture in the mobile phone, and then submit it to the web server system, the system can recognize the font accurately at last. So mobile phone font recognition software has a huge market demand. To develop this product based on the Android platform has become our preferred solution.

The realization of font grasping function

When a font presents in front of us, usually it shows in the form of picture. Or, we can use the camera function to capture required font. Therefore, we can realize it through the Android camera function. Developing the application to realize the function, at first, we need to define a "camera" button. Then, in the *layout* interface design, for the "camera" button to add the trigger event *camera*. When a user clicks the *camera* button, the phone calls this event automatically, opens the built-in camera function to take pictures[3]. For the user to open the local library and choose font pictures to identify conveniently need, we also should design the function of photo albums.

Image processing technology

Image binarization. Using mobile phone to capture a character with picture, which is usually accompany with colorful background. The first step in picture processing, the picture should be processed to monochrome image of white background and black character. Then, the font of all background colors should be taken out to grey value of 0 and 255 binary image, we call this the binarization processing of images. This makes the character more clearly, also image compression is higher, and the late font processing more simply.

Image segmentation. After the image has been processed, we need further intercept the character from image, which is image segmentation. Image segmentation is dividing the image into some different characteristics and having meaningful regions, in order to further analysis the image and understand it. Therefore, image segmentation is the foundation of image understanding. Commonly used image segmentation techniques are as follows: based on threshold segmentation technology, based on region segmentation technology, based on the edge of the segmentation technology and based on the theory of the specific technology, etc. Here we use the threshold segmentation. Through the threshold technology for image binarization will greatly reduce the amount of data processed by the computer.

Dual threshold image segmentation method. This system is developed based on the Android mobile phone platform. Due to its own memory capacity constraints, mobile phone can not meet the user drag the control to real time change of the threshold function. So it is necessary to find a suitable threshold segmentation algorithm for image processing. If using a single threshold

algorithm, which is suitable for the ideal image more of a balance. But for gray average value is too small or too large, single threshold algorithm will be very difficult to get the right results. So we use dual threshold calculation methods, namely: the optimal threshold method and the Otsu method combined to find a suitable threshold automatically[4][5]. The specific calculation formula is as follows:

Setting: the calculation of the optimal threshold method of threshold is N, Otsu method to calculate the threshold is M, the average gray value is aver, the double threshold calculation formula:

(1)
$$\text{Threshold} = \begin{cases} M+3 & （1.8N < aver）\text{ and }（M+3）<255 \\ N \end{cases}$$

(a)Grasping initial character image by phone
(b)After processed the character
Fig.1.The effect contrast before and after using dual threshold
processing technology

Image denoising algorithm. Due to the different models of mobile phone camera, the performance is different, and the shots are different also. The procedures to obtain the picture source quality is not high. When the image segmented by dual threshold, mainly existing salt noise and burr noise etc. Therefore the noise should be eliminated. Denoising algorithms commonly are: median filter, mean filter, symmetry neighbor mean filter, etc. Denoise methods should be not only can eliminate noise for image effects, but also not to make the image details blurred. In dealing with small noise algorithm k-means algorithm has higher efficiency but easy to reduce the image sharpness and detail. From the effects of view, selecting the median filtering method is more suitable[6].

Let f (x, y) for the original image, the G (x, y) for the image after median filtering treatment, W for 2D template, the two-dimensional median filtering algorithm is:

$$G(x,y) = med\{f(x-k,y-l),(k,l \in W)\} \qquad (2)$$

Image matching technology

When the font picture processed through the dual threshold binarization processing technology and the median filtering method for noise reduction, but also should contrast matching font uploaded to the background database, and then ultimately the backstage database accurately, finally identify the font and return. Therefore, an important step in image matching technology is the ultimate realization of the system font recognition. Image matching can be divided into: based on the gray correlation matching, based on the characteristics of the correlation matching, based on advanced features matching, etc.[7] Commonly used methods are: based on the structural matching method, based on neural network matching method, based on gray matching methods, based on the sub pixel matching method, based on feature matching method, etc.

This system uses the feature based Hu algorithm of moment invariant[8]. Due to limited space, here is not describe in detail.

The realization of mobile phone Chinese font recognition system for Android

The Chinese font recognition system includes: the foreground image acquisition and processing and the background font image recognition. The foreground image acquisition and processing part includes:(1)grasping font picture, (2)font picture clipping and editing, (3)image binarization, (4)determine the font four boundary, (5)clipping the image form the final upload font image and other functions. The font image recognition based on background part includes:(1)call the system font generated the corresponding pictures, (2)determine the font four boundary, (3)clipping font image, (4) matching comparison with the foreground font image, (5)font similarity sorting and other functions. Part of the code snippets are as follows:

Mobile phone client-side the dual threshold processing code snippet:

```
public Bitmap binaryPic(Bitmap obm){
        Bitmap nbm=null;
        this.w=obm.getWidth();
        this.h=obm.getHeight();
        int[] grayPoint=grayPoint(obm);
        int ave=aver(grayPoint);  //average
        int otsu=otsu(grayPoint);  //Otsu method
        int best=bestThresh(grayPoint);  //optimal threshold method
        //decision which threshold
        int thres=0;
        if((best*1.8)<ave){
                if(otsu+3<255){
                        otsu+=3;
                }
                thres=otsu;//the result for Otsu method be selected
          }
        else {
                thres=best;//the result for optimal threshold method
be selected
        }
        nbm=newPic(obm,thres);
        return nbm;
    }
```

The server-side image of binarization processing code snippet:

```
public BufferedImage binaryPic(BufferedImage pictureBuff){
        int width = pictureBuff.getWidth();
        int height = pictureBuff.getHeight();
        BufferedImage grayImage = new BufferedImage(width,
        height, BufferedImage.TYPE_BYTE_BINARY);
        for (int i = 0; i < width; i++) {
```

```
                    for (int j = 0; j < height; j++) {

                            int rgb = pictureBuff.getRGB(i, j);

                            grayImage.setRGB(i, j, rgb);

                    }

            }

            return  grayImage;

    }
```

Conclusion

The mobile phone font recognition software has been encapsulated as apk file, installed in Android smart phone and put into use. Users can use a mobile phone to directly take font pictures, crop the image, recognize the required font and upload the data to server, etc. Due to the adoption of dual threshold image processing technology for font recognition, the accuracy rate in this software system is up to 99.7%. We will further improve the functions of the system, and make further improvements on the algorithm, in order to improve the recognition ability of the font, accelerate the speed of font processing.

References

[1] Solli M., Lenz R.: Find-your-font in large font databases, Proceedings of the 15th Scandinavian Conference on Image analysis, Aalborg, Denmark, (2007): 432–441

[2] Lidke J., Thurau C. and Bauckhage C.:The snippet statistics of font recognition, 20th International Conference on Pattern Recognition, Istanbul, (2010):1868–1871

[3] YAN Qiuzhen, ZHU Shihai and ZHANG Weicong: Research of Auto Focus Technique for Mobile CMOS SoC Image Sensor, 7th international symposium on test and measurement, Beijing, China(2007)

[4] Cheriet M., Farrahi Moghaddam R. and Hedjam R.: A learning framework for the optimization and automation of document binarization methods, Computer vision and image understanding, 117(3) (2013)

[5] Farrahi Moghaddam R., Cheriet M.: AdOtsu: An adaptive and parameterless generalization of Otsu's method for document image binarization, Pattern Recognition, 45(6) (2012)

[6] Yuan, H.-D.: Blind Forensics of Median Filtering in Digital Images, IEEE transactions on information forensics and security, 6(4) (2011)

[7] Jorge Moraleda: Large scalability in document image matching using text retrieval, Pattern recognition letters, 33(7) (2012)

[8] Ruliang Zhang, Lin Wang: An image matching evolutionary algorithm based on Hu invariant moments, International Conference on Image Analysis and Signal Processing (IASP 2011) 3rd, Wuhan, China, (2011)