

Research of Acupoint Location Methods in Traditional Chinese Medicine

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Abstract: The advancement of science and technology has brought new opportunities and challenges to the development of Chinese medicine. In recent years, people have conducted extensive research on the methods of applying modern science and technology to acupoint positioning in Chinese medicine. Based on the current research status, the report summarizes and categorizes the general methods of the past 10 years. The methods are roughly divided into four categories, which are based on the direction of vision technology, based on algorithms, based on the direction of the electrical impedance characteristics of acupoints, and other methods. The methods are roughly divided into four categories, which are based on the direction of vision, algorithms, the direction of the electrical impedance characteristics of acupoint, and other methods. This paper makes a simple comparison of its advantages and disadvantages, and looks forward to the future research direction based on the integration of various other methods of vision technology. Thus, it could provide a certain reference for the future development of acupuncture point positioning technology.

1 INTRODUCTION

Nowadays, people's pressure is increasing, and more and more people are paying attention to medical care. Traditional Chinese medicine plays a very important role in health care. Our human body has many acupuncture points. Acupoints can not only treat diseases clinically, but also have great health benefits in daily life. Therefore, the accuracy of finding and positioning acupoints plays a decisive role in traditional Chinese medicine (Chang 2017). Failure to find accurate acupuncture points will not only affect the effect of treatment and health care, but also impair health. It takes a lot of energy and time to find and locate acupuncture points, which is even more difficult for non-professionals. With the development of science and technology, people began to try to combine the search and positioning of acupoints with modern technology, so as to achieve higher accuracy in finding and positioning acupoints and the liberation of human labor. Nowadays, there are more and more researches on acupoint location. This report categorizes the general research methods into 4 categories, and summarizes some of the specific methods based on these 4 categories, and then compares the advantages and

disadvantages of the 4 categories of methods, and puts forward the prospects for future research directions.

2 RESEARCH CLASSIFICATION

2.1 Positioning based on the Direction of Vision Technology

The machine vision is used to extract and organize the data of the collected images, so as to realize the accurate positioning of the acupuncture points. Ma Zhewen and Yu Haoguang established a massage robot acupoint tracking system based on visual positioning, and realized real-time detection and dynamic tracking of acupoints through image acquisition, image processing, coordinate conversion, etc. (Ma & Yu. 2010). Huanbing Gao et al. judge whether the human body is moving by comparing two adjacent images, and use methods such as sharpening using morphology to process the image using multiple morphological structural elements to corrode the prior edges, and recognize that the values in the coordinates should be

converted. It is the movement coordinates, so as to realize the dynamic tracking of the acupoints (Gao, Lu, & Wang 2014).

Zhang Huakai designed a monocular visual servo system in 2012, proposed an acupoint location method based on artificial signs, and compared the acupoint location based on fast normalized correlation gray-scale matching algorithm with the second time based on Mahalanobis distance. Matching the stability of the SIFT feature to match

the acupoint location algorithm, it is concluded that the latter has better stability (Zhang 2012). Sheng Lin et al. further considered that based on computer binocular vision technology, collecting images of different human limbs, obtaining three-dimensional coordinates in space, through technical analysis, to realize the recognition and positioning of human acupoints, which is more accurate and has lower error (Lin, & Yi 2019).

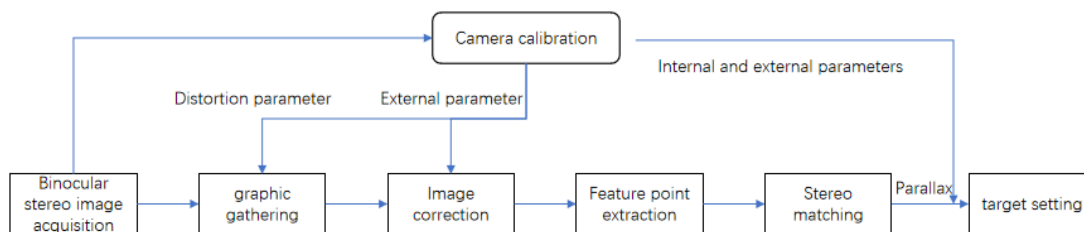


Figure 1: The basic block diagram of the positioning research of binocular vision (Lin, & Yi 2019).

Zhao Yang et al. applied infrared image processing to TCM diagnosis and treatment in 2012, and proposed an automatic facial acupoint location algorithm, which combines Minimum Eigenvalue corner detection and Log edge detection to locate the position of basic facial features. On this basis, automatic acupuncture points are realized. Positioning (Zhao, Zhang & Lian 2012). In 2020, Wang Cong carried out research on the vision-based acupoint-finding method in the field of medical acupuncture, mainly from the overall recognition of human posture and limbs, and then local acupoint positioning, and obtained preliminary research results (Wang 2020). In 2020, in order to improve the accuracy of human acupoint recognition and shorten the time of human acupoint recognition, Fu Yangyang and Gao Zhiyu used Matlab 9.0 digital image processing technology, gradient descent, and sliding window hybrid algorithm to identify and localize human acupoints. This method can effectively improve the efficiency of human body acupoint positioning (Fu & Gao 2020).

2.2 Orientation based on Algorithm Direction

The acupoint location using algorithm mainly relies on the learning function of the neural network to predict the acupoint coordinates and realize the

function of automatically finding acupuncture points. Wang Hongwei proposed an automatic acupoint positioning method based on the fusion of CMAC network and Q learning algorithm for human foot acupuncture and acupoint positioning skills learning (Wang 2013). More research relies on BP neural network. Based on the learning function of BP network in neural network theory, Du Guangyue et al. took several acupoint coordinate data as samples, and used MATLAB for data programming training to realize the function of massage robots in human acupoint search (Du, Lu & Zhang 2011). Zhang Qiuyun optimized it and proposed a point coordinate prediction method based on a genetic algorithm to optimize BP neural network, which made up for some shortcomings of BP neural network. From the simulation results, it can be seen that the learning speed of this method is faster and faster. The accuracy is high and the prediction effect is better (Zhang, Zhang & Li 2017). Yang Xiangping and Wu Yudan designed a prediction model of acupoint relative coordinates based on particle swarm optimization optimized BP neural network (PSO-BP), which combined with ARM to form a system that can be used for human acupoint positioning. The results show that the system can predict the location of acupoints well (Yang & Wu 2018).

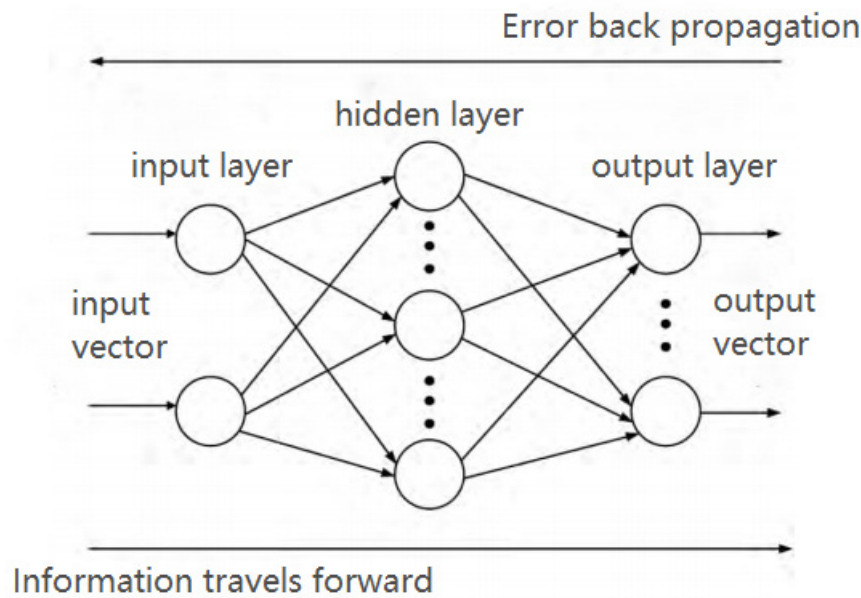


Figure 2: Neural network three-layer topology (Yang & Wu 2018).

2.3 Positioning based on Electrical Impedance Characteristics of Acupoints

In terms of electrical properties, acupoints have low electrical resistance compared to non-acupoint tissues (Chen 2010). In 2010, according to the low impedance characteristics of acupuncture points, Chen Zhengliang designed and manufactured an integrated dot matrix measurement electrode based on a flexible circuit board, stimulated the human body by excitation current, and compared the results to determine the spatial location of acupuncture points (Chen 2010). Yang Xiangping and Xia Zhiyuan in 2018, by improving the two-electrode method of acupoint resistance detection technology, combined with the mechanical structure design and embedded control technology, designed a new embedded acupoint recognition device (Yang & Xia 2018). In 2018, based on the two-electrode method of acupoint resistance detection technology, Yang Xiangping and Xia Zhiyuan designed a new embedded acupoint recognition device, which combined the mechanical structure design with the embedded control technology.

2.4 Other Methods

The use of many other methods also provides a lot of new ideas for the location of acupuncture points.

In 2013, Gao Dongwen, Xiao Husheng and others conducted a study on acupuncture positioning of pork using three-dimensional and two-dimensional high-frequency ultrasound technology. The results show that high-frequency ultrasound guidance is accurate, intuitive, dynamic, and accurate for the anatomical positioning of the acupoints of the living body. The feature of low price can be used as the conclusion of the standard of living body acupoint positioning (Gao, Xiao, Xu, Zhang, Xu, Yin & Wang 2013).

In 2018, Dong Shihui and Wang Xu were based on the intelligent functions of ABB robots. According to the characteristics of the distribution of acupoints in the main parts of the human body, the human acupoints were classified and processed. According to the spatial movement instructions of their manipulators, they designed their coordinate displacements on the surface of the human body. Localization, so as to identify the acupoints of the meridians of the human body (Dong & Wang 2018).

In 2019, Kun-Chan Lan and Gerhard Litscher proposed a system that uses augmented reality to locate acupuncture points. Compared with traditional acupuncture point probe devices that work by measuring skin impedance, this system does not require any additional hardware, but only based on software. In the case of mild symptoms, through this system, patients can quickly find the corresponding acupuncture points for acupuncture or massage (Lan, & Litscher 2019).

3 COMPARISON AND OUTLOOK

Algorithm-based acupoint positioning mainly uses the learning function of neural network theory. Taking the coordinate data of several acupoints on the body as a sample, other acupoint coordinates are derived through training to realize the function of finding acupuncture points. Because the positioning of a neural network depends on physiological characteristics, and some acupuncture points only rely on the physiological structure of the body, because the proportions of the human body are different, it is impossible to find the characteristics according to the image based on the principle of vision, so it is difficult to locate by visual means, using neural network. The characteristics of this type of acupuncture points can be realized. However, the algorithm-based approach has strict requirements on data samples, and the number of samples needs to be large. Acupuncture point location based on vision method uses visual measurement combined with image processing to manually mark acupoint location. In actual massage or acupuncture, it is impossible for the patient to remain motionless. If the patient moves, the coordinates of the acupoints need to be changed. The real-time image collection can be achieved based on vision, so as to achieve the effect of accurately positioning the acupuncture points. However, because the entire system is too large, the fast real-time performance of positioning is reduced (Zhang, Zhang & Li 2017). Based on the electrical impedance characteristics of acupoints, the acupoints and their surrounding non-acupoint tissues have low electrical resistance and high potential in electrical properties to locate acupoints. This method is very safe and accurate, so it is often used as a way to verify the accuracy of data in algorithms and visual methods. Like many other methods, it is also difficult to popularize because of the high equipment requirements.

Many acupuncture point positioning techniques now have a strong purpose. For example, according to needs, different methods of acupuncture point positioning on the face and feet are selected. Because different methods have different applicability to different parts of acupuncture points, before conducting research, you should clarify your needs and choose the appropriate method. In general, vision-based acupuncture point positioning methods are more common, with more application scenarios and more complex. The future research direction can be based on the acupuncture point positioning in the visual direction, combined with other methods to make up for the shortcomings, to

improve the accuracy and respond to various scenarios and needs.

4 CONCLUSIONS

This report introduces the background of the combination of TCM acupoint location and modern technology, and summarizes and categorizes the current technology research. The current method of acupoint location is developing steadily, and more and more people are trying to use new methods to improve and improve the research on accurate acupoint positioning system. After a simple analysis of the advantages and disadvantages of each method, it can be seen that each method has its own special applications. Among them, the vision-based method is more comprehensive. In the future, the vision method can be combined with other methods to solve specific problems and make up for the shortcomings, so as to achieve more accurate results.

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