Automatic Recognition System of Motion Posture Based on Information Video Processing Technology

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Abstract. With the rapid development of science and technology, information video processing technology has become a research field that has attracted widespread attention. Automatic recognition of motion gestures is an important research object in the field of information technology. It has been widely used in education, medical treatment and finance, and has promoted the further development of this technology. The application of information video processing technology in motion posture and automatic recognition of motion posture contribute to better scientific education and technical diagnosis. This article is based on the research of automatic motion detection system based on video information processing technology. Based on the summary and analysis of relevant research work at home and abroad, this paper mainly studies the detection of moving posture targets, the segmentation of moving posture targets, and the automatic recognition of moving posture tracking in video sequences based on the characteristics of the motion posture. This research aims to effectively improve the effect of automatic recognition of sports high poses while appropriately reducing the computational complexity. The research focuses on finding simpler and more informative automatic recognition methods of sports poses, and a large number of targeted methods have been carried out. This research uses these algorithms to extract moving images from videos, and proposes an automatic recognition method of motion gestures based on information video processing technology. Experimental results show that the average error rate of the system designed in this paper is 89.5%, which can meet the current application requirements for automatic recognition of motion gestures.

Keywords: Information Video Processing, Automatic Recognition, Motion Posture, Target Detection

1. Introduction
In the past two decades, my country's information and video processing technology has developed rapidly, and the application and popularization level of video processing technology has been significantly improved [1-2]. The automatic recognition system of motion posture based on information and video processing technology has become one of the important interdisciplinary
research fields [3-4]. Information video processing technology is an effective method for automatic recognition in a motion gesture recognition system, and is the development trend of motion gesture tracking, moving target detection, and motion gesture recognition in the future [5-6]. How to design an automatic recognition system for motion gestures based on information and video processing technology is the main direction of current research in academia and industry [7-8].

In the research of motion detection automation based on video information processing technology, many researchers have conducted research on this and have achieved good results. For example, Kim JH converts bone information from the perspective of human body structure into human body angle features to achieve motion posture Classification system [9]. Through research, Zhang G and Xin B combined the use of depth images with related operators to extract the edges of the human body into the image, calculate the head position, and achieve the purpose of human detection and recognition [10].

Based on the information and video processing technology, this paper conducts research on the automatic recognition system of motion posture. This paper first proposes an automatic recognition algorithm for motion posture. It extracts motion posture video images from the video through moving target detection and tracking algorithms, and then uses video image segmentation and image orientation gradient histogram features to represent the motion posture. It is designed A motion posture automatic recognition system based on information and video processing technology. In this research, the information video is processed, the background subtraction method is used to obtain the moving target, and then the video image is subjected to morphological processing and connectivity analysis to recognize the movement posture and realize the standardization of the feature sequence. Based on the analysis and thinking of various motion gesture feature recognition algorithms, this research has studied the module of automatic motion gesture recognition in detail, and proposed an improved new algorithm to improve the automatic recognition rate to a certain extent.

2. Automatic Recognition System of Motion Posture Based on Information Video Processing Technology

2.1 Role and Approach of Information Video Processing Technology for Automatic Recognition of Motion Gestures

(1) Moving target detection technology

The moving target position is to segment the changed foreground information of interest from the basically unchanged background information into a sequence of images. Video capture target detection is to detect moving objects in the video. This is the main task of video image editing. Only by segmenting the moving target from the video image, the target can be further monitored and its behavior can be further monitored. Powerful core support for processing tasks such as analysis.

(2) Image cropping and edge extraction

After a series of preprocessing, the size of human motion images has not changed. From an intuitive point of view, the effective moving target information in these images only accounts for a small proportion, and most of the remaining images are worthless background information. Cropping the existing image can remove the redundant background information in the image, and make the cropped image as small as possible on the premise of ensuring the integrity of the moving target. The trimmed pavilion image area contains the edge of the foreground moving target, and most of the feature extraction and recognition links in the computer vision system are operated on the edge of the moving target. The purpose of obtaining a clear and accurate contour image of the motion posture is achieved, which is convenient for subsequent feature extraction and automatic recognition research.

(2) Motion posture extraction

The background subtraction method extracts moving targets under static background with high accuracy. Perform another step of processing on the motion posture video, that is morphological processing and connectivity analysis. The moving target extracted from the binarized image is processed by morphological factors, which effectively eliminates the influence of background noise on
the image, and makes the edge of the human contour in the image smoother. Analyze the connectivity of the image, eliminate the large area of noise left in the morphology processing, and fill in the large holes in the image. All pixels in the binarized image are scanned one by one using structural elements, and use the specific logic calculates each pixel on the structural element with the corresponding pixel on the binarized image to determine the pixel value at the corresponding position of the output image.

(3) Feature fusion

According to certain established rules, the various features obtained in the feature extraction link are processed by related operations to obtain a representative comprehensive matching value. The algorithm that combines identity recognition and fusion technology can achieve the purpose of using multiple types of features for motion recognition. This combination method can effectively improve the recognition rate of pattern recognition and improve the performance of motion recognition.

2.2 Motion Posture Automatic Recognition System Based on Information Video Processing Technology

(1) Moving target detection

The motion target detection algorithm without pose restriction is divided into two steps: First, the shape context matching algorithm is used to quickly find many candidate human bodies from the images to be detected. Due to the influence of noise, there are many non-false positive objects in the candidates. Then calculate the HOG descriptor of the area covered by the candidate in the image, and input the calculated HOG features into the support vector machine for classification, so that the false positive samples of the candidate set obtained in the first step can be removed. The algorithm first uses the characteristics of the rotation invariance of the shape context descriptor, and combines the template matching algorithm to quickly find candidate targets in various poses, and then establishes the HOG features of the candidate target image area, and inputs the feature vector into the support vector machine for classification and verification. Through comparative experiments on the images of the two image libraries, the results show that the algorithm proposed in this paper can not only detect non-upright objects that cannot be detected by the HOG detection algorithm, but also increase the detection speed by about 5 times.

(2) Tracking of moving targets

Using the relative position of the moving object in the video image sequence, after capturing the position of the moving object in the first frame, the tracking method can be used to locate the moving object in subsequent images, thereby improving computer performance. Combined with Mean shift's particle filter tracking algorithm, it can meet the real-time tracking requirements of high-speed moving targets. Under conditions such as partially concealed targets, interpolation targets and complex scenes, particle filter monitoring can achieve better monitoring results. By introducing the average displacement optimization method, the standard "particles" reflecting the system probability characteristics can be extracted faster, and a small amount of particles can meet the accuracy monitoring requirements, thereby improving the efficiency of the particle filter and meeting actual needs.

(3) Automatic recognition of motion posture

The object foreground image is obtained through the method of object recognition, tracking and target segmentation, and the directional gradient histogram of the object foreground image is used to represent the image characteristics to construct the object motion posture self-similarity matrix. Experiments show that this object posture self-similarity matrix is used to represent the object. In addition to the viewpoint stability, movement can also eliminate the influence of camera movement.

2.3 Design of Motion Gesture Recognition Algorithm Based on DTW

The matrix element represents the distance $D(T_i S_j)$ from two points (that is, the similarity between each point in the sequence and each point in the sequence, the smaller the distance, the higher the similarity, this algorithm uses Euclidean distance, a certain point in time. On the posture feature
vector, it is determined that the vector is a 24-dimensional distance feature vector, so the calculation is formula (1) is to calculate the Euclidean distance formula of a corresponding point in two sequences.

\[ D(T_i, S_j) = \sqrt{\sum_{w=1}^{N} (T_{iw} - S_{jw})^2}, \quad 1 \leq w \leq N, \quad N = 24 \]  

Among them, it represents a certain distance feature value corresponding to the frame-th posture in the posture sequence, represents a certain distance feature value corresponding to the frame-th posture in the posture sequence, and represents the dimension of the distance feature.

Define this path as a regular path, and define the k element representing W as:

\[ W_k = (i, j) \]  

The mapping relationship between sequence T and S is defined, such as formula (3):

\[ W = \{ W_1, W_2, \ldots, W_K \} \text{max}(m,n) \leq K < m + n - 3 \]

3. Research on Automatic Recognition System of Motion Posture Based on Information Video Processing Technology

3.1 Logical Architecture and Module Flow of System

This system is mainly composed of recording template, loading template, recognition module, and main window module. The first three modules are explained through the flowchart below. The process of recording the template is as follows:

Start → select the recorded action name A → prepare for acquisition, timer countdown → start to collect 30 frames of bone data for feature extraction of the action sequence → save A action template → end

4. Implementation of an Automatic Recognition System for Motion Gestures Based on Information and Video Processing Technology

4.1 Experiment and Analysis of Automatic Recognition of Motion Posture

Table 1. The recognition results, unit(%) 

| Action | Rejection rate | Misunderstanding rate | Recognition rate |
|--------|----------------|-----------------------|------------------|
| A1     | 5              | 0.0                   | 95.0             |
| A2     | 4.2            | 5.0                   | 91.8             |
| A3     | 3.3            | 0.0                   | 96.7             |
| A4     | 2.7            | 0.0                   | 97.3             |
| A5     | 8.3            | 0.0                   | 91.7             |
| A6     | 5.8            | 5.0                   | 89.2             |

This study tested 6 simple actions, including raising the left hand, making a fist with the right hand, and "OK" gesture with both hands, raising the right leg, lowering the right leg, and raising and lowering the left leg at the same time. For A1-A6.
In the first experiment, the first experimenter recorded and saved the standard mode of each action, which was used as a reference template for the experimenter. During the test, each action was performed 20 times. After each action was completed, the recognition results were recorded. After testing an action, the experimenter was allowed to rest for a while. One experimenter performed a total of 150 experiments with 6 experimenters, a total of Perform 900 experiments. Record the recognition result of each action, you can get the rejection rate and misrecognition rate of each action.

![Recognition Results Diagram](image.png)

**Figure 1.** The recognition results, unit(%)

It can be clearly seen from Figure 1 that the recognition rate of the action designed in this experiment is relatively high, with an average recognition rate of 93.6%. In the process of action recognition, each experimenter can move freely, because they have obtained a higher recognition rate through standard action learning and specific training. In addition, because the similarity between these actions is not high and mutual interference is small, the misrecognition rate is relatively low. Among the movements designed in the experiment, only the two movements of the right hand to the right and the two movements of the right hand to draw a circle will cause some errors. If a certain number of action styles are added to the action library, and more similar actions are added, the unrecognition rate may increase.

Similarly, in the second experiment, the experimenters were asked to perform standardized standard actions and recorded in the system, and then the other 5 experimenters were allowed to perform the exercise posture test. Each action needs to be tested 20 times, and each experimenter 150 experiments will be performed, and the system will be tested 900 experiments in total. This time the experiment is more difficult, including drawing a circle with left and right hands, turning the body in a circle, jumping up, sprinting, running in small steps, and standing up and down. After the experimenter's right hand moves, he needs to record the recognition results of each action, and finally calculate each percentage of action recognition, the experimental data is shown in Table 2.
Table 2. The recognition results, unit(%) 

| Action | Rejection rate | Misunderstanding rate | Recognition rate |
|--------|----------------|-----------------------|------------------|
| A1     | 12.0           | 0.0                   | 88.0             |
| A2     | 9.0            | 6.0                   | 85.0             |
| A3     | 4.0            | 0.0                   | 96.0             |
| A4     | 5.0            | 0.0                   | 95               |
| A5     | 12             | 0.0                   | 88               |
| A6     | 10             | 5.0                   | 85               |

Figure 2. The recognition results, unit(%) 

It can be concluded from the data in Figure 2 that the recognition rate of this experiment has decreased. The average recognition rate is 89.5%, which is a decrease of 4.1%. According to the later investigation, it is found that the reason for the decrease is that the experimenter did not perform the operation due to personal reasons (fatigue, etc.) during the test, and the irregularity or distortion of the action caused the recognition rate to decrease. Generally, the recognition rate can meet the requirements of automatic recognition applications for general motion gestures. This experimental program can not only be used to identify or train these actions. It can also recognize slightly complex actions (such as running, jumping, walking, etc.), but when the motion gesture description contains too many options, it may reduce a certain recognition rate. Therefore, automatic recognition content and content should be used when selecting functional components and actions.
5. Conclusions
This paper studies the automatic recognition system of motion posture based on information video processing technology. First, it solves the problem of how to represent motion posture under information video processing technology. It analyzes the strong randomness of motion posture on the time axis, combined with the time of motion posture. With a regular idea, an automatic recognition algorithm for motion gestures based on information and video processing technology is designed, an automatic recognition system for experimental motions is realized, and 6 motion motions based on interaction are defined. The experimental verification can achieve a high recognition effect and meet the interaction Application requirements, and finally discussed the application value of the system. This article introduces the basic theories and methods involved in motion pose recognition, analyzes the characteristics and difficulties of motion pose recognition, and focuses on more complex motion pose target segmentation methods, as well as automatic recognition of motion poses through multi-feature fusion. The research results of this thesis have certain application value in the fields of motion gesture recognition, motion gesture analysis, and motion gesture classification.

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