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Computer Stitch Needle Strategy Based 0n Machine Vision

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Abstract: This paper presents a machine vision-based automatic needle knitting method for computerized embroidery machines. The method can obtain a panoratically embroidery image to achieve the position of the needle, and automatically generate the cross pattern file. And it is verificated that the error is less than 0.1mm through analysis of positioning accuracy .
Keywords: Machine vision, Machine cross stitch, Automatic knitting needle.

1. INTRODUCTION

The great development of the cross-stitch industry puts forward higher requirements on the automation and intelligence of cross-stitch embroidered by computerized embroidery machines. Nowadays, the cross-stitch embroidered by a computerized embroidery machine requires manual plate making. The operation is complicated and laborious. And there are also many defects in the embroidery products. For example, stitches and cloth holes cannot be aligned, which makes the embroidery products have a bad frontal effect. The method of automatic needle knitting based on machine not only can realize automatic plate making to improve the efficiency of plate making, but can realize the positioning of embroidery needles to ensure that the stitches fall in the fabric holes of the embroidery cloth, thus changing the quality of embroidery products.

2. OVERALL PLAN

This article adopts a single camera of CCD sensor to scan the panorama of embroidered cloth to obtain all image information, analyze and process the image, generate an embroidering path, form a processing file readed by an embroidery machine to complete the embroidery task. This scheme needs to ensure that the embroidered cloth is accurately fixed. In the process of embroidering, the embroidered cloth is relatively stable, that is, the embroidered cloth is fixed with a stable machine coordinate coefficient to avoid accumulated errors. In order to achieve the above requirements, the embroidered cloth needs to be relatively stable and not deformed during the sewing process. Adding a paper liner at the bottom of the embroidering cloth can effectively solve this problem. The paper liner is a layer of auxiliary material laid under the cloth to stabilize the reinforcing stitches and improve the smoothness of the embroidered embroidery. After the embroidery is completed, the paper can be torn off. As shown in Fig. 1, the relationship between embroidered fabric and liner is shown. First, put the liner on the shed, put the embroidered fabric on the liner, and finally tighten the screw.At the same time, the rack frame of the fixed embroidery fabric is marked, and the camera and the embroidery fabric are always perpendicular, and the frame marking can be described, thereby ensuring complete image information is obtained.

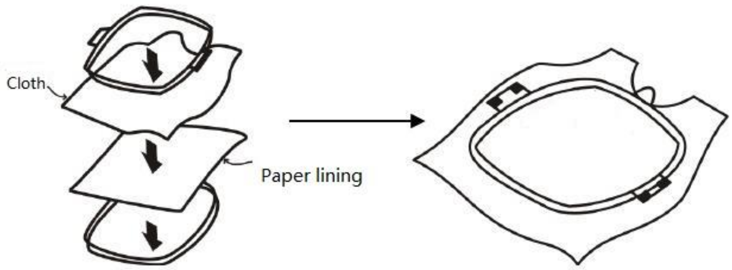

Fig.1 The of Embroidery and paper lining

3. MACHINE VISION WORK

The research in this paper needs to be accomplished by machine vision. This requires building a machine vision system and determining how the machine vision works. The positioning of the fabric hole is achieved by acquiring the image of the embroidered cloth and extracting the coordinates of the fabric hole. There are two options for obtaining the image.

First: The static panorama scans the whole embroidery fabric to get all the information, processes the image, extracts the holes and stores it for pattern making.

Second: Dynamically scan image information. After the initial point is determined, the first stitch is embroidered, and when the second stitch motion is performed, image information is obtained, image processing is performed, coordinate information of the current cloth hole is extracted, and the motor is driven to the designated coordinate point. Next, before the next stitch is embroidered, the position of the target image is acquired in real time, and the image is then processed to control the motion.

Due to image processing, large data needs to be stored, the amount of calculation is large, and the calculation time is long. Therefore, in order to improve the overall embroidery efficiency, it is not appropriate to adopt a real-time processing scheme, and image processing is performed at each step, and during the processing, Repeated processing of non-target information increases the amount of calculation, so the first scheme is adopted. The overall pattern is scanned at a time and the coordinates of the fabric holes are extracted for pattern making.

4. GET THE SEWING PATH INFORMATION

The acquired image information includes the embroidered image color type, the embroidered cloth size, etc., and the embroidered path information is thereby generated. Fig.2 shows the information flow chart for extracting the embroidery path.

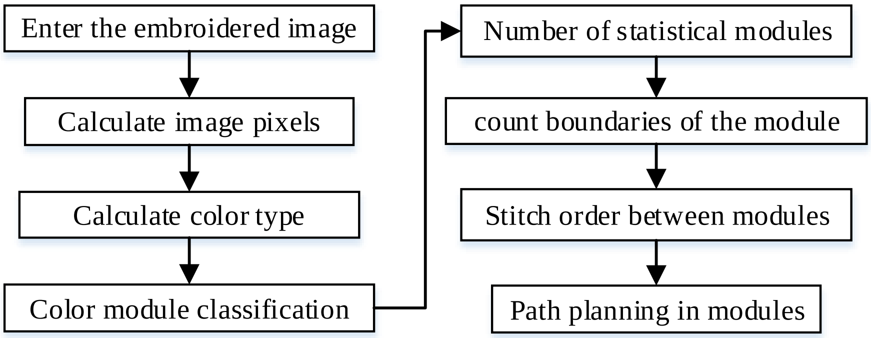

Fig.2 Flowchart for obtaining the embroidery path

By using the Image Segmentation in the MATLAB toolbox[1-2] and using L*a*b color space and K-Means Clustering, the image is subjected to color separation. Next, each color block is processed separately to obtain the boundary information of each color block. After all the color blocks are extracted, the sewing sequence among the color blocks is determined with the shortest path. Finally, the internal path of the color patch is determined separately with the principle of the shortest path .

5. NEEDLE POSITIONING ANALYSIS

When determining the shortest embroidering path in a color patch, the coordinates of the cloth hole in the color patch must be extracted first, and the coordinate information used as the needle position is used for path planning. This ensures that when each color patch is embroidered , The needle can be accurately positioned to the center of the cloth hole. Fig.3 shows the procedure for obtaining the mesh coordinate information as follows.

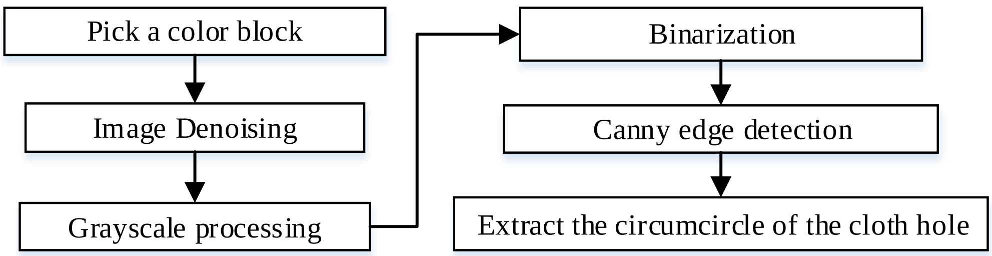

Fig.3 Flow chart for obtaining the coordinate of the cloth hole

To extract the coordinate information, the color block is firstly pre-processed[3], and the extracted color block is first subjected to denoising to eliminate high-frequency interference information, and then gray-scale processing is performed to convert the color block into a gray-scale image. then the picture is converted into a binary image through Binarization. Finally, The edge detection of the binary image is performed to obtain edge of each fabric hole in the color patch by using the canny edge detection algorithm [4-5]. Followed by the work of extracting coordinate information, first locate the starting point of the color patch to use the contour tracking algorithm to pick the outline of the first cloth hole, extract the circumcircle of the outline to obtain the center coordinates of the circumscribed circle used as the center coordinate of the cloth hole. According to the same method, the center coordinates of each cloth hole in the color patch are sequentially extracted and put into the linked list, and the coordinate points in the linked list are used as the needle positions to plan the shortest sewing path. Fig.4 shows the circumscribed circle of the extracted standard hole edge

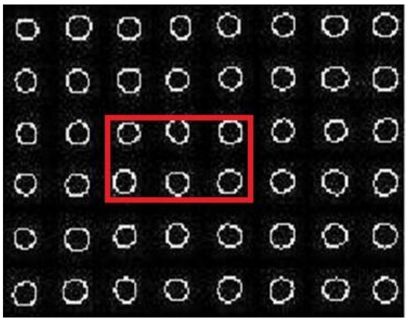

Fig.4 The circumcircle of the cloth hole edg

The standard cross-stitch cloth mesh is usually considered to be an ideal equidistant distribution. When determining the specific position of the cross-grid, first determine several important points, and then find the positions of other coordinate points according to the relationship of the arithmetic series. As shown in Table 1, we select the coordinates of the six locations of the adjacent areas of the standard embroidered cloth, by comparing the horizontal and vertical coordinates extracted from the image with the theoretical coordinates (here considered to be the uniform distribution standard aperture coordinates),we analyze the extraction error.

Table 1 Comparison of extracted coordinates and theoretical coordinates

No.	Extracted abscissa	Theoretical abscissa	Abscissa error	Extracted ordinate	Theoretical ordinate	Ordinate error
1	25.120	25.10	0.020	10.822	10.86	0.038
2	28.299	28.36	0.061	10.798	10.86	0.062
3	31.567	31.62	0.053	10.803	10.86	0.057
4	25.181	25.10	0.081	14.095	14.12	0.025
5	28,351	28.36	0.009	14.188	14.12	0.068
6	31.588	31.62	0.032	14.173	14.12	0.053

6. CONCLUSION

A machine vision-based cross-stitch needle positioning method and an automatic needle knitting method are proposed. Only by obtaining a panorama of the cross-stitch cloth on which the cross-stitch pattern is printed, a processing file can be automatically generated. According to experimental data, The accuracy of the cloth hole coordinates is less than 0.1 mm, which can meet the accuracy requirements.

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