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Research on Human Skeleton extraction algorithm based on Machine Learning

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Abstract: Analyzing the human skeleton of the target and extracting the motion information is of great significance to the establishment of human model and the research and analysis of human motion. In this paper, an improved method for establishing the "star" skeleton model of the human body is proposed. The centroid extracted from the traditional "star" skeleton model moves up and down according to the proportion of the human torso to obtain the parameters of the central point of the shoulder and buttocks. And the combination of face-to-face mannequin and side-looking mannequin to build a more detailed mannequin. The experimental results show that this method improves the accuracy of locating the endpoints of human limbs and can better obtain the human skeleton model.

1. Introduction

Visual analysis of human motion is a frontier direction in the field of computer vision in recent years, which is widely used in different scenes [1]. Skeleton is an effective way to express the information of human body regions and contours. The human skeleton contains a lot of motion information. In recent years, it is also a very hot research direction to extract the human skeleton to build a human model [2]. The so-called mannequin, to put it simply, is to correctly estimate the location of key parts of the human body on the image and other information. Human skeleton model can be applied in the following aspects: (1) intelligent monitoring; (2) motion analysis; (3) human-computer interaction; (4) virtual reality [3].

Based on the research and analysis of the "star" skeleton model of human body, this paper puts forward an improved method of "star" skeleton model of human body, which lays a good foundation for human feature recognition and tracking of moving human body [4].

Figure 1: Star skeleton model

2. Human skeleton extraction

2.1 Moving target detection

The purpose of moving target detection is to extract the target object from the video sequence, which is very important. At present, there are many algorithms, such as background difference method for still camera, inter-frame difference method, ViBe background extraction algorithm, optical flow method for moving camera and so on.

First of all, we convert the video into a picture sequence through Matlab. In this paper, we mainly use VideoReader to read the video and use imwrite to save the video by frame. The experimental results are shown in figure 1.

2.2 Target detection and binarization processing

Background difference method is a general method for motion segmentation of still scenes. First of all, the first frame is extracted as the background image and grayed out, and then the picture sequence, that is, the pictures of other frames, is read in, and the background is subtracted and binarized to get the image we need. The background subtracted image we obtained for the first time has a burr at the edge due to the influence of illumination and the algorithm itself. Then, we perform the open operation on the binary image, that is, the operation of corrosion and then expansion, to achieve the effect of eliminating burr and smoothing the edge. In this way, we can get the picture of human motion after going to the background. The experimental results are shown in figure 2 (Fig. 2 shows the experimental results at frames 50 and 83).

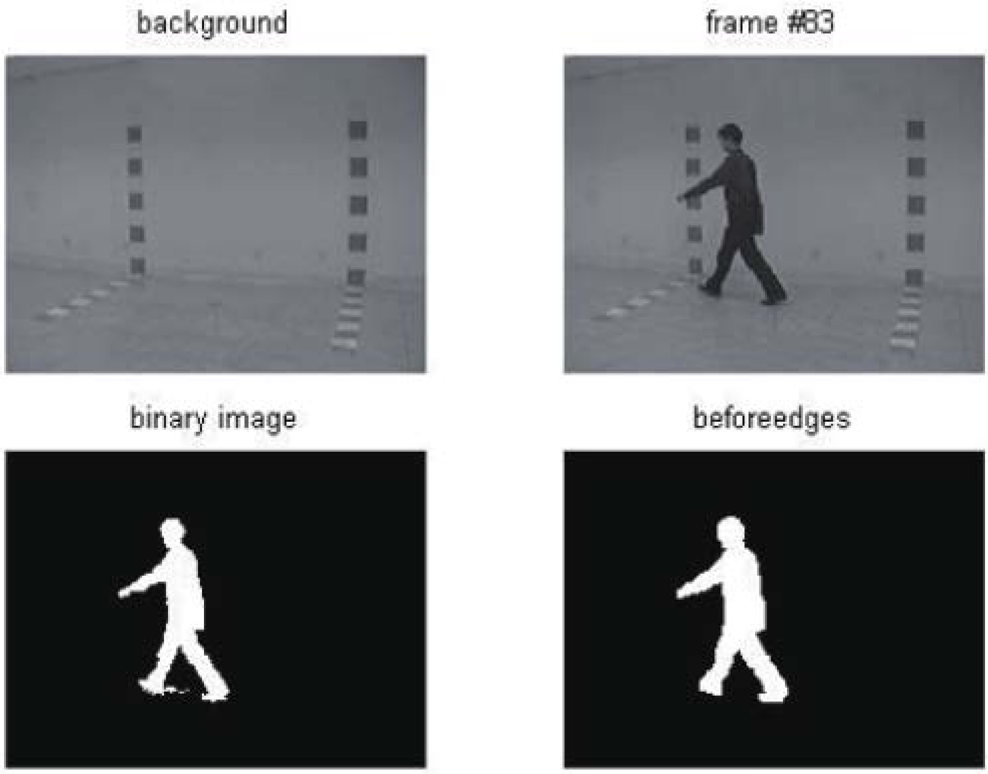

Figure 2: Illustration of the experimental effect of background subtraction and burr removal

2.3 Skeleton extraction

We move the centroid extracted from the traditional human "star" skeleton modeling method up and down according to the proportion of the human torso to obtain the parameters of the central point of the shoulder and buttocks. Compared with the "star" skeleton, the improved model contains 2 key nodes and 5 feature points. They can describe human limb parts more accurately; at the same time, they can describe human limb parameters.

$$\left\{\begin{aligned} x_c &= \frac{1}{N_b}\sum_{i=1}^{N_b} x_i \\ y_c &= \frac{1}{N_b}\sum_{i=1}^{N_b} y_i \end{aligned}\right.$$

3. Analysis of experimental results

The software platform of this method is that the video data used in VisualStudio2013 and OpenCV, experiments come from Lena_walk2 and other video files in the video library of reference [16]. In this paper, some experimental results of human body facing squarely and sideways are given by using the improved "star" skeleton model.

Figure 3 depicts the results of human modeling in the face-to-face situation. The following is a list of the experimental results of the human body waving its arms when facing squarely, when the body's legs are together and waving their arms in place. We examined whether the mannequin is effective in this process. As can be seen in figure 3, our method has achieved good results when the human limbs are fully expanded. It further shows that the mannequin in this paper is effective [5].

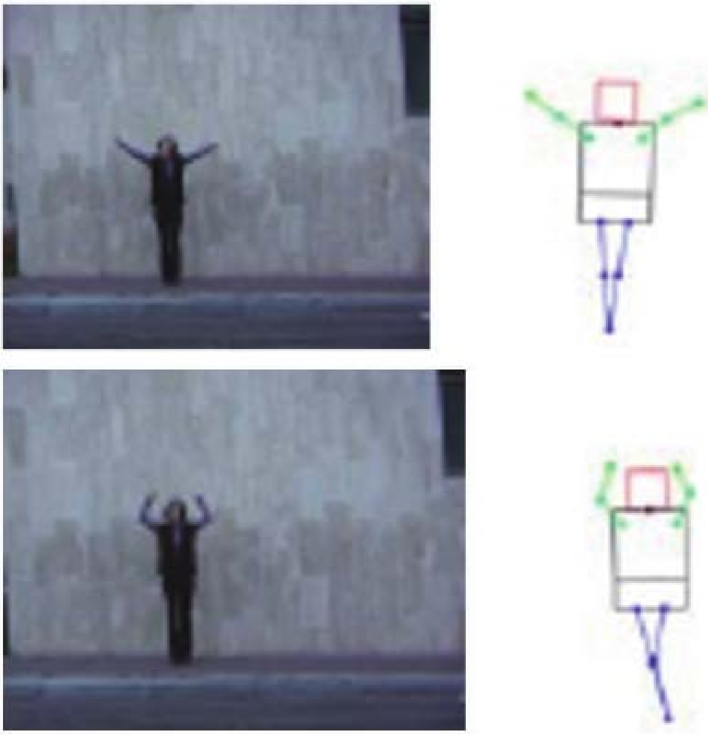

Figure 3: The results of mannequin experiment under squarely condition

4. Conclusion

On the basis of the improved method of establishing the "star" skeleton model, this paper uses the face-to-face mannequin and the side-view mannequin to establish a more detailed human body model under the condition of facing squarely and sideways, so as to better obtain the further limb division and limb parameters of the human body. It lays a foundation for further research and analysis of human motion.

References

[1] Qin Hongxing, Zhang Songshan, Liu Qihuang, Chen Li, Chen Baoquan. PointSkelCNN: Deep Learning-Based 3D Human Skeleton Extraction from Point Clouds [J]. Computer Graphics Forum, 2020, 39 (7).

[2] Wen-Yu Cai, Jia-Hao Guo, Mei-Yan Zhang, Zhi-Xiang Ruan, Xue-Chen Zheng, Shuai-Shuai Lv, Fabrizio Taffoni. GBDT-Based Fall Detection with Comprehensive Data from Posture Sensor and Human Skeleton Extraction [J]. Journal of Healthcare Engineering, 2020, 2020.

[3] Li Ruotong, Si Weixin, Weinmann Michael, Klein Reinhard. Constraint-Based Optimized Human Skeleton Extraction from Single-Depth Camera. [J]. Sensors (Basel, Switzerland), 2019, 19 (11).

[4] Ruotong Li, Weixin Si, Michael Weinmann, Reinhard Klein. Constraint-Based Optimized Human Skeleton Extraction from Single-Depth Camera [J]. Sensors, 2019, 19 (11).

[5] Kang Wang, Abdul Razzaq, Zhongke Wu, Feng Tian, Sajid Ali, Taorui Jia, Xingce Wang, Mingquan Zhou. Novel correspondence-based approach for consistent human skeleton extraction [J]. Multimedia Tools and Applications, 2016, 75 (19).