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# National Dances Protection Based on Motion Capture Technology

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**Abstract.** In order to preserve national dances of China, motion capture technique was used to imitate the dancer motion. In this paper, a human motion capture system was used to capture the dancer motion and analyze the captured data of human motion for animation design. First the data of the dancer motion can be obtained by the motion capture system. Then we matched the personal model with the entire image sequence to obtain a vector of motion parameters including body positions, at last creation of animations using the motion sequences. The experiment results show the national dance animation, which data was obtained by the motion capture system.

**Keywords:** Motion capture, Animation motion analysis, National dances protection

## 1. Introduction

Chinese national dances are considered as intangible cultural assets. However, some of them are disappearing because of lack of successors. Motion capture technique is used to preserve these dances in this paper. First the data of the actor motion can be obtained by the motion capture system, then creation of animations using the motion sequences.

In recent years, some researchers have presented a method to generate human motion based on human motion capture system. The technique in [1] presented the dynamic simulation of humanoid motion based on captured data. The method in [2] using a symbolic description of leg motion primitives, to create the real humanoid dance. In [3] demonstrated the dance motion of humanoid upper arms by capturing human dance. A method for matching the frames of human motions and creating blended motions according to the matching result was presented in [4].However, these papers analyze the captured data of human motion for animation design have not been discussed sufficiently.

In this paper, motion capture technique was used to imitate the dancer motion. System component is firstly presented in Section 2. Then in Section 3, motion capture system is established. Experimental results are given in Section 4. Conclusions are drawn in Section 5.

## 2. Overview of the system

Fig. 1 depicts the overview of the system. As it is shown in Fig. 1, the major steps of motion capturing and animation generation start with 1) capturing the dancer motion, 2) identifying the feature points and tracking the feature points, 3) correcting the feature points, 4) building a standard human model, and 5) generating animations

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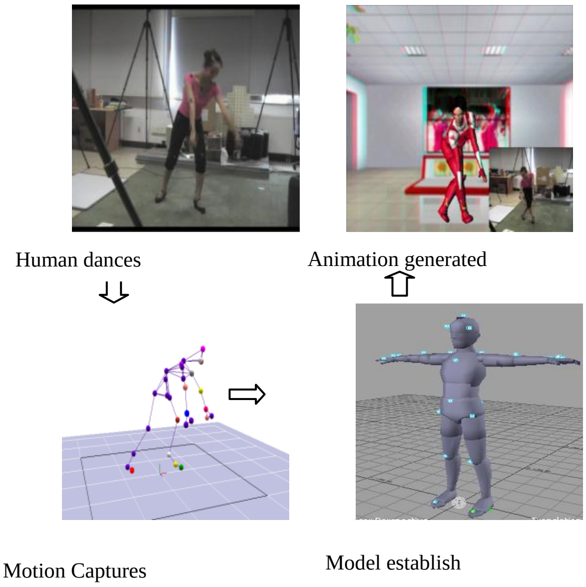


Fig. 1. Overview of the system

# 3. Motion capture

## 3.1. Motion capture system

The motion capture system was composed of 7 digital cameras and real time capture software. The dancer was asked to wear tight clothes with 29 reflective marks, which can be recognized by computer. Fig. 2 shows the dancer wearing close-fitting suit and the position of markers points, Fig. 3 shows the 3-D human motion data. Table 1 is the position of marker points.

Fig. 2. Dancer wearing close-fitting suit

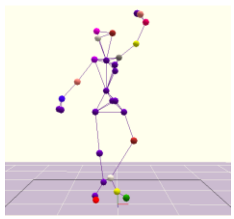

Fig. 3. 3-D human motion data

TABLE 1. THE POSITION OF MARKER POINTS

| Marker label | Position |
| --- | --- |
| HTOP | Top of the head |
| LFHD | Left front head |
| RFHD | Right front head |
| C7 | Seventh cervical vertebrae |
| T10 | Tenth thoracic vertebrae |
| CLAV | Clavicle |
| STRN | Sternum |
| RBAC | Right back |
| LSHO | Left shoulder |
| LELB | Left elbow |
| LWRA | Left wrist A |
| LWRB | Left wrist B |
| LFIN | Left finger |
| RSHO | Right shoulder |
| RELB | Right elbow |
| RWRA | Right wrist bar thumb side |

| | |
|---|---|
| RWRB | Right wrist bar pinkie side |
| RFIN | Right finger |
| LFWT | Left front waist |
| RFWT | Right front waist |
| BWT | Back middle |
| LKNE | Left knee |
| LANK | Left ankle |
| LMT5 | Left 5th metatarsal |
| LTOE | Left toe |
| RKNE | Right knee |
| RANK | Right ankle |
| RMT5 | Right 5th metatarsal |
| RTOE | Right toe |

### 3.2. Motion Collection

Motion capture technology tracks the key points of human body model from camera video sequences, and 3-D human motion recovery.

Firstly, according to camera tracking, get the two-dimensional coordinates of feature points in image. Then create the relationship between the 2D image coordinates and 3D object coordinates. This relationship needs to be determined by camera calibration. The relationship between image coordinates (u, v) and 3-D spatial coordinates (X, Y, Z) can be expressed by the matrix equation:

$$z_c \begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{d_x} & 0 & u_c \\ 0 & \frac{1}{d_y} & v_0 \\ 0 & 0 & 1 \end{bmatrix} \bullet \begin{bmatrix} f & 0 & 0 & 0 \\ 0 & f & 0 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \bullet \begin{bmatrix} R & t \\ 0^T & 1 \end{bmatrix} \bullet \begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix} \tag{1}$$

where Zc is length of spatial point in the direction z of the camera coordinate, dx and dy are the physical dimensions of a pixel and (u0,v0) is the origin of the pixel coordinate system, f is focal length of camera, (R, t) standard translation and rotation.

3-D human motion sequences can be recovered through feature tracking and calibration results. The basic idea is using the relationship between 2D image coordinates and 3D object coordinates transformation, which can recover 3-D coordinates of image points.

### 3.3. The process of 3-D data used in the animation

Motion capture data is Track Row Column (.TRC) format, which represents the raw form of tracking output and contains a header section and a motion section. All tracking markers were stored in a TRC file, which contains X-Y-Z position data for the reflective marker. The model can be colored or textured and can be scaled, translated and rotated. The motion capture data will match the model. Fig. 4 shows the human body model.

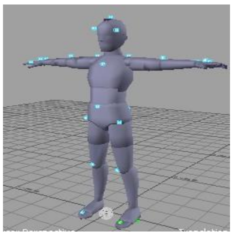

Fig.4. Human body model

## 4. Experimental results

In motion capture, reflective markers are attached to a person’s body and multiple infrared cameras are used to detect the positions of these markers in three-dimensional space.

The experimental apparatus was configured using a Motion Analysis Hawk-i motion capture system with 7 Hawk cameras. The 7 cameras were set up inside the measurement space so as to enable absolute coordinates to be measured in three dimensions within a space of 5m (x)* 5 m (y)* 2 m (z). We used a total of 29 markers in various locations from the head to the tips of the toes.

Fig. 5 shows Baishou dances animated video, the dancer action obtained through motion capture. Baishou dance is Chinese national dance. Using motion capture technology can imitate the dancer motion and preserve these dances.

Fig. 5. The national dances animated video and the dancer action

## 5. Conclusions

In this paper, motion capture technique is used to preserve Chinese national dances. First the data of the actor motion can be obtained by the motion capture system. Then we match the personal model with the entire image sequence to obtain a vector of motion parameters including body positions. The motion parameters will be used to drive various personal models for generating dynamic action. In the future, we should consider how to deal with occlusion between the motion capture data points.

## 6. Acknowledgements

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