Conducting and Performing Virtual Orchestra

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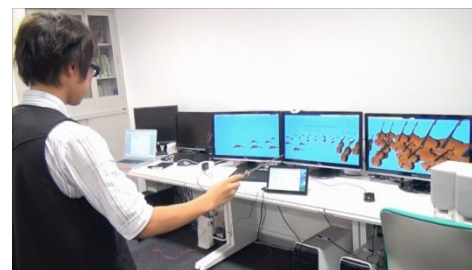
Figure 1. *Performance Scene of Virtual Orchestra.*

Figure 2. *Conducting Virtual Orchestra.*

1. Introduction

There are a lot of people who have had yearning for conducting orchestra. It must be a very pleasant experience to coordinate orchestra performance with your own conduct, but it requires a vast amount of money. With such needs, there have been researches to simulate the situation of conducting orchestra by using gesture recognition [Usa][Baba][Sunagawa]. But, they do not generate performance scenes.

Schertenleib, et al., generated performance scenes by using 3DCG model instruments [Schertenleib]. However, performance information such as *slur* is not considered at generation of performance scenes.

Our research aims at representing the situation that an orchestra is playing with 3DCG by considering performance scene generation. Our purpose is to represent the atmosphere close to the one a user actually conducts the orchestra.

2. System Functions

We have developed a system which installs three functions to realize conducting and performing virtual orchestra. Details of three functions are described in the following sub-chapters. We have newly built up a performance scene generation function utilizing the performance information obtained from the music piece playback and the performance control function.

2.1 Conductor's Baton Movement Chart Recognition Function

When a user takes a gesture of conducting baton, the system recognizes the gesture. We experimentally built a conductor's baton type controller, in which IR-LED is installed as an input interface.

The conductor's baton movement chart drawn with the baton is represented as tangential direction at the arbitrary point on the chart as the quantized 16 directional chain code. Our system based on Hidden Markov Model recognizes the conducting gesture precisely by representing such fluctuations as probability.

2.2 Piece Playback and Performance Control Function

When a user changes a gesture of conducing baton, the system can play a piece of music by changing its tempo and volume. The recognition results are obtained discretely. However, as a piece of music has to be played in a series, future playback tempo has to be estimated from the past beat recognition result. Our system predicts the future tempo from the beat information of a certain amount of time in the past by using least-square approach. Due to

this playback method based on the prediction, music continues without any break.

2.3 Performance Scene Generation Function

The system needs to equip a function to visualize the situations of the orchestra being performed by using 3DCG, in synchronization with the music piece playback and the performance control function described in the previous sub-chapter.

In addition, this system analyzes the messages sent from MIDI in details and seeks for the information regarding performance techniques such as *slur* and *bowing*, *pizzicato* (see Figures 3, 4, and the supplemental movie). It generates the performance scene according to the performance information acquired automatically and in real time.
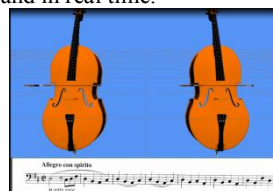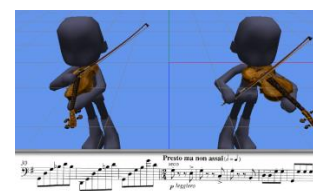

Figure 3. *Slur.*

Figure 4. *Pizzicato and Bowing.*

3. Results

Our system applies Microsoft's XNA and represents the orchestra performance scene with 3DCG model instruments in animation. Figures 1, 2, and the supplemental movie are the representation of the virtual orchestra with the application of XNA.

4. Conclusions

We have realized the method to control musical performance by recognizing conductor's conducting gesture, and the method to generate 3DCG animation of instruments played. This system has made the experience of orchestra conduct possible.

References

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