Recognition Model Of Sports Athletes' Wrong Actions Based On Computer Vision

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Abstract: Computer vision analysis and image processing technology are widely used in the structural analysis of human body. The purpose of this study is to establish a movement recognition model based on computer vision system. In this paper, we establish a three-dimensional coordinate system and formally describe the point inference rules of the flying leg. In this study, by establishing the error function and the deduction model of the flying feet based on the computer vision system, the wrong actions of the head, shoulders, wrists and feet in the skull can be identified clearly, and have a high degree of coincidence with the correct actions. The experimental results show that the accuracy of the algorithm in the 30th experiment is as high as 95%, 15% higher than the traditional algorithm.

1. Introduction

Computer vision uses a variety of computer imaging equipment to obtain the things captured by the camera, and transmits the captured visual information to the computer for various information processing and understanding [1-2]. Human motion recognition is also an integral part of this technology. It can make machines better understand human behavior and actions, and then communicate and interact with human beings [3-4]. Thus, through communication and human dialogue. In the field of sports, computer vision feature analysis technology has also been introduced to realize the recognition and correction of athletes' actions, and improve the effect and judgment of athletes' training [5-7].

Srinivasan discussed the principle of designing effective convnet video action recognition architecture, and learns these model samples under limited training [8]. Charalampous combined joint location with current popular deep learning features for action recognition [9]. In this paper, a principal component oriented (hopc) description histogram is proposed by Xin M, which is robust to noise, viewpoint, scale and motion speed changes [10].

In this study, we mainly use the visual feature extraction method to identify the effective sports of athletes and evaluate the accuracy of sports. In the aspect of athlete's wrong action recognition, the three-dimensional visual detection modeling method is mainly used to form the three-dimensional visual recognition function of athlete's wrong behavior and construct the three-dimensional visual detection model of athlete's wrong behavior. So as to evaluate the wrong behavior in the process of action.

2. Proposed Method

2.1. Description of Athletes' Characteristics Based on 3D Coordinates

In order to formulate the formal description of the action rules of the flying feet, according to the requirements of the action rules of the flying feet, the key joints and parts of the body of the players are marked on the three-dimensional coordinate points.

The correct action of the flying foot is: the left foot is in front and above, the right foot is above, the body is in the air, the arm is in front and above, the right hand is in the left palm, the right foot is in front and above (the height of the right foot must be higher than the waist), the foot is straight, the right hand hits the right foot; at the same time, the left foot can be bent, the left foot can be closed on the right foot side, the foot is straight and the toe is down; after the completion of the landing of the right foot, one foot of the right foot , left foot landing again. After the athlete completes the routine, 0.1 point will be deducted for each jump when the foot touches the foot or the front end of the swinging foot does not cross the shoulder.

2.2. Establishment of Error Function for Error Action of Takeoff Feet

The judge of action specification (group A) only judges whether the action is wrong or not, and points will be deducted if the action is wrong, and no points will be deducted if there is no error. Therefore, this paper uses the classical error function to study, when the action is wrong, the error value is set to 1; when there is no error in the action, the error value is set to 0, and the corresponding error function is established as follows.

$$\mathbf{f}(\mathbf{u_{22}}) = \begin{cases} \mathbf{1}, \mathbf{x_{rsz}} \neq \mathbf{x_{rjm}}, \ \mathbf{y_{rsz}} \neq \mathbf{y_{rjm}}, \ \mathbf{z_{rsz}} \neq \mathbf{z_{rjm}} \\ \mathbf{2}, \mathbf{x_{rsz}} = \mathbf{x_{rjm}}, \ \mathbf{y_{rsz}} = \mathbf{y_{rjm}}, \ \mathbf{z_{rsz}} = \mathbf{z_{rjm}} \end{cases} \tag{1}$$

When $x_{rsz} \neq x_{rjm}$, $y_{rsz} \neq y_{rjm}$, $z_{rsz} \neq z_{rjm}$, the error function value is 1 at the moment T1 of the takeoff foot strike;

When $x_{rsz}=x_{rjm}$, $y_{rsz}=y_{rjm}$, $z_{rsz}=z_{rjm}$, the error function value is 0.

In conclusion, the function equation of U2 is as follows:

$$\mathbf{F}(\mathbf{u_2}) = \mathbf{F}(\mathbf{u_{21}}) \vee \mathbf{F}(\mathbf{u_{22}}) \tag{2}$$

3. Experiments

3.1 Data Collection

In order to verify the scientificity and validity of the three-dimensional visual inspection modeling method, 10 students from the physical education university are taken as the objects, and the flying feet are trained as the experimental content. Ten students are divided into two experimental groups as shown in Table 1.

Table 1. Group experiment

Experimental group	Number of experiments	Number of experiments
Algorithm in this paper	5	30
Traditional algorithm	5	30

4. Discussion

4.1. Computer Vision Based Deduction Model of False Action of Takeoff Feet

In an action, deduct 0.1 point for each error in two or more action specifications. Therefore, in order to combine the formal description of rules and error functions and realize the decision support system of judges based on computer vision, a deduction model of flying feet based on computer vision is established.

Set the takeoff foot action as u_{tf}, $f(u_{kfij1})$ as the i-th point deduction item, j as the j-th point deduction, $f(u_{kftf})$ as the total point deduction value of the takeoff foot action, and establish the takeoff foot action deduction model as follows:

$$\mathbf{f}(\mathbf{u_{kfij}}) = \begin{cases} \mathbf{0}, \mathbf{0}; \\ -\mathbf{0}.\mathbf{1}, \mathbf{1}; \end{cases} (\mathbf{i}, \mathbf{j} = \mathbf{1}, \mathbf{2}, \dots, \mathbf{n}) \tag{3}$$

4.2. Test Modeling Verification

In this paper, 18 students of the Institute of physical education who train the flying feet are recorded in the flying feet test, which is used as the basis to verify the three-dimensional visual detection modeling method of the flying feet ‘wrong actions. The specific verification results are shown in Figure 1.

a.Improved algorithm in this paper

b.Monocular sequence

Figure 1. Verification results

In (b) of Fig. 1, the left image represents the correct action of the flying foot, and the right image represents the wrong action of the flying foot. According to the content of (a), when a competitor flies in the air, the movements of his head, shoulders, wrists and feet will be clearly confirmed. However, in figure (b), there is a big deviation in the player’s movements. The results show that the three-dimensional visual model proposed in this paper has an important role in the practical application to identify the jumping movement of athletes.

At the same time, on the basis of this verification, this paper will use two different algorithms to establish a three-dimensional visual detection model, and compare the accuracy of the two models under different experimental times. The specific comparison results are shown in Table 2.

Table 2. Comparison of model detection accuracy

Number of tests	10	20	30
Algorithm in this paper	90%	93%	95%
Traditional algorithm	78%	75%	80%

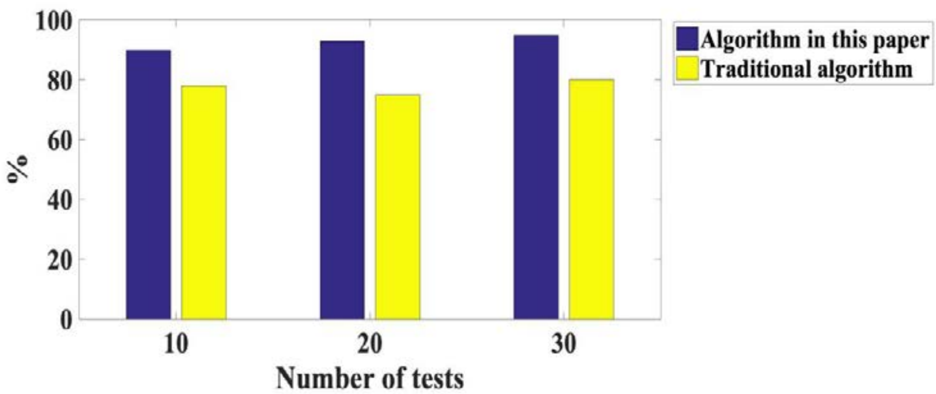

Figure 2. Model detection accuracy comparison

As shown in Figure 2, the accuracy of the algorithm in the 30th experiment is as high as 95%, 15% higher than that of the traditional algorithm. The algorithm proposed in this paper has more advantages in 3D vision detection accuracy, and can control the detection error to a reasonable range.

The algorithm proposed in this paper is more advantageous in the detection accuracy of 3D vision, and can control the detection error within the appropriate range. It is found that the algorithm proposed in this study is used to determine the wrong operation of the takeoff feet. The accuracy of judgment is much higher than that of traditional algorithm. It can be confirmed that the algorithm has obvious advantages in identifying wrong operations, and then it can verify the feasibility and accuracy of the above methods.

5. Conclusions

With the continuous development and maturity of human motion tracking technology and algorithm, various tracking technologies, such as video based method and sensor based method, have been able to better obtain the kinematic data of human body. In this paper, the athletes are taken as the research object, and the deduction of the wrong movements of the flying feet is to formalize the rules by establishing a three-dimensional coordinate system, then the corresponding classical error function is established. Finally, in order to realize the real-time recognition and scoring of athletes' wrong movements by electronic reference, a decision support system based on computer vision system is established, and a deduction model based on the computer vision system of flying feet movement is established.

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