

Develop “Medical Image Processing” Experimental Teaching Platform with Chinese Characteristics

Kang ZHANG, Guo-Long ZHANG, He-Ling ZHANG*

Jiangxi University of Traditional Chinese Medicine, Nanchang 330004, China

21846498@qq.com

Keywords: Experimental teaching; Medical image processing; Traditional Chinese medical.

Abstract. Combined with its own characteristics and advantages, Chinese medicine colleges develop medical image processing experimental teaching platform with Chinese characteristics. Tongue inspection is the main content for traditional Chinese medical science, so the tongue image processing as experimental content. The experimental platform enables automatic image segmentation, automatic identification of the tongue nature and the fur, automatic classification of tongue color and tongue fat or thin. By experimental platform to enable students master the theoretical knowledge and algorithms, while raising awareness and interest in traditional Chinese medicine.

Introduction

“Medical Image Processing” is an important professional course for biomedical engineering. Due to the current experimental content of medical image processing is basically processed image for Western medicine, Chinese medicine rarely involves the content of medical image processing experiments. Therefore, the current common image processing experimental platform does not apply to the content of the image processing experiments of traditional Chinese medicine. In this paper, with its own characteristics and advantages of TCM colleges and universities, Develop “Medical Image Processing” Experimental Teaching Platform with Chinese characteristics, reform experimental content.

Students only need to enter some parameters on the experimental teaching platform, we can get the corresponding results. And by comparing the results of different experimental parameters to help students better understand the theory of teaching. Students raise awareness and interest in traditional Chinese medicine.

Experimental Environment

Most comprehensive university teachers would choose VC as an experimental development environment. But the combination of traditional Chinese medicine biomedical engineering college students’ characteristics, most students are not familiar with the VC, and Matlab has a powerful image processing toolkit and function, easy to use, so we chose Matlab as a programming language, based on Matlab GUI interface to develop “Medical Image Processing” Experimental Teaching Platform with Chinese characteristics.

Experimental Content and Algorithms

Tongue is a traditional Chinese medicine four diagnostic “look, listen, questioning” important content, so the tongue image processing as experimental content.

1. Automatic segmentation algorithm of tongue

The tongue is separated from the original image (Fig. 1a), it is an important prerequisite Tongue Characterization of the study. Original image contains a tongue, lips and part of the face area, the area we are interested in the tongue area (Fig. 1c).

Converting the image F1 to the HIS color space, based on the H and I histogram get dual-threshold, threshold segmentation, to obtain the binary image, as shown in Fig. 1 (b).

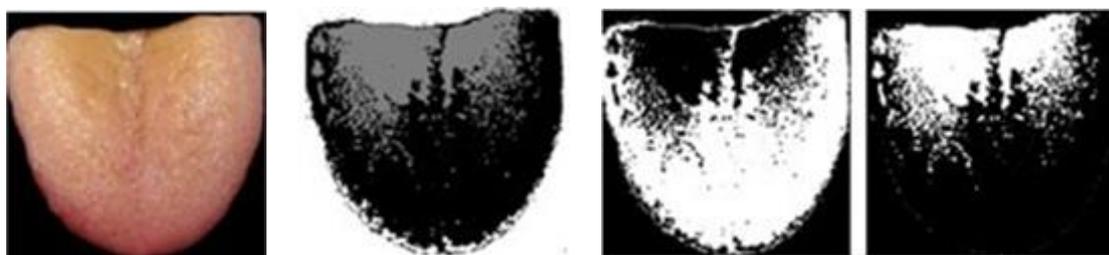


(a) The original image F1 (b) Tongue image (c) Tongue image

Figure 1. Segmentation process renderings of tongue.

2. Automatic separation algorithm of the tongue nature and the fur

Use FCM clustering algorithm, the tongue is divided into the tongue nature, the fur and the background area, as shown in Fig. 2 (b). Then based on the location feature, fur surrounded by the tongue nature, automatically get tongue nature, as shown in Fig. 2 (c), fur, as shown in 2 (d).



(a) Original image (b) FCM clustering (c) Tongue nature (d) fur

Figure 2. Automatically separate renderings of tongue nature and fur.

3. Automatic classification of tongue color.

Neural networks mimic the human brain. It has a strong fault-tolerant, self-learning, self-organizing capabilities and the ability to generalize. We use a neural network to classify the color of tongue.

4. Edge detection and curve fitting of tongue

The template of tongue (as shown in Fig. 3). The upper part of the template to zero (as shown in Fig. 4).



Figure 3. Tongue body template. Figure 4. The edge of tongue body.

To curve fitting the edge of tongue body (as shown in Fig.5), Then, use BP neural network to get the classification of tongue fat or thin.

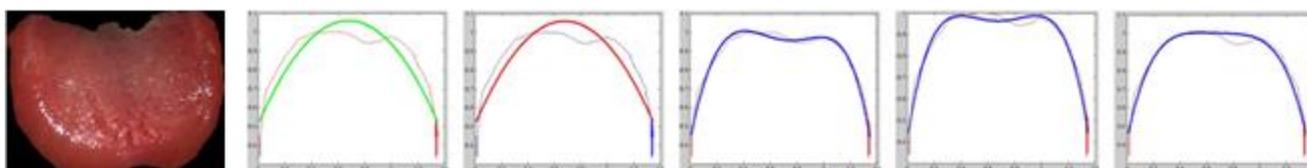


Figure 5. Curve fitting the edge of tongue body.

Image Processing Experimental Platform

Experimental platform has two modules, namely the Chinese medicine class image processing experiment module and common medical image processing algorithms experiment module.

Traditional Chinese Medicine medical image processing experiment module, students can open a tongue image, the experimental platform enables automatic image segmentation, automatic identification of the tongue nature and the fur, automatic classification of tongue color and tongue fat or thin, as shown in Fig.6. Common medical image processing algorithms experiment module, students can open an image process it, as shown in Fig. 7.

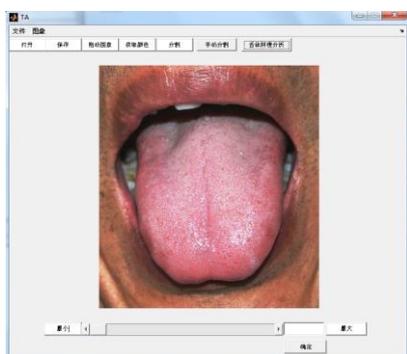


Figure 6. Traditional Chinese Medicine.



Figure 7. General module.

Experimental Teaching Assessment

To test the effect of the experimental platform for experimental teaching reform, we carried out an anonymous questionnaire to collect 42 valid samples. Questions are as follows: up to 10 points, the lowest 1 point. Evaluation results are shown in Table 1 below.

- #1 By medical image processing experiments, if you have an interest in traditional Chinese medicine;
- #2 By medical image processing experiments, you learn how much knowledge of Chinese medicine;
- #3 Medical image processing applications in the field of traditional Chinese medicine;
- #4 Proficiency in medical image processing experimental techniques;
- #5 Please describe your experiments team scoring;
- #6 The degree of medical image processing learning;

Table 1. Experimental Teaching questionnaire results.

question	score									
	1	2	3	4	5	6	7	8	9	10
#1							2	3	6	31
#2							1	1	7	33
#3								2	5	35
#4									30	12
#5										42
#6								1	30	11

From the feedback statistics, reflect ability get a good raise, student have a new understanding for Traditional Chinese Medicine.

Acknowledgements

Jiangxi Provincial Department of Education (JXJG-14-12-32).

Summary

By medical image processing experimental platform with Chinese characteristics, in daily teaching and experiments add a lot of Chinese medicine image processing example, raise students' awareness and interest in Chinese medicine, motivate them to contribute to the modernization of traditional Chinese medicine.

References

- [1] Zhou Yue, Yang Jie, Shen Li, Journal of Biomedical Engineering, 2004; 21(6): 917-920.
- [2] Tan Wu-xing, Li Bing, Yue Xiao-qiang. Journal of University of Science and Technology of China, 2010. 8 vol.40.
- [3] Prasanna Sahoo, Gurdial Arora. Pattern Recognition Letters, 2006,27(6):520-528.