Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2015, 7(3):1098-1100

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Motion caption applied in sports training system

Yuxiang Wu

School of Physical Education, Jianghan University, Wuhan, China

---

ABSTRACT

This paper aims at real-time and reality, reaches a new precision level in foundation of guaranteeing it's real-time, and uses the device to assist training, and create an applied training system based on motion capture. The significance of advancing the reality and real time of motion-capture is summarized and the development actuality of the motion-capture systems is depicted.

Key words: Motion caption; sports training; real-time

INTRODUCTION

Motion Capture is to record the motion track in three dimensions by sensor devices, to transform it to motion data, and then to drive the virtual human to move based on these data.

In recent years, there are a lot of works done on the Motion Capture outside nation and many systems on Motion Capture have been provided to use. But all of the systems are so expensive that few institutes or companies in our country can afford. A few institutes in our country have been engaging in the business for several yeas, however, the images collected by the system made by them are often planar and have no three-dimensional motion parameter because the images are captured by cameras and have to be disposed on sensibility experience. As a result, it is very necessary to design a 3D Motion Capture system by ourselves to fulfill the internal demand.

Ball Animation Algorithm of Virtual motion caption

This section studies ball's motion animation in the large scale scene. Spherical object is a kind of basic geometric object, with broad representation. Here mainly considered for virtual shooting system, studying the elastic deformation of the spherical surface and parabolic motion animation of spherical object. Elastic deformation is a common pattern of deformation, after the object occurred the deformation, it can restore the original shape according to the elastic model. The algorithm of elastic deformation is based on particle system, at the same time, gridless method is adopted to improve the efficiency of the calculation of deformation[5]. It will make each vertex of the dimensional objects that formed the three-dimensional deformation as particle, thus, the deformed object can represent a particle system, by controlling the particle, it can also change the shape of object. At the same time, it sets up a corresponding target position for each particle that consisted of the deformation objects. After occurring the deformation, elastic power will pull the particles to the target position, so that the deformed object can restore the original shape, the object in the thesis that is dealt with deformed algorithm is a three-dimensional object composed by the particle with quality and initial position. Because there is no connected information between each particles, so it need not consider the interaction between particles, it only need consider the collision of particle and environment, as well as the external force of the particle.It is assumed that the corresponding relationship is known between the initial shape and the actual shape of the object[6]. Therefore, the main task is to determine the optimal rigid transformation of the two point clouds, the problem can be stated as follows: for the two groups of given point: xi and x0, calculate the rotation matrix R and the translation vector t and t0, minimizing the formula below:

$$\sum_i w_i (R(x_i^0 - t_0) + t - x_i)^2 \quad (1)$$

Among them, mi is the weight value of each point, apparently the optimal translation vector is the centroid of the initial shape and the actual shape, i.e.:

$$t_0 = x_{cm}^0 = \frac{\sum_i m_i x_i^0}{\sum_i m_i}, t = x_{cm} = \frac{\sum_i m_i x_i}{\sum_i m_i} \quad (2)$$

Among them, T_{vv} is a symmetric matrix, containing only scaling without rotation. Therefore, the optimum rotary torque array R is the rotating part of matrix $T_{uv,}$ through the polar decomposition $T_{uv} = R \cdot S$, R can be obtained, among them, $S = \sqrt{T_{uv}^T T_{uv}}$ is the symmetric part, $R = T_{UV} S^{-1}$ is the rotating part, the final target position can be calculated by the following formula:

$$g_i = R(x_i^0 - x_{cm}^0) + x_{cm} \quad (3)$$

Among them, a is the parameter of object's hardness, f_{ext} is the external force on the particle. According to the algorithm of elastic deformation, it can realize the simulation of object's deformation.

$$v_i = (t + \Delta t) = v_i(t) + a\frac{g_i(t) - x_{i(t)}}{\Delta t} + \Delta t \cdot f_{ext}(t)/m_i \quad (4)$$

$$x_i(t + \Delta t) = x_i(t) + \Delta t \cdot v_i(t + \Delta t) \quad (5)$$

Check the Algorithm of Elastic Deformation

The deformed object used here is the 3D model of basketball, from the left to the right is the process of the ball falling from the sky to the ground, collided and deformed, bounced back to the air, and restored to the original shape[7]. By using the algorithm of elastic deformation proposed in this thesis to simulate the deformation of basketball, after the deformation of the sphere, it can be recovered to the original shape. The following described the performance of the algorithm of elastic deformation, it can be seen, as the number of particles of the deformed object is increased, the rendering speed is decreased , this is because with the increased size of the particles, it requires more resources to calculate the deformation; but compared with the calculation of not adopting deformation algorithm, adopting the algorithm of deformation does not make the rendering speed dropped a lot, this because in this thesis it adopts gridless method, which dose not need to consider,the interaction between the particles, thus, it reduces the complexity and improves the efficiency of calculation. Therefore, the algorithm of elastic deformation can be enough to meet the need of real-time rendering.

Tab. 1 The Performance of Algorithm of Elastic Deformation

Rendering frames The number of particles	2710	3050	3745
The algorithm without deformation algorithm	59FPS	52FPS	45FPS
The algorithm added with deformation algorithm	49FPS	43FPS	37FPS

According to the analysis of virtual shooting of basketball. First of all, basketball games are usually held indoors, so there is no interference of wind and rain. The influence of the power from the gravity and air resistance in the process of basketball's rapid flight is far greater than the effect of buoyancy of the air and air pressure. Therefore, it can ignore the influence factors of air buoyancy and air pressure. Secondly, the moving distance of basketball is much smaller than the radius of the earth. So, it can be assumed that the surface of the earth is flat rather than spherical and it can ignore the Coriolis inertial force caused by the rotation of the earth. Finally, assuming that the shape of basketball is in the spherical shape with standard axial symmetry during the flight, the effect of the air friction on the speed of basketball can also be ignored.

The motion model proposed in this thesis is mainly considering the effect of gravity and the air resistance on basketball. Through analyzing the force of gravity and the air resistance, the flight trajectory of basketball is a parabola. The parabola trajectory of basketball and the final landing point is depended on the initial velocity vector that fingers of athletes left basketball, including velocity and direction. Fig.2 use *X'*, *Y* and *Z* as 3D coordinate to describe the motion model of basketball. The *X'* axis represents the horizontal direction from hand to basketball rack,*Y* axis represents the moving height of basketball. It can be assumed that the deflexion-angle of *X'* axis and the direction of the actual shooting in *X'Z* plane is *a*. Assuming X_k axis is the projection of basketball's flying parabolic path in *X'Z* plane. The following is the analysis on X_kY, which is as shown in Fig. 1:

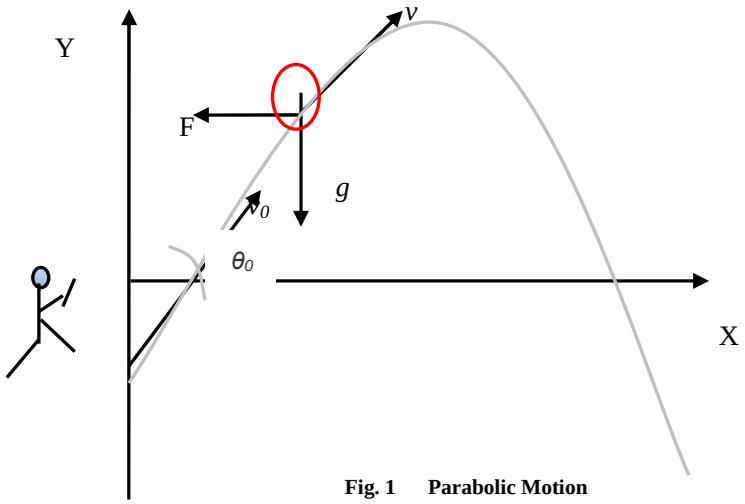

Fig. 1 Parabolic Motion

Virtual 3D shooting regards the shooting as an independent and complete system, using the information feedback function of the system to correct errors in each exercise timely, which can make the action more and more reasonable, and the system can evaluate from the initial disordered state to the ordered state, so as to reach a new equilibrium state, namely the action can form the dynamic stereotype. In the evolution process, the exercisers (students) are always controlling the technique shooting action, so as to the shooting action can be completed according to the set procedures.

Through this kind of teaching method, firstly it can make students understand shooting technique from the rational level, then use the rational understanding to guide practical exercises, the perceptual understanding from the practical experience can inspect the former rational understanding of in turn, so as to obtain the rational knowledge of standing shot, using the acquired rational standing shot knowledge to guide the practical standing shot technology, while in the conventional teaching of single-hand basket-shooting, students began it from learning by imitation, the wrong action is also occurred from the imitation, but the students don't know where they are wrong, they also do not know how to correct them, correcting them only by the teachers is often not timely and in low efficiency, which made waste phenomenon of re-correcting wrong actions after the correction. Therefore, after the experiment, through the retest of single-hand basket-shooting of the two classes of students, it got the data of hit rate and the data of technique assessment, so as to compare the results of the analysis.

CONCLUSION

The Sport Training System on athletics motion is very important in the development of sports. Studied on the sport Training System by motion of shooting, the system had been completed based on analyzing other assist-training systems with motion-capture devices. These methods can be used to correct the incorrect of the trainee.

REFERENCES

[1] Wang, H.G., The principle and application of computer simulation. *national defense university of science and technology press* . (**2004**).
[2] Williamson, O., Computer simulation technology applied in the field of sports teaching. *Sports research*. 68-70 (**2008**).
[3] Luo. X. D., *Education technology*. 53-54 (**2003**).
[4] Rajan, R., *Computer engineering and design*, 157-159(**2009**).
[5] Hu, Z.Y., *Journal of computers*, 149-156 (**2002**).