# Using Animation Databases Interactively on the Network

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**Abstract** : This research is on an interactive animation prototype which can be used by many users from different computers, that means a network with one server and many clients. In our research, a complete motion is represented by simple motion characteristics. We establish databases which contain all kinds of human motion characteristics. Using flexible connection and appropriate time control, we are able to recompose a sequential serial motion data. Moreover, an interactive application system is needed among the users with a server from animator. In this research, we also investigate three methods of "connect motion database". We are planing to use the method of connecting motion database under networks with a client-server application system.

## 1 Introduction

A computer is used not only at complicated calculation, but also for playing as social media. We can obtain many kinds of information under the networking system using the interactive applications, for example, 'Talk', 'Chat', 'Netscape' etc. Under the condition of network,it is easy to seek some information needed, and possible to communicate by the words. In this paper we propose interactive system using our animation database.

The main contribution of this paper is found in two categories. The first purpose is to analyze living motions to emphasize some actors characteristics and save them in an animation database, then to recompose into a sequential movement from the database. The second is describe an animation interactive system by the animation database.

## 2 Animation Database

Animation is a technique of motion filming by successive drawings an illusion in motion when the film is shown sequentially. Normally in the animation production, the action of the actors is drawn by an animator. But in fact the action of the same species of actors or some animated animals, there are almost similar movements. According to this fact, we propose to collect those characteristic of the motion into a database. From the database, we recompose the motion of the lives in the virtual computer world. On this research we try this propose about the human motions.

The method to collect the data of the characteristic of human motions. we input the motion data from the animation system [2], which can visualize the character's motion by 24 segments **skeleton model**[2]. Depending on the visual motion in the animation system, we developed the characteristic and classification of the human motions.

## 2.1 Characteristics and Classification

We collected many kinds of the human motions from the image reference book[5]. then inputted those motions at the timing with the animation system[2]. In order to categorize those motion data, we classified motion characteristic as following.

### 2.1.1 Characteristics

After inputting the data of human motions by the animation system, and from the analysis of the motion at changing curvature, we can separate those motion into two states, **Static** and **Dynamic** shown in the Figure 1.

We can extend the two states into four types of **base data** : pause, starting, cycle, and stopping. The **base data** mean the lowest level of motion data used in this research.

### 2.1.2 Classification

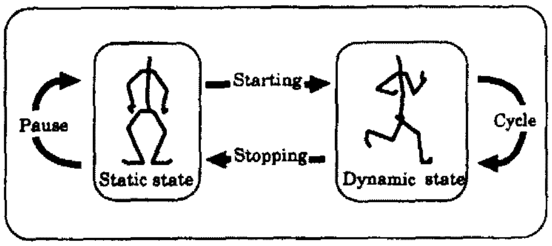


Figure 1: Static and Dynamic States

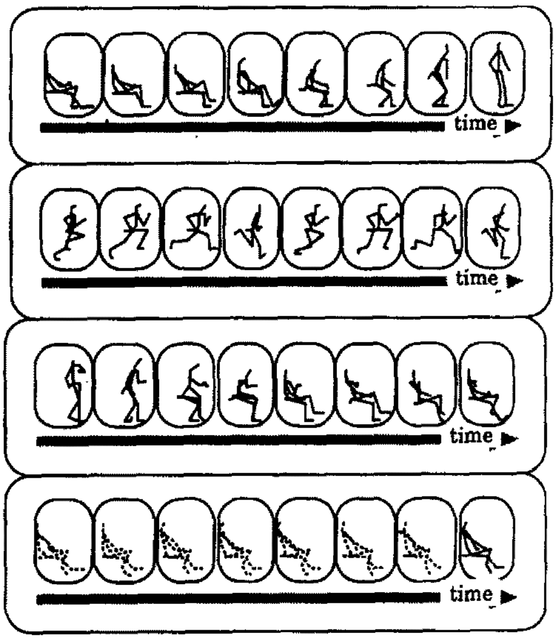


Figure 2: classification

According to the results of the characteristics, we established that the number $2^n$ be the frame number of the base data. We define those data:(1)**Pause** is a state when a character is under the static condition; (2)**Starting** is a character moving to change from the static condition to the dynamic; (3)**Cycle** is a stage when character is doing recurrent motion; (4)**Stopping** is a character varies the dynamic condition to static. Examples of those kinds of the motion data are shown in Figure 2.

## 2.2 Inbetweening and Connecting

After classifying all the necessary data, we introduce the method how to use those data and to connect two kinds of data.

### 2.2.1 Inbetweening

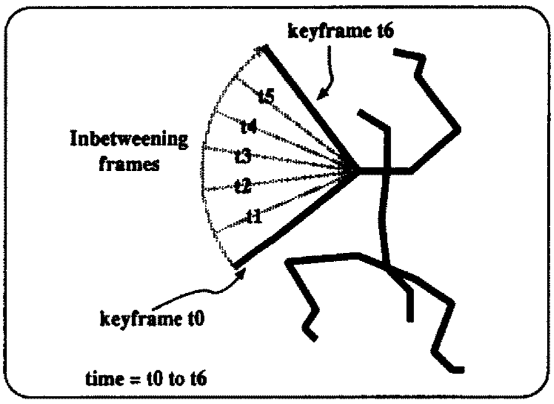


Figure 3: Inbetweening Frame

Inbetweening [3](Figure 3) is a method to facial expression between two keyframes with a linear interpolating. Besides it can control the timing to show in the animation. In our research, we saved 8 ($2^3$) frames (Figure 2) to define the default number of the base data, we called them **key-frames**, and used 5 inbetween frames to control the timing and facial the motion.

### 2.2.2 Connecting Method

We proposed three simple methods [1] to connect between two base data into one sequential motion data.

First method is to construct the inbetween keyframes which shown on following formula 1. According to the formula 1 to connect between base data of starting and of cycle, we pick out the characteristics from the last keyframe of base data of starting, and several characteristic frames from base data of the cycle. Using those characteristic frames, we are able to compose the inbetween keyframes to connect two base data.

$$\mathrm{kf_i} = \frac{(\mathrm{up_k} \times (\frac{k}{2} - i + 1)) + (\mathrm{down}_{i\times 2-1} \times i)}{\frac{k}{2} + 1} \tag{1}$$

Second method is to construct the inbetween keyframes which shown on following formula 2. According to the formula 2 to connect between two base data of the cycle, we pick out the several characteristic frames from both base data of the cycle. Using those characteristic frames, we are able to compose the inbetween keyframes to connect two base data.

$$\mathrm{kf_i} = \frac{(\mathrm{up_i} \times (k - i + 1)) + (\mathrm{down_i} \times i)}{k + 1} \tag{2}$$

Third method is to construct the inbetween keyframes which shown on following formula 3. According to the formula 3 to connect between base data of cycle and of stopping, we pick out several characteristics from base data of the cycle, and the first characteristic keyframe from base data of stopping. Using those characteristic frames, we are able to compose inbetween keyframes to connect two base data.

$$\mathrm{kf_i} = \frac{(\mathrm{up}_{i\times 2-1} \times i) + (\mathrm{down_1} \times (\frac{k}{2} - i + 1))}{\frac{k}{2} + 1} \tag{3}$$

## 2.3 Composition

We propose how to compose a sequential motion data shown in the Figure 4.

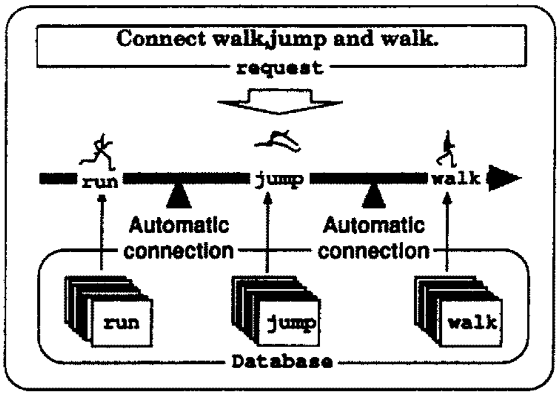


Figure 4: Using Animation Database

We explain the method how to recompose a sequence series of data from several base data. This system needs some of rules to adopt the Formula 1, 2 and 3.

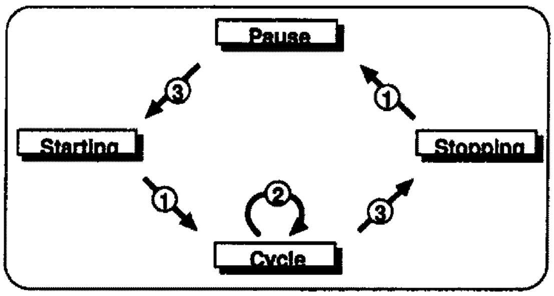


Figure 5: Connecting Rule

Figure 5 shows the rule of connection among all the base data. We have to connect those data with the rule, in order to let the system can pick out all the characteristics from the base data.

After we know the rule of the connection, the system performs the connection inbetween the two base data. We show the simple progress of the work at Figure 6. When the system repeats this progress, we can obtain a sequence motion data.

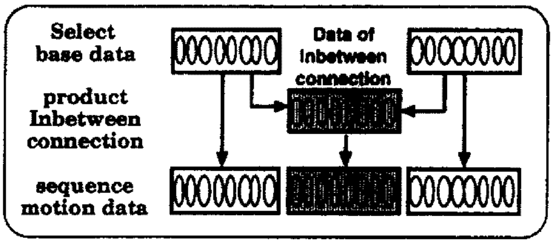


Figure 6: Method of Connecting

## 2.4 Experiment

Figure 7 shows sequence motions which are built by 4 base data, (1) **starting motion**,(2)-(3) **cycle motion**,(4) **stopping motion**.

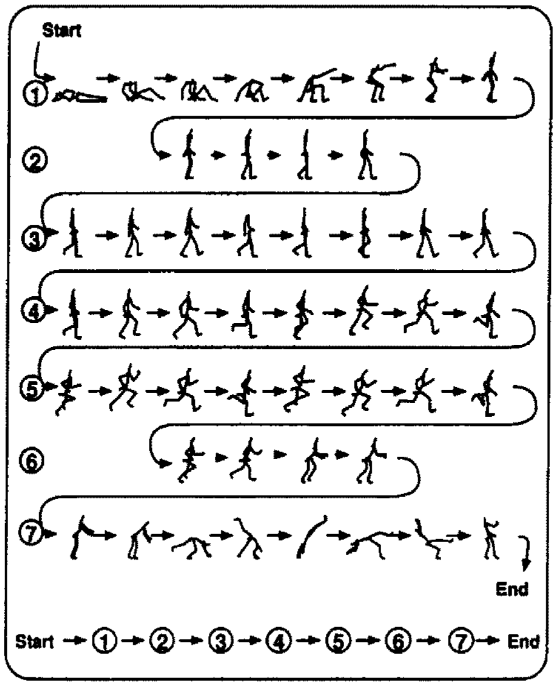


Figure 7: Example of Sequential Series Animation Data

# 3 Animation Interactive Network system

By the results of section 2.2 and 2.3, it becomes to merge two base data into one sequential motion data. We used those function to apply into an animation interactive network system which shown in Figure 8.

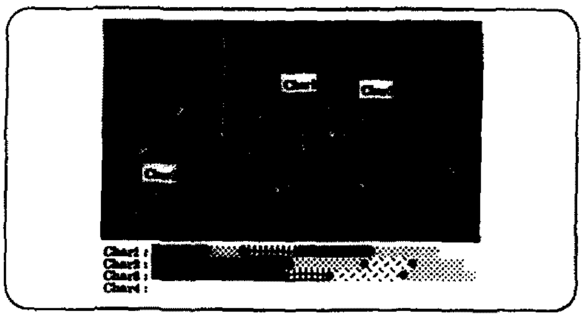

Figure 8: Character's Running Path

This system is model of a **puppet show** that works together by multi users at the same virtual field, and controlling different motions of a character at the same time. This application is constructed the network under UNIX operating system, We are doing the test under IPC[4](*Inter Process Communication*).

## 3.1 Client Application

The network of this study is carried out by one server and multi clients application. Client application is an animation development application under a 3-dimensional virtual field. Inside this application, we can point the running path for the character in the virtual field, and edit the different types of the motion along the running path.

The clients can work on the communication mode, or singular mode. The communication mode(Figure 9) means that, user can use the application along with multi users together on a same virtual field at a same time. They can see each other about the character motion, and edit the motion together with other users. Singular mode means that, the application is out of communication network.

## 3.2 Server Application

The duty of the Server in this system is to control the communication among the clients. The server has to allow or reject the clients. Besides, the server receives a script report from the clients and let them know to every client to make communicate whole virtual field in a real time(Figure 9).

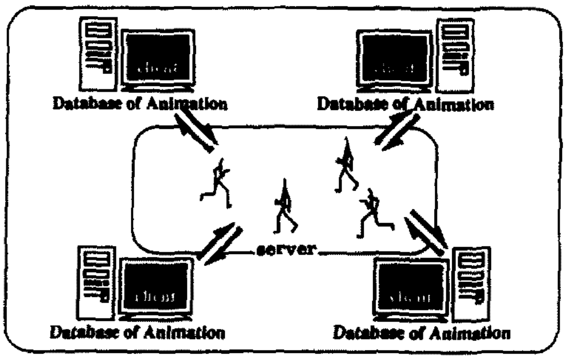


Figure 9: Interactive Network System

# 4 Conclusion

We established an animation development system with motion database. First we classified the motion database from the characteristic of human motion onto computer visual field. Then we proposed three methods to create sequential several motion data from base data. Finally we construct an interactive animation development system in the network.

# References

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