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REVIEW ARTICLE

PHYSICAL DANCE TEACHING BASED ON VIRTUAL ENVIRONMENT

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ABSTRACT

To study the teaching of physical dance in the virtual environment, the motion capture technology was used to obtain the human body movement parameters in real life. Then, the methods such as offset mapping, affine transformation and motion mirror were used to describe the user-selected action segments as a new action sequence. In the coordination of sound and dance, the synchronized playback of audio and video was established starting from the interrelationship between action sequences and audio passages. The experiment results showed that the mentioned methods were suitable for the teaching of physical dance in the virtual environment. It is concluded that the combination of computer and sports dance will inspire more creative passion and artistic spirituality.

KEYWORDS

Virtual technology, sports dance teaching, digital media technology, sports.

1. INTRODUCTION

Digital media technology is the integration of a variety of media, such as text, graphics, images, sound, animation and video through a computer. They are processed by sampling and quantization, editing and modification, coding compression, reconstruction display and storage transmission and so on, and a logical connection is established [1-2].

With its unparalleled convenience, accuracy, efficiency and convenient storage, the computer constantly refreshes the records. With the rapid development of multimedia technology and the continuous upgrading of software in recent years, the wide application of computer in the field of design and performance has gained broad prospects. The multimedia technology not only brings a revolution to the stage visual performance in the form of a new salary, but also a great change has taken place in the people's aesthetic concept [3-4]. With the widespread use of multimedia technology, dance and art are now breaking the limitations and closures of the traditional manual era. The stage is designed as a combination of time and space art, with both temporal and aural aspects of literature and music, as well as the spatial and visual aspects of painting and architecture. The function of art of theatrical art not only expands the visual range of the audience and editor, but also expands people's thinking ability. Computer technology plays an important role in the stage of creation and graphic design, providing a new way for the sports dance practitioners. The computer can be a completely new stage language. There is also enough reason to believe that the combination of computer and sports dance will inspire more creative passion and artistic spirituality [5-6].

2. ALGORITHM INTRODUCTION

2.1 Physical Training Simulation System Based On Vr

The applications of virtual reality technology in sports have been studied by many scholars at home and abroad in the field of competitive sports and mass fitness, and remarkable achievements have been made. Amusitronix's research staff developed the VRBasebalK VRGolf, VRKayaking, VRTeimis and VRSnow, VRSkate, VRSurf and other virtual system. Becker and others set up the Taiji trainer in the modified version of the Alive system [7]. The modified version of the Alive system can provide better depth information. The system will feed back the motion fragment that differs from their coaches to athletes and give a simple comment. The virtual reality technology provides the sports workers with the training teaching methods which are completely different from the traditional methods. It liberates the coach from heavy manual labor to engage in mental work, and liberates the students from the outdoor sports field. As long as there is a computer, it can be studied anytime and anywhere. The above features of virtual reality technology decide that it has a broad application prospect in sports simulation.

2.2 Algorithm Principle

How to ensure that the virtual action sequence is smooth and realistic is the goal of this algorithm. This article does not modify the real motion data that is captured. Three methods such as moving mirror, affine transformation and offset mapping are used to splice the two motion fragments. Sports mirrors play a key role in replicating source action and target action. Affine transformation helps the animation designer to avoid the error introduced by the difference between the size of the source object and the target object. The offset mapping is effective in correcting the motion calculation in a single direction. In the process of repeatedly simulating the traditional algorithm, it is found that the tail frame of the current action segment is very different from the first frame of the next action [8]. Even if the intermediate frame is computed by interpolation, it will not guarantee the integrity, smoothness and authenticity of the synthesized animation, and it will introduce a large amount of computation. In actual engineering, it is artificially possible to agree that the tail frame of the previous motion segment has similarities with the first frame of the next motion, which is in line with real life. Based on this convention, the interpolation algorithm of this algorithm absorbs three mature tools: motion mirror, affine transformation and migration map. First, the motion mirror refers to the involuntary movement of the other side of the limb when it is free to exercise at the same time. Second, affine transformation refers to a linear transformation in one vector space in geometry and a translation, which is transformed into another vector space. Third, the offset mapping refers to the synthesis of the original motion f(t) and an additional movement d(t) to obtain m(t)=f(t)+d(t), and d(t) is called an offset mapping.

2.3 Selection Of Public Frames

The existence of the common frame is the basis of this algorithm. The two movements before and after the action choreography should have a similar posture to ensure a smooth transition. For two attitude data fi and fj, the formula (1) is used to measure the two gravity distances.

$$D_R(f_i, f_j) = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2} \quad (1)$$

In the formula, x, y and z represent the coordinates of the body center of gravity. As described in formula (2), it mainly reflects the difference of the freedom of the whole body.

$$D_d(f_i, f_j) = \sum_{k=1}^{S} \left\| J_i - J_i^* \right\|^2 \quad (2)$$

In the formula, J is a measure of the freedom degree of the human body. According to formula (1) and (2), the similarity of the two frames of the two action segments is determined. According to this similarity, different arrangement algorithms are selected.

$$\frac{\min_F \sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij} d_{ij}}{\sum_{i=1}^{m} \sum_{j=1}^{n} f_{ij}} \quad (3)$$

For the first frame, fi and fj are used to calculated the gravity distance. If a certain threshold is exceeded, it is impossible to follow up. Otherwise, the formula (2) is used to calculate the discrepancy of the body's freedom degree. Further, the Monge-Kantorovich distance between frames fi and fj is calculated according to the formula (3). If it satisfies the relevant conditions, the point set A and B are interpolated, and fi and fj are the key tipping for us. In practical engineering, the action of intersection points must be selected as a key meal. At this point, it is viewed as a starting frame or a node meal, and then manually looking for another frame. There are some very special cases. For example, video playback is too fast, the difference between the two frames is too large, and the appropriate first and tail frame cannot be found according to the method above. At this point, the above method is completely invalid. We should look for the video taken by the high-speed camera again. In this video, the time interval between two consecutive frames is much smaller than the ordinary video, and it is often possible to find the first and tail frames we need. One more case is that the time interval between the first and the end frames is too large. At this point, the tail should be abandoned and a new tail frame should be looked forward. Experience tells us that this method is practical.

2.4 Arrangement Algorithm Of Action Fragments

If the action fragment does not conform to the agreement of the action connection at both ends of the preceding text, the interpolation or fusion method is used to obtain the new action sequence. For action fragments A and B, there are three ways to place smooth action A and B.

The first is the tail of B fragment. Five frames at the end of the B fragment are smoothed, and the last frame is transitioning to the initial state of the A fragment.

The second is the head of A fragment. The first five frames of the A fragment are processed smoothly. Therefore, the initial dip is similar to the starting frame of the B fragment.

The third is between fragment A and B. At the same time, the last three frames of the B fragment and the first three frames of the A fragment are smoothed. Therefore, the B fragment is smooth transition to the A fragment. The fusion of action fragments has been widely used. The action fusion formula is shown as follows:

$$\varphi(t) = C_1(t)(1 - v(t)) + C_2(t)v(t), (v(t) \in (0,1)) \quad (4)$$

The key is the selection of v(t). The fusion data in this paper is the rotation freedom of the human joint with internal coupling. First, the Euler angle values in the non-Euclidean space should be transformed to the angle value of the Euclidean space through the rotation matrix transformation, the four element number conversion and the logarithm map. The interpolation is performed in the Euclidean space, and then it is invert to the Euler angle of the non - Euclidean space.

3. ANALYSIS OF EXPERIMENTAL RESULTS

3.1 Results Of Sports Editing

Based on the above algorithm, we take the trampoline data as the experimental data and do the experiments of multiple trampoline action segments. The order of actions is from top to bottom and from left to right. For the action data with few fragments, one of the successive action segments is similar to the human posture. The new action sequence generated by the correlation action fragment layout algorithm is applied. At the same time, the graphical analysis of the continuity of human gravity is provided. As shown in figure 1, the new sequence may not be realized in the physical practice when the posture difference between the first and the end of the action fragment is relatively large.

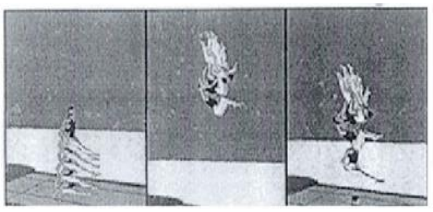

Figure 1: Arrangement results of the two action segments with relatively large difference in posture at the end and the head

In this paper, an action scheduling algorithm based on motion capture is proposed in the generation of virtual human action in 3D animation. First, according to the stipulation of the algorithm for two action segments to be arranged, the head and the end are alike, we use motion capture technology to get human motion parameters in real life. Then, through the motion image, the action affine transformation and the offset mapping, the selected action fragments are rearranged to form a new action sequence. The experimental results show that the action arrangement effect is not only vivid, but also maintains the continuity of action in mathematics.

3.2 Synchronous Multimedia System

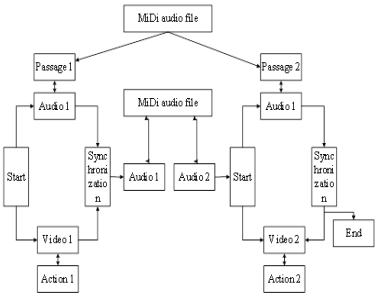

Figure 2: The temporal relationship between streaming media objects

Synchronous multimedia system is the synchronization of multiple video and audio in a certain sequence. Synchronization can be divided into three categories according to time relation, including synchronization between media streams, synchronization in media streams and synchronization between media objects. Figure 2 is the temporal relationship between the various media objects in a multimedia system.

3.3 Harmonization of sound and dance

In this paper, the output media information is formally defined, and the multimedia output synchronization control model is shown in figure 3.

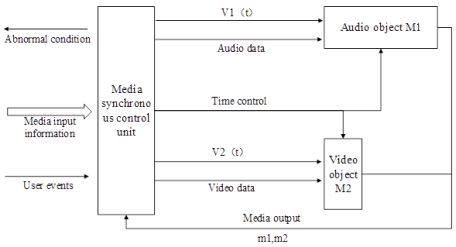

Figure 3: Multimedia output synchronous control model

It is assumed that there are only two kinds of multimedia information in the system: audio and video, which are represented by f1 and f2 respectively. t represents the time. F= (f1,f2) is the expected output function. f1(t) and f2(t) represent the time information of audio signal ft and video signal f2 at the t time. F represents the temporal relationship of the output f1 and f2. F, I1 and I2 constitute the input I of the system. As shown in figure 3, I1 and I2 are output data streams derived from the input information I of multimedia system. v1 and v2 represent the output speed of media objects. m1 and m2 represent video and audio playback information. In general, M has a functional relationship with variables V, I and t, that is, M = M (I, V, t).

4. CONCLUSION

Two interpolation methods, linear interpolation and four element number spherical interpolation, are applied to interpolate the real human motion information, which ensures the fidelity of the synthetic animation and avoids the jump caused by linear interpolation alone. To redirect the modified result to the virtual human, we perform exact data analysis for each action and reproduce the result in 3D scene through the action of virtual human. In the aspect of dancer's motion editing, it is required that the two action fragments to be arranged must have similar posture at the beginning and end stage, which is very easy to do in practical operation. First, the motion capture technology is used to get human motion parameters in real life. Then, offset mapping, action affine transformation, and motion mirror are used to arrange selected action segments as a new action sequence. The experimental results show that the algorithm has a good effect. In the coordination of acoustic dance, the synchronized playback of audio and video was established starting from the interrelationship between action sequences and audio passages.

REFERENCES

[1] Ruffaldi, E., Filippeschi, A. 2013. Structuring a virtual environment for sport training: A case study on rowing technique, 61(4), 390-397.

[2] Chen, D. J., Maffei, A., Ferreirar, J., Akillioglu, H., Khabazzi, M. R., Zhang, X. 2016. A virtual environment for the management and development of cyber-physical manufacturing systems, IFAC-PapersOnLine, 48(7), 29-36.

[3] Müller, P., Schwerdel, D., Cappos, J. 2014. ToMaTo a Virtual Research Environment for Large Scale Distributed Systems Research, PIK - Praxis der Informationsverarbeitung und Kommunikation, 37(1), 23-32.

[4] Code, J., Clarke, M. J., Zap, N., Dede, C. 2013. The Utility of Using Immersive Virtual Environments for the Assessment of Science Inquiry Learning, Journal of Interactive Learning Research, 24(4), 371-396.

[5] Correia, V. 2013. Using Virtual environments to study interactions in sport performance, Allergy & Asthma Proceedings the Official Journal of Regional & State Allergy Societies, 32(3), 230-8.

[6] Sangeetha, M., Kalaivani, K., Priya, K. U. 2017. Mobile application for virtual sports environment, Journal of Advanced Research in Dynamical & Control Systems, 2017(4), 121-125.

[7] Vlasov, E., Paterikin, V. 2016. Optical information collaboration systems based on the volumetric virtual environment and the physical reality, Technological Design Institute of Scientific Instrument Engineering, 40(6), 972–975.

[8] Cai, J. Y., Zhang, P. P. 2017. The support environment construction for teaching and research of physical education based on emerging information technology, Journal of Computational & Theoretical Nanoscience, 14(4), 2015-2020.