3D MOTION ANALYSIS AND ITS APPLICATION IN ADAPTIVE DANCE EDUCATION SYSTEM

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DOCTOR OF PHILOSOPHY

CITY UNIVERSITY OF HONG KONG

SEPTEMBER 2012

CITY UNIVERSITY OF HONG KONG
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3D Motion Analysis and Its Application in Adaptive Dance Education System
三維人體動作分析及其在智能舞蹈教學系統中的應用

submitted to
Department of Computer Science
電腦科學系
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
哲學博士學位

by

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September 2012
二零一二年九月

Abstract

Dance, as an art of the body movement, has great impact on our lives. However, learning to dance is a non-trivial task. In this dissertation, an adaptive educational system for dance education is presented to guide students in learning dances. It provides a virtual reality learning environment with an efficient two-phase dance lesson.

Learning the whole dance at once would overwhelm most students, and for that reason, the dance is divided into small segments which we call patterns by extracting the repetitions. These patterns are treated as the learning objects in phase-1 learning. In order to achieve an organized learning, the prerequisite structure is then automatically built by considering the relations between the learning objects. Then based on the prerequisite structure, we could build the knowledge structure. Finally, according to the proposed motion complexity measure, an easy-to-complex learning path while respecting the prerequisite relations is derived to guide the students in going through all the patterns.

People learn in many different ways. The preferred way people apply in learning is what psychologists called learning style. Adapting different learning strategies to different learning styles yields better learning experience. In this dissertation, we proposed a novel rule-based approach to detect the students' learning styles (holist or serialist). The approach could infer the students' learning styles by analyzing the students' navigation along the prerequisite structure. Based on the detected learning style, we proposed a method to extend the phase-1 learning environment into a learning style based adaptive learning environment. Adaptive navigation support is implemented to facilitate the phase-1 learning, two major techniques are involved, i.e., adaptive order-

ing and adaptive annotation.

After dividing the dance into small segments, the next issue to address is to guide the students to string these patterns together into the full dance. In order to do that, an adaptive discrete increments of instruction is presented, the size of increment is dynamically adjusted during the learning process. The learning process of the phase-2 adapts to the student's background knowledge and preference. It keeps monitoring the students' performances during the learning process, and adaptively adding new patterns for the students to learn. Generally speaking, within the capacity of human working memory, the more the students have scored, the more the additional patterns will be presented. Adaptive navigation support based on the adaptive ordering and adaptive annotation is also implemented to facilitate the phase-2 learning.

In this dissertation, we proposed an automatic way to construct the prerequisite structure which serves as the basis for further deriving the two-phase lesson. We proposed to automatically derive an easy-to-complex phase-1 lesson to guide the students in learning the patterns. Furthermore, we proposed a rule-based approach to detect the students' learning styles. By adapting to the different learning styles, the phase-1 learning environment is further extended into an adaptive learning environment. As for phase-2 learning, we provide the students with adaptive discrete increments of instruction to teach them to string these patterns together into the full dance. We have also implemented the proposed two-phase dance learning system called Dance Learning from Bottom-Up Structure (DL-BUS). Several user studies are conducted to evaluate the proposed system, t-test and chi-squared test were explored to study the collected data. The experiment results indicate that our proposed DL-BUS is an interesting and effective platform for dance education. DL-BUS will have a great impact on how people learn dance.

Keywords: motion capture, adaptive educational system, prerequisite structure, learning style

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