Automatic location of facial acupuncture-point based on facial feature points positioning

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Abstract. Acupuncture-point is a very important part in traditional Chinese medicine, but to locate the points is very difficult for non professionals. In this paper, we put forward a new method to locate the acupuncture points of human facial based on the research of the pattern recognition technology in the facial acupuncture points. The method is easy to operate and can be used without professional training, so it can greatly reduce the difficulty of positioning, improve the positioning accuracy, and is beneficial to the application of acupuncture points in the treatment and health care. Experiments show that the method proposed in this paper is effective.

INTRODUCTION

In recent years, many studies have begun to focus on the field of traditional Chinese medicine, because the traditional Chinese medicine can be very effective in the treatment of patients with disease with low risk. There are a lot of research are the application of the technology in the field of image diagnosis technique in traditional Chinese medicine. For example: In traditional Chinese medicine, observing the tongue can evaluate a person's health, Wang Yazhen et al, use the support vector machine classify the tongues by the feature extraction of human tongue texture, color and geometric features, and then, and the classification accuracy is verified that this method could provide help to accurately select clinical image. Results the features of tongue image can be used to evaluate the quality of tongue image, and the tongue image can be selected accurately [1]. Tan HaiSong made a further study on the recognition of tongue image, improved the recognition method, and the recognition efficiency [2]. Wang Xiaoyi and others through the identification analysis of liver ultrasonic images, can identify whether patients with fatty liver [3].

However, in addition to the graphics technology application in the diagnosis, there is little research is based on image recognition on acupoint positioning. As we all know, acupuncture is a very important part of the field of traditional Chinese medicine, in daily health care and treatment of disease has a very good effect. But it is very complicated for point positioning, because every acupuncture point is independent and special, people need a long time professional training to find the location. It’s very difficult for beginners or ordinary people to learn.

In this paper, I propose a method based on graphic recognition technology to find some of the face points, it can effectively find the points in the Chinese medicine through the computer to achieve, reduce the difficulty of finding points. Experiments show that this method can get good positioning effect.

FINDING FACIAL ACUPOINTS BY IMAGE RECOGNITION TECHNOLOGY

In the field of pattern recognition nowadays, face recognition is a very popular field, which is widely used in security, entertainment and other field [4-10]. But they usually only stay in search and positioning the facial features, there is no relevant research about get the location of non-features points, such as acupoints. While the Chinese localization points also have great subjectivity, the doctor will usually rely on their own experience to find the acupoints, low accuracy that may lead to every doctor found points have different positions. So we need a way to locate the acupoints through the patient's own body characteristics

According to the different characteristics of facial acupoints, I divided them into two categories, one that is associated with facial organs and can be seen directly, the second must be found by touch. Because the second kinds of acupuncture points do not have any characteristic in the graphic image, the method proposed in this paper only aims at the first kinds of acupoints.

A. Facial feature point location

The purpose of facial feature point localization is to further determine the location of facial feature points (eyes, eyebrows, nose, mouth, facial contour) on the basis of face detection. The basic idea of localization algorithm is to combine the texture features of faces with the position constraints of each feature point.

B. The theory of traditional Chinese medicine bone length measurement

In traditional Chinese medicine theory, there are many special positions on the human body, by pressing these positions, or acupuncture can achieve different therapeutic effects. These special positions are acupoints.

There are many ways to find the acupoints, most of which are relative e to some physiological characteristics, such as at this point Zusanli, is located in the lateral leg, under calf nose 3 “inches”, as shown in Figure 1.

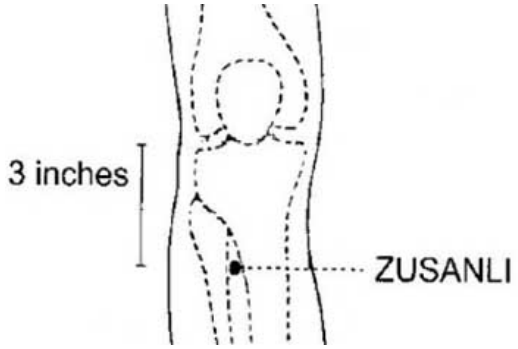

FIGURE 1. The location of acupoint Zusanli.

Because each person's physiological characteristics are different, so this “inch” is also varying from person to person. It is calculated according to the physiological proportion of the human body. In the traditional Chinese medicine commonly used method is to establish the length of bone length measurement, its principle is to calculate the length of different position according to the width of the bones in the human body, traditional Chinese medicine bone length measurement based on Figure 2.

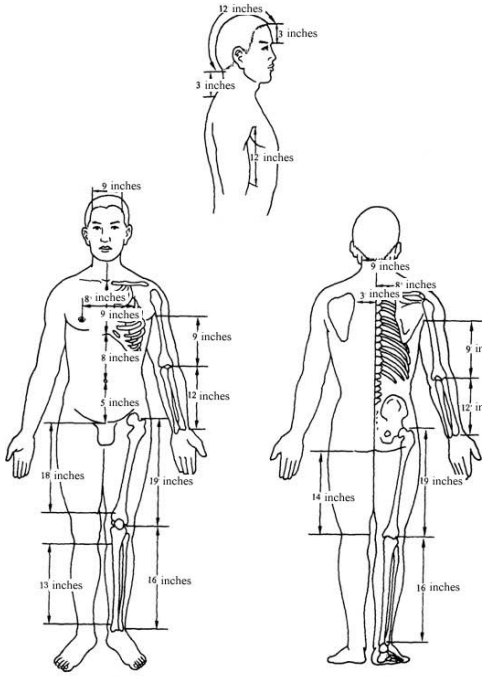

FIGURE 2. Chinese medicine bone length measurement.

This study is based on the distance between the eyebrows to the hairline is 3 inches.

C. Automatic positioning of facial acupuncture points

The image processing technology is employed into the automatic location of facial acupuncture-point. The detail location algorithm is given as following.

- **Step 1:** Using Canny edge extraction algorithm to identify the image edge, as shown in Figure 3. By extracting the edge of the image, we can get the point set of face curve.

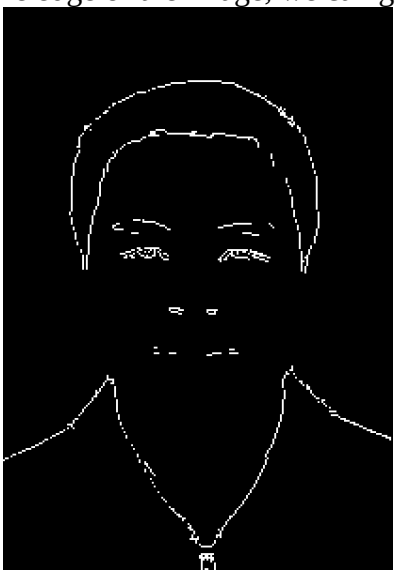

FIGURE 3. Canny algorithm results.

- **Step 2:** Using face recognition algorithm to detect facial feature points with detected images. In this paper, I used ASM algorithm to locate feature points. Each image in the sample has 83 feature points covering the major facial organs and facial contours.

- **Step 3:** Computing the center point coordinates（X，Y）between two eyebrows. I get eyebrows coordinates in step 2, left eyebrow is (X_1, Y_1) , right eyebrow is (X_2, Y_2).

$$\mathrm{X} = \frac{X_1+X_2}{2}\ ,\ \mathrm{Y} = \frac{Y_1+Y_2}{2};$$

- **Step 4:** Get the hair center point coordinate(X_3, Y_3) through the horizontal coordinate X and the point set I got in step 1.

- **Step 5:** The length of an inch of the person's body is calculated by the two-point distance.

$$\mathrm{d} = \sqrt{(X - x_3)^2 + (Y - y_3)^2}$$

An inch is $\frac{d}{3}$.

- **Step 6:** According to facial feature points and body inches, find the corresponding facial points.

With the above six steps, the facial acupuncture-point is able to be located automatically and be benefit for the assisted- diagnosis of facial disease.

EXPERIMENTS AND ANALYSIS

To demonstrate the effects of the proposed method, several experiments are designed from different views of infrared thermal image. Firstly, the performance of automatic location for facial acupuncture-point is shown to compare with the effectiveness of hand location. Secondly, six

acupuncture-points are chosen to evaluate the average precise of automatic location. According to the experimental results, it is obvious that the proposed method is an effective method for automatic location of facial acupuncture-point and hence it is helpful to improve the characterization development of Chinese Medicine.

A. Presentation of automatic location of facial acupuncture-point

The positioning effect of six acupoints was demonstrated in this experiment.

In the experiment, firstly, the six acupoints are automatically positioned by the method presented in this paper. And then on the same picture manual positioning by professionals. Finally overlap two pictures.

Comparative effect as shown in Figure 4. The first picture shows the acupoints and the other points I get in Step 2. The second picture shows the six acupoints which positioning manually. The third picture overlap them to compare.

FIGURE 4. Compare result

B. Analysis of experiments

$$E = \frac{1}{N}\sum_{i=1}^{N}(\frac{1}{n}\sum_{j=1}^{n} dist(p_{ij}, p_{ij}^{'}))$$

This is a common method in traditional feature point location verification work. Where N is the image number, n is the number of feature points in each face, $dist(p_{ij}, p_{ij}^{'})$ representing the Euclidean distance between two feature points, p_{ij} representing the manually-points, $p_{ij}^{'}$ representing the method-points, the average error is used to reflect the positioning result.

The final experimental results show that the deviation is less than the human finger pressing area. In the acceptable range, which proves that the experiment is effective.

CONCLUSIONS

In this paper, a method of automatic positioning of the facial points is proposed. By using the image technology of face feature analysis, automatic positioning of facial acupuncture points, contribute to the diagnosis of face. The experimental results show that the localization method retains good scalability and high accuracy.

REFERENCES

[1]. Wang Yazhen, Zhang Xinfeng, et al., et al. Research on tongue image quality evaluation based on support vector machine [J]. Beijing biomedical engineering, 2015, 34 (6): 551-557.

[2]. Tan HaiSong. Tongue quantitative image processing method of [D]. Central South University, 2014.

[3]. Wang Xiaoyi, Li Li, Li Deyu, et al. Recognition of fatty liver based on texture analysis [J]. aerospace medicine and medical engineering, 2004, 17 (3): 144-148.

[4]. Gee A, Cipolla R. Determining the gaze of faces in images[J]. Image & Vision

[5]. Computing, 1994, 12(94):639–647.

[6]. Xie J, Lin X. Gaze Direction Estimation Based on Natural Head Movements[C]// Fourth International Conference on Image & Graphics. IEEE Computer Society, 2007:672-677.

[7]. Yamazoe H, Utsumi A, Yonezawa T, et al. Remote and head-motion-free gaze tracking for real environments with automated head-eye model calibrations[C]// IEEE Computer Society Conference on Computer Vision & Pattern Recognition Workshops. IEEE Computer Society, 2008:1-6.

[8]. Ji Q, Zhu Z, Lan P. Real-time nonintrusive monitoring and prediction of driver fatigue[J]. IEEE Transactions on Vehicular Technology, 2004, 53(4):1052--1068.

[9]. Zhang Z, Zhang J S. Driver Fatigue Detection Based Intelligent Vehicle Control[C]// International Conference on Pattern Recognition. IEEE Computer Society, 2006:1262-1265.

[10]. Fan X, Yin B, Sun Y. Nonintrusive Driver Fatigue Detection[C]// Networking, Sensing and Control, 2008. ICNSC 2008. IEEE International Conference on. IEEE, 2008:905-910.

[11]. Tang X, Wang X. Face Sketch Synthesis and Recognition[C]// null. IEEE Computer Society, 2003:687.