

Research on Animation and Its Motion Capture Technology

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Abstract: Animation is a type of animated cartoon with strong visual impact and realistic effect, which has attracted more and more attention of computer animation. 3D motion capture technology is also widely used as a means to make animation. Motion capture technology is capable of measuring, tracking and recording the trajectories of objects in three-dimensional space and has been widely used in many research fields. The paper analyzed the animation production process, the bottleneck in animation production and the advantages of motion capture technology for animation production. The author also discussed the application and development of motion capture technology.

1. Introduction

Motion capture technology emerged in the late 1970s and was originally proposed by psychologist Johansson in the MLD (moving light display) experiment. In the 1980s, professor Calvert in Simon Fraser University, Carol from MIT and scholars Robertson and Walters conducted in-depth research on motion capture technology and this promoted the development of this technology [1]. In the 1990s, scholars represented by Tardif further promoted the motion capture technology, making the technology more mature. In recent years, motion capture technology has made rapid progress. Commercial motion capture devices have been introduced to the market, and motion capture technology has been widely used in digital protection, games, animation, ergonomics research, simulation training, virtual reality and other research areas. This paper focused on the application research of motion capture technology in these fields and discussed its development trend[2].

2. Overview of Motion Capture Technology

Motion capture technology is developed to solve the above problems. Motion capture technology refers to setting trackers in key parts of real moving objects (such as people and animals). By tracking and processing the position of these trackers, the computer records the motion data of moving objects to form motion data, and finally re-assigns animated model to these motion data to create a realistic and natural movement of the animated model. At present, the commonly used motion capture technologies are mechanical type, acoustic type, electromagnetic type and optical type. Among them, optical motion capture is the most common one with its high sampling rate, large range of performers' motion, and no restrictions on cables and mechanical devices. Therefore, the problem of character movement adjustment that has long plagued animators has been solved[3]. The specific conditions are shown in Table 1.

The process of optical motion capture is to set the calibration of the camera first, and then use the camera to capture the light spot of the key parts of the performer to form the image material. The light spots generated by the image material is processed by the computer system and then it will be matched and tracked in the virtual space. Finally, with the help of post-processing by the computer, the motion trajectories in the space are completely captured. These trajectories can endow the animation characters created by the animation software according to the motion capture redirection, so that we can realize many scenes that cannot be realized in real life. If you put a light spot on the key points of the performer's facial expressions, you can achieve expression capture, which is what many animators wish for.

Table 1 Classifications and characteristics of motion capture technology

Name	Mechanical motion	Acoustic motion	Electromagnetic motion	Optical motion	Video motion capture
System composition	Capture joints with sensors, rigid connecting links	Capture sound generator, receiver and processing unit	Capture electromagnetic generators, sensors and data processing units	Capture points, cameras, and data processing equipment	Camera and data processing equipment
Advantages	Fewer restrictions on the environment; low cost; simple calibration; high precision; real-time measurement; multiple objects can be simultaneously captured	Low cost; it can solve the problem of human body occlusion	Low cost; mature technology; good real-time performance; ability to record spatial position and direction of motion	The marking points are easy to wear; the motion is less limited; the sampling rate is high, which can satisfy most high-speed motion capture; the system has low expansion cost	No restrictions on capturing objects; low cost; it can be applied in complex environments
Disadvantages	It is inconvenient to wear; the action of the performer is more restricted	Sound is captured with low real-time performance; low precision; it is susceptible to noise interference	There can be no metal in the environment; the adopting rate is low; it is not suitable for high-speed motion capture	The overall cost of the system is high; the environment requirements are high; the system installation is complex; the marking points are confusing and it is easily occluded; the post-processing workload is large	It is difficult to implement; the algorithm is complex; the technology is not perfect

3. The Advantages of Motion Capture Technology in Animation

Expressions and movements are important expression forms of human emotions and desires. Motion capture technology has completed the work of digitizing expressions and movements, providing new human-computer interaction means, which is more direct and convenient than traditional keyboards and mice. The three-dimensional mouse and gesture recognition can be realized, and it can enable the operator to directly control the computer with natural movements and expressions, which provides a technical basis for the final realization of computer systems and robots that can understand human expressions and movements. In the virtual reality system, in order to realize the interaction between human, the virtual environment and the system, it is necessary to determine the position and direction of the participant's head, hands and body, accurately track and measure the actions of the participants, and detect these actions in real time. All data will be fed back to the display and control system. These tasks are indispensable for the virtual reality system, and it is also the research content of the motion capture technology[4].

Early 3D animation production relies mainly on the animator's frame-by-frame adjustment. This is not insufficient, and more importantly, the manually adjusted animation motion is not real. The emergence of motion capture technology has changed this situation. Based on motion capture

technology, many vivid animated characters have been created, such as the courageous creature Avatar in the 3D movie "Avatar", queer-looking Gollum in "The Lord of the Rings", and the mighty King Kong and horrible dinosaurs in "King Kong". These characters' vivid physical movements and well-rounded facial expressions are achieved by capturing real-world movements and expressions. The use of motion capture technology has substantially reduced the time required for traditional animation adjustments to 1/6. A lot of time and effort can be saved for the artistic creation and creativity of animation scripts. For the 3D animation production team, it is wise to take motion capture. Once the motion capture data is recorded, it can be applied to any virtual character. If you record a lot of motion data, it is equivalent to creating a large motion database. Animators can recombine and edit this data to create more motion data. Therefore, if the motion capture gets 40 minutes of data, it can basically be used to make 8-segment MTV clips.

It is expected to achieve magical special effects with integrated application of new technologies, such as 3D scanning and virtual studios. It is conceivable to scan a 80-year-old white-haired old woman with three-dimensional scanning technique to form a digital character model. Then, we can capture Jordan's movements to drive the movement of the old woman model. The audience will see that a 80-year-old woman dunks. You can even use the actors' performances to drive animal models and film real animal kingdom stories. As technology matures, technology will become more widely used. As the indispensable and most crucial part of the system, motion capture technology must show its more important position.

4. Application and Development of Motion Capture Technology

Beijing Film Academy, Communication University of China, Shenzhen Polytechnic and many other colleges have long been equipped with motion capture systems. At the same time, sports capture data has been widely used in teaching of 3D animation production, multimedia production, game simulation, film and television post production. Meanwhile, motion capture technology is constantly evolving, such as how to reduce the cost of motion capture, how to make the capture system more convenient and how to make motion capture suitable for video[5].

4.1 Application of motion capture technology.

The motion capture system was used in the animation production from the beginning, so the 3D motion capture technology is mainly applied to the teaching and creation of related majors, such as film and television animation, games and multimedia. In the field of film and television animation, the motion data captured by the motion capture technology can generate natural animations to reduce the manual editing of animations, which plays a great role in the animation effects of special scenes and the production of film titles. The application of motion capture technology abroad has produced a lot of shocking blockbusters. China has also applied this technology to complete the three-dimensional cartoon "The Legend of Qin" with the essence of Chinese martial arts. The games that are made with motion capture technology abroad are also numerous, such as the smooth and realistic football game "FIFA" and "World of Warcraft", one of the most popular online games. In addition to film and television animation and multimedia, motion capture technology has also begun to be applied in sports training, medical research, virtual reality, judicial reproduction and distance education. It can be expected that with the continuous improvement of its technical level, the motion capture technology will be more deeply and widely used.

4.2 Development of motion capture technology.

Motion capture technology itself also has development constraints. For example, the optical motion capture equipment is too expensive; we need to stick special light spot on the performer; workload of post-adjustment and error data correction is heavy. Therefore, the motion capture technology itself is constantly developing and improving. In the optical motion capture process, it is precisely the use of the light spot that causes many problems in the post processing of motion data. Researchers in the field are currently using image processing techniques and video processing techniques to identify the trajectory of the performer rather than directly capturing the information

of the light spot, thereby simplifying the capture process[6]. For example, in the 2006 SIGGRAPH (Special Interest Group on Computer Graphics and Interactive Techniques) seminar, MOVA company published the latest technology "Contour" that can accurately scan human facial expressions. This technology changes the light spot into a phosphor to capture data. The cost was greatly reduced; at the SIGGRAPH seminar in 2008, iPi Soft company released the "Shoo t3D" desktop motion capture system, which used only one digital camera and also reduced the cost of motion capture to some extent.

5. Summary

The emergence of animation technology has brought revolutionary changes to film and television special effects production and animated cartoon technology. It greatly improves the efficiency of animation production, reduces costs, and makes the animation process more intuitive and vivid. Motion capture technology can also be used for robotic remote control. The robot transmits the information in the dangerous environment to the controller, and the controller makes various actions according to the information. The motion capture system captures the motion, transmits it to the robot in real time and controls the robot to perform the same action. Compared with the traditional remote control method, the system can be more detailed and complex. It can be expected that with the development of technology and the improvement of the technical level of related application fields, motion capture technology will be more and more widely used.

References

- [1] Xiang Zerui, Zhi Jinyi, Xu Bochu and Li Juan. Review of Motion Capture Technology and Its Applied Research [J]. Applications Research of Computer, 2013, 30 (08): 2241-2245.
- [2] Ye Xin. An Applied Research of 3D Motion Capture Technology [J]. Electronic Technology and Software Engineering, 2016 (07): 87.
- [3] Zhou Yiguo, Wu Sai. Integrated Application of Dynamic Capture Technology and Key Frame Technology in 3D Animation [J]. Art Education Research, 2016 (09):89.
- [4] Liu Bing. An Application Analysis of Motion Capture Technology in Film and TV Animation Production [J]. Television Technology, 2018, 42 (10): 46-49.
- [5] Song Qiang. Motion Capture and Motion Control Technology in Film Production [J]. Advanced Motion Picture Technology, 2017 (02): 29-32.
- [6] Zhang Kebo. Frame-by-frame Shooting and Animation Ontology in the Context of Digital Technology [J]. Art of Design (Journal of Shandong University of Arts and Design), 2017 (02): 90-93.