

Research on Image Processing Technology of Tai Chi Teaching Based on Numerical Simulation Software Matlab

Xiaoxin Xie

School of Physical Education, Hezhou University, Guangxi, China

Keywords: multimedia technology; Tai Chi; Image processing; Gray scale value; The BP neural network algorithm; Matlab software

Abstract. With the development of computer multimedia technology, more and more people start applying computer information technology means to the practice of engineering and life. In addition, it is the office automation, machinery manufacturing automation and electronic commerce information automation that are gradually being realized. Image processing technology is a branch of computer information technology development and image processing is widely applied to various fields. Under this background, this paper makes a deep research on computer image recognition technology. At the same time, image recognition technology is also used to develop and design the gray level value in order to redesign the image. Neatly, this paper builds a mathematical model for multimedia recognition technology, and prepares the application of image design by using the BP neural network algorithms. Finally, taking the design of Tai Chi sports teaching movement for example, this paper verifies the program by using the general software MATLAB. As a result, it is the single and two people's training design effect figure of Tai Chi movement that is obtained.

Introduction

With the improvement of computer software and hardware performance, image processing technology has rapidly developed [1]. Among them, there appears many algorithms in the process of image processing, such as genetic algorithm, wavelet transform and BP neural network algorithm used in this paper. These algorithms are designed to speed up image processing, enhance the quality of image processing and achieve high pixels and high resolution images in the shortest time [2,3]. Through the analysis of the image's gray value, this paper can regroup and optimize the design. Under the guidance of this thought, this paper uses the BP neural network algorithm to develop and design the movement scheme of Tai Chi. At the same time, as a debugging software, the general software MATLAB debugs the development program [4]. Thus, it provides the theoretical reference for the numerical and intuitive research of Tai Chi movement. What's more, it provides a numerical support for Tai Chi actions' objective criteria.

Introduction of computer multimedia teaching

Image processing technology is mainly the algorithm design of image data processing. The ultimate goal of data processing is to obtain high resolution and good quality's pictures through the algorithm. Genetic algorithm and wavelet filtering algorithm is mainly used to deal with the resolution and color of image [5]. In this paper, the actions will be optimized by changing the image gray value. Thus, the BP neural network algorithm is chosen to deal with the image [6]. Generally speaking, the basic principle of image processing is to identify and change gray value of image. According to this principle, this paper makes an algorithm design for the image processing. Concrete steps are mainly shown in Figure 1.

As shown in Figure 1, it is the schematic diagram of image processing. From figure 1, it can be obtained that the steps of computer image processing designed by this paper are mainly divided into three parts [7,8]. The first part involves image input and preprocessing, image design and image segmentation. Secondly, this paper will further design the image through image segmentation, and then the designed image will be normalized. Finally, the action will be extracted. The good action will be applied to sports teaching.

This section mainly introduces the common algorithms of computer multimedia image processing [9]. And through analyzing these algorithms, BP neural network image processing algorithm is chosen as the algorithm of this paper. In the second section of this paper, the mathematical modeling will be carried out on the image processing and then the algorithm of data processing will be obtained.

Research on the mathematical model of computer multimedia action design

In order to design the computer image multimedia action, this paper needs to locate the image and then solve the barycentric coordinates to obtain the position of pixel. First of all, this paper assumes that the coordinate of two-dimensional image is $Z(x, y)$, and the centroid is (x_a, y_a) . The calculation of centroid is shown in formula (1).

$$\begin{aligned} M_{00} &= \sum_x \sum_y Z(x, y) \\ M_{10} &= \sum_x \sum_y xZ(x, y) \\ M_{01} &= \sum_x \sum_y yZ(x, y) \end{aligned} \quad (1)$$

Formula (2) is obtained by computing the zero order and first order of X, Y.

$$x_a = \frac{M_{10}}{M_{00}}, y_a = \frac{M_{01}}{M_{00}} \quad (2)$$

Images are not always shot in the ideal environment. Because of the influence of weather and light, there are often big differences between the shooting effect and display [10]. Thus, it is very necessary to deal with the data of image.

Gray imbalance problem is often met in image processing. This problem can be solved by using the gray level correction method, which can enhance the brightness and resolution of image. Changes of gray scale have hierarchy, so the image action can be designed and analyzed through changing the gray value.

Here, we will take the images between $r = (60, 200)$ for example to build the mathematical model. On the whole, the image effect at this format is not satisfied. Image gray value is low and the image is dark. Therefore, the gray scale range can be designed to $H = (0, 255)$ through the gray value design algorithm. The transform formula of gray value can be written as equation (3).

$$H = T(r) \quad r = [r_{\min}, r_{\max}] \quad (3)$$

Among them, $H \in [H_{\min}, H_{\max}]$, T is the linear transformation. By making an offline transform on the gray value, it can be obtained in formula (4).

$$S = \frac{S_{\max} - S_{\min}}{r_{\max} - r_{\min}} r + \frac{S_{\min} \times r_{\max} - S_{\max} \times r_{\min}}{r_{\max} - r_{\min}} \quad (4)$$

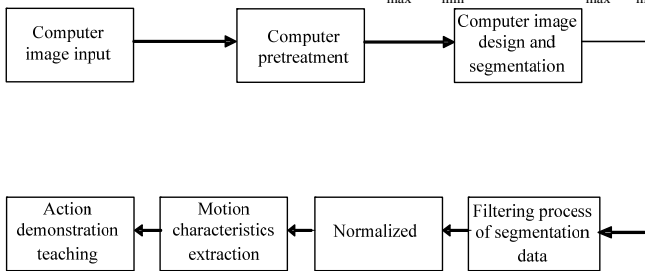


Figure 1. Schematic figure of image processing process

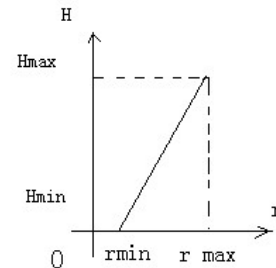


Figure 2. Schematic diagram of gray value linear transformation

Figure 2 is the schematic diagram of gray value linear transform. If r belongs to $(60, 200)$ and s belongs to $(0, 255)$, so

$$S = \frac{255}{150} r - \frac{255 \times 60}{150} \approx 1.7r - 102 \quad (5)$$

If the image is seriously impacted by the environment, it will need to be optimized by means of filtering. Generally, filtering will be chosen by the high frequency of mapping. By choosing the mapping high frequency component which has a lot of noise points can we achieve the goal of optimization.

In order to simplify the algorithm, this paper directly uses the average value method to reduce the noise effects and smoothly deal with the image. This paper assumes that there are two kinds of

expression methods of a pixel point's neighborhood S: the neighborhood averages of 8 neighborhoods and 4 neighborhoods are respectively shown in formula (6).

$$g(i, j) = \frac{1}{M} \sum_{(i, j) \in S} f(i, j) \quad (6)$$

Application and research on the computer multimedia action design of Tai Chi teaching

In the second section, this paper has introduced the method of image processing gray value calculation and has built the mathematical model of multimedia image processing motion design [11,12]. In this section, this paper will focus on the validation of the algorithm feasibility and make a study on the practical application of the algorithm. The main process of computer multimedia action design's practical application is shown in Figure 3.

From the figure 3, it can be seen that the main steps of computer multimedia image motion design are to locate the pixel through BP neural network algorithm and then obtain the new location map by coordinate transformation. Finally, the updated ideal image will be obtained by changing the gray value.

This article firstly validities the effectiveness of the neural network algorithm. It is mainly realized by using the method of learning and training to optimize image. Eventually, the effect of image optimization will be achieved in the process of reducing image transformation. Through calculation, MATLAB computation results are obtained which are shown in Figure 4.

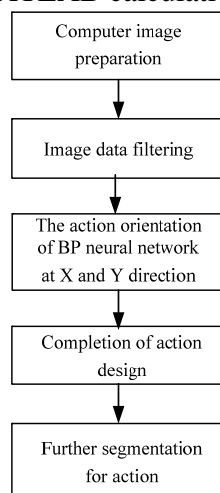


Figure 3. Schematic diagram of computer multimedia image action design steps

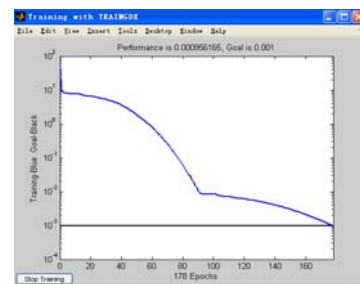


Figure 4. MATLAB computation results

From figure 4, it can be seen that there is bigger error in the initial phase of image processing. However, through the BP neural network learning and training, with continued iteration, the range of error is gradually narrowed and eventually the error is close to unlimited small value. Thus, it proves that this algorithm is effective.



Figure 5. Calculation result of MATLAB single gray Figure6. value Design result of MATLAB Tai Chi actions

By taking the Tai Chi action design in the process of sports teaching for example, this paper makes a study on the practical application of the algorithm. Firstly, it identifies the actions of Tai Chi; secondly, this paper marks and optimizes the images through the gray value; finally, the result is obtained which is as shown in figure 5, in which, the biggest gray value is close to 1000.

Figure 6 is the effect figure of Tai Chi action design. Through changing the image gray value, this paper successfully achieves the redesign and choreography of action. In addition, it also achieves the design effect of Tai Chi double action. From the calculated results, it can be seen that the maximum

of image gray value is also close to 1000, which is consistent with the action recognition result of figure 5. Thus, it proves the effectiveness of the action design. This action design procedure can be applied to the Tai Chi teaching process which can greatly improve teaching efficiency and the quality of teaching through the visual effect.

Conclusion

Combined with multimedia technology, this paper used MATLAB numerical simulation software to recognize the image motion and made a deep research on the design process. At the same time, the mathematical model was established in the process of image processing. The computer image processing algorithm was also established based on BP neural network algorithm. At last, by taking the development and design of Tai Chi action as an example, this paper took advantage of the MATLAB numerical simulation function to identify and design the gray value of image. Through calculation, it was obtained that the biggest gray value was close to 1000 by using gray value identification to mark and optimize the image. The reorganized maximum image gray value was also close to 1000, which was consistent with the action recognition results of figure 4. Thus, it proved the effectiveness of the action design. If this kind of way was applied to practical sports teaching, the teaching efficiency would be improved to make up for the inadequacy of teaching resources and improve teaching quality.

References

- [1] Wang Wenwen. Xiong Hui. Introduction of the offensive and defensive skills in the process of colleges and universities' Tai Chi teaching [J]. Journal of sports science and technology literature bulletin, 2010 (10) : 65-66.
- [2] Shi Xianbin.Sun Jian. Application in the Tai Chi teaching based on the campus spread horizon of Tai Chi culture [J]. Journal of xichang college, 2011 (3) : 88-89.
- [3] Fu Wen. Exploration on the reform of common colleges and universities' Tai Chi teaching [J]. Journal of capital institute of physical education, 2011 (1) : 102-103.
- [4] Qin Jie. Research on the present development situation of ordinary university sports option class [J]. Journal of Beijing sports university, 2010.28 (6) : 817-819.
- [5] Ruan Zhe. Influence of Tai Chi movements on elderly lower limb mechanical factors [J]. Journal of Beijing sport university master's theory, 2010(1): 223-224.
- [6] Tong Jixi. Tai chi standing pile action's biomechanical analysis on the impact of Spinal physiological bending [J]. Journal of Beijing sports school, 2011, 9 (3): 14-15.
- [7] Cheng Dali. The "circle" and "change" of Tai chi [J]. Journal of fight martial arts and science, 2010, 4, (1): 1-2.
- [8] Hu Shixing, Zhang Bo. Discussion about Tai Chi causing knee joint damage mechanism [J]. Journal of chongqing college of arts and science, 2011, 1(2): 3-5.
- [9] Han Bo, Ma Huiting. Introduction about the function of simplifying twenty-four Tai Chi on easing the psychological pressure of senior students [J]. Journal of neijiang science and technology, 2010(9): 164-165.
- [10] Wang Li, Wang Sen. Analysis on the impact of Tai Chi on the elderly psychological factors [J]. Journal of Chinese clinical rehabilitation practices, 2011(3):1128-1129.
- [11] Zhao Yong. Good attitude of students developed in Tai Chi teaching [J]. Journal of mental health education of primary and secondary schools, 2011(8):43-43.
- [12] Li Jianshe, Niu Xiurong. Research on the effects of Tai Chi exercise on children's physical health [J]. Journal of JiLin institute of physical education, 2010(5):125-127.