Realization of clothing image contour extraction and collar segmentation

Ling Zhang¹, Zengbo Xu¹², Yanhong Zhang¹

¹ Digitization of clothing, School of Textile and Clothing, Shanghai University of Engineering Science, 333 Longteng Road, Songjiang District, Shanghai, China

Abstract: With the change of personalized ideas, the clothing and apparel industry is developing towards small batches and multiple varieties. Looking for fast and efficient apparel image processing and recognition is the most urgent problem to be solved by apparel companies. The establishment of a collar style sample library is the prerequisite for apparel image processing and recognition research. Apparel image preprocessing is the basis of research. This article takes the clothing style map as the research object, establishes a collar style sample library, and takes a round neck T-shirt image as an example, which contains 8 types of collars commonly used in clothing, and each collar type corresponds to 60 images. The advantages and disadvantages of commonly used image graying, sharpening, edge detection, morphological processing, and image segmentation processing methods are compared and analyzed. Corresponding image preprocessing schemes have been formulated to provide new ideas for automatic pattern recognition, software development and application.

1. Introduction

The rapid development of multimedia technology and communication technology has driven humans into the information age, and images have become an important way for humans to obtain information. Digital image processing technology refers to the processing of images through computers or other digital technologies to identify and extract the required target information. It has the characteristics of good image reproducibility, high processing accuracy, good adaptability, and flexibility. Digital image processing refers to the use of computers or other digital technologies to process images, mainly including image sampling, image transformation, image enhancement and restoration, image coding compression, image segmentation, edge detection, etc.

The current clothing image feature extraction technology is relatively complicated, the classification method is inefficient, and is not suitable for the recognition of clothing image patterns. Among them, the establishment of a collar style library is the premise of the research, and the preprocessing of clothing images is the basis of the research. With this as a background, this article takes the image of a round neck T-shirt as an example to perform preprocessing such as graying, sharpening, edge detection, morphological processing and image segmentation. At the same time, a corresponding image preprocessing plan was formulated, which provided new ideas for automatic pattern recognition, software development and application.

2. Collar style sample library

This article selects V-necks, square collars, ordinary stand-up collars, shirt collars, flat collars, continuous collars, and collars, a total of 8 collar types, each collar type corresponds to 60 samples, and
establish a collar. For a sample library of styles, see Table 1. The main method of obtaining samples in this paper is to use image processing technology to obtain collar style images from Tmall.

**Table 1.** Types and quantity of collar style drawings in the sample library

| Serial number | Style name     | Sample map       | Style gallery correspondence | Structure gallery correspondence |
|---------------|----------------|------------------|-------------------------------|----------------------------------|
| 1#            | Round neck     | ![Round neck](image) | Round neck | ![Round neck structure drawing](image) |
| 2#            | V-neck         | ![V-neck](image)  | ![V-neck.png](image)          | ![V-neck structure drawing](image) |
| 3#            | Square collar  | ![Square collar](image) | ![Square collar.png](image)  | ![Square collar structure diagram](image) |
| 4#            | Stand collar   | ![Stand collar](image) | ![Stand collar.png](image)  | ![Stand collar structure drawing](image) |
3. Methods

Image preprocessing is the premise of image recognition. The clothing image preprocessing is mainly divided into two parts: clothing image contour extraction and collar part segmentation.

3.1 Grayscale image

The color image is composed of three components, R, G and B. In order to improve the efficiency of the algorithm, the gray image is usually used to convert the color image into a single-channel gray image. Commonly used image graying methods include single-component method, maximum value method, average value method and weighted average method [4]. The comparison and analysis results of grayscale processing are shown in Figure 1.

![Comparison of processing effects of different graying methods](Original image    Weighted average method   Average method    Maximum method)

**Figure 1.** Comparison of processing effects of different graying methods

As can be seen from Figure 1, the overall effect of the image after the weighted average method and the average method is better than the maximum method. Among them, the weighted average method is a weight ratio set according to the sensitivity of the human eye to color.

3.2 Sharpe

The common method for obtaining the outline of clothing images is to use edge detection operators, such as Roberts operator, Canny operator, Laplace Operators, etc. Figure 2 shows the comparative analysis effect of image edge detection processing.

![Effect of different sharpening algorithms](Original image    Grayscale image    Gradient method    Laplace operator method)

**Figure 2.** Effect of different sharpening algorithms.
It can be seen from Figures 2 and 3 that the sharpened edge image obtained by directional filtering has some edges lost, and there are a lot of noise, the gradient method and Laplace are used. The operator method can get a relatively complete sharpened edge map. Like, among them, the gradient method has more noise, and overall, the Laplacian method is more ideal.

3.3 Clothing contour extraction

The common method for obtaining the outline of clothing images is to use edge detection operators, such as Roberts operator, Canny operator, Laplace Operators, etc. Figure 4 shows the comparative analysis effect of image edge detection processing.

It can be seen from Figure 4: The Log operator is greatly affected by noise, which is easy to cause interference to subsequent image processing; Prewitt operator, Roberts operator and Sobel operator There are some missing key edges in the detection results, which is not conducive to the further processing of subsequent images; comprehensive analysis results, the Canny operator best meets the needs of this topic. In order to avoid interference and improve the efficiency of the algorithm, the edge image is further processed and redundant discrete pixels are deleted. The final comparison effect of contour extraction is shown in Figure 5.

3.4 Part split

The purpose of clothing image segmentation is to filter useless information and extract desired target areas from clothing images, such as clothing contours, clothing structure lines, clothing parts, etc. Traditional image segmentation methods mainly include threshold segmentation, boundary segmentation, and region segmentation [7]. Background of clothing images with complex backgrounds, commonly used methods are Graph Cuts, Mean Shift GrabCut and other algorithms [8], of which Graph Cuts and GrabCut belong to interactive image segmentation, which requires manual assistance and is easily affected by artificial subjective factors.
The regional growth method, the regional split method and the regional split merge method \cite{9} are all typical regional segmentation methods. We choose an image segmentation method based on region growth method to obtain collar parts from clothing images. The basic idea is to start from a set growth point and merge pixels or regions with similar properties to the growth point. Form a new growth point, and repeat the above operation until the end of growth.

As shown in Figure 6, the number represents the gray value of each pixel, and the pixel with a gray value of 8 is set as the growth point \( f(i, j) \); the similarity criterion is set to the gray value of the growth point The difference is 0 or 1. Figure (a) is the original image, and Figure (b) is the result after the first growth. Among them, the 3 pixels with the gray value of 7 in the 8 areas of the growth point meet the growth conditions, so they are merged; Figure (c) For the results after the second growth, 3 pixels with a gray value of 7 are used as new growth points. Among the 8 areas, there are 1 pixel with a gray value of 6 that meets the growth conditions; Figure (d) For the result after the third growth, a pixel with a gray value of 6 is used as a new growth point. There are two pixels with a gray value of 5 in the 8 fields that meet the growth conditions, so they are merged. After the third merger, there are no pixels that meet the growth conditions, and the growth ends.

![Diagrammatic sketch of region growth.](image)

The algorithm implementation steps are as follows:

1. Determine the starting point of growth: manually click on the black area of the collar (gray value is 0) to determine the initial growth point (set the gray value to 1), as shown in Figure 7.
2. Formulate similarity criterion: merge the pixels with gray value 0 in the area around the growth point, that is, the collar in the black area, the pixels that meet the similarity criterion set the gray value to 1.
3. Define the termination condition of growth: the growth area is the inner area of the collar boundary (gray value is 1).

![Collar component segmentation based on region growing method.](image)

4. Results

According to the above clothing image preprocessing scheme, the preprocessing process using the round neck T-shirt image as an example is as follows: Firstly, the image is gray-scale processed. The comparison shows that the weighted average method is based on the weight ratio set by the human eye's sensitivity to color. After a large number of experiments and theories, it is proved that the gray-scale image obtained by this method is the most reasonable. Secondly, the image is sharpened, and the comparison shows that the Laplacian method can obtain a relatively complete sharpened edge image. Once again, the extraction of image contours and comprehensive analysis of the results, the Canny
operator obtained the most complete image. Finally, the image segmentation method of the region growing method is used to obtain the collar parts from the clothing image, and the edge of the collar is extracted. According to the above pretreatment process, the effect diagram is shown in Figure 8.

![Figure 8 Effect of image preprocessing algorithm.](image)

5. Conclusions
This chapter mainly describes the whole process of clothing image preprocessing in detail and shows examples. Firstly, the establishment of the image sample library of clothing collar is introduced; then the corresponding image preprocessing scheme is formulated according to the research needs. The common gray-scale image processing methods are compared and analyzed. According to the effect of the processed image, the average value method is selected as the gray-scale image processing method in this paper. The Laplace operator method, gradient method, directional filtering and other commonly used methods are analyzed and compared. Image sharpening processing method, of which, the sharpening effect of Laplace operator method is more ideal, which can strengthen the edge of the image without generating too much noise; summarizes the advantages and disadvantages of commonly used edge detection operators. Among them, Canny The operator has strong noise suppression ability, which can not only get a more complete edge contour, but also will not generate unnecessary noise, and the processing effect is ideal. In addition, in order to facilitate subsequent image segmentation, the initial contour is morphologically processed by a method of combining dilation and corrosion to obtain an ideal clothing contour. Finally, according to the characteristics of the pre-processed image, a simple operation area growth method is used to segment the image to obtain the target part (collar part). Provide new ideas for automatic pattern recognition, software development and application.

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References
[1] Liu M N. Research on Objective Evaluation Method and Application of Image Quality Based on Vision System and Feature Extraction [D]. shanghai: Shanghai Jiao tong University, 2010.
[2] Zhang T & Qi Y Q. MATLAB image processing programming and application [M]. Beijing: Mechanical Industry Press, 2014.
[3] Xu C Y. Review of Research on Image Recognition Technology [J]. Computer knowledge and technology, 2013, 9(10): 2446-2447.
[4] Liu Y B. Research on lane line detection based on structured road [J]. Transportation Technology, 2019(04): 117-121.
[5] Hou Y Y, He R H, Li M, et al. Clothing image retrieval method combining multi-layer feature fusion of convolutional neural network and K-Means clustering [J]. Computer Science, 2019(S1): 215-221.
[6] Chen H Q, Wan Y L, Wang G G. Research progress of digital image processing technology [J]. Industrial control computer, 2013, 26(01): 72-74.
[7] Hu R X, Jia W, Zhang D, et al. *Hand shape recognition based on coherent distance shape contexts*[J]. Pattern Recognition, 2012, 45(9): 0-0.

[8] Hou H Y, Gao T, Li T. *Overview of image segmentation methods*[J]. Computer knowledge and technology, 2019, 15(05): 176-177.

[9] Hussain K F, Ali S A, Malek S M. *An efficient approach for automatic cloth panel extraction from pattern images* [J]. International Journal of Computer Applications, 2014, 98(3): 15-22. 03-2019. 11.