Research on the Application of Computer Big Data Technology in Artistic Innovation Design

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Abstract. This article uses computer big data methods to simulate and model the emergence of creative innovations in performances. Use computer symbolization theory and computer recognition technology to express different creative elements of performing arts on a computer. According to the characteristics of performing arts, we realize the computer modelling method based on projection decomposition and realize the segmentation and reorganization of video data with parallel and multi-core fast algorithms. The results show that the system can effectively improve the practicability, reliability and efficiency of the stage design.

Keywords: Computer, big data technology, Performance innovation, Projection decomposition, Artistic innovation.

1. Introduction

Digital performance, as a product of the development of digital technology in the information age, realizes the combination of performing arts and engineering technology, and makes performing arts digitized, systemized, and intelligent. Simulation technology provides theoretical foundation and technical support for cross-collaboration in multiple fields of digital performance. In response to the special creative needs of the three-dimensional digital stage, we have designed and developed a dynamic stage digital simulation and control system with rapid design, real-time preview, safety evaluation and implementation assistance capabilities, which can display and evaluate stage art creativity with high credibility to meet Various business needs from director design to project report. At the same time, it can output the state, position and various internal parameters of the stage art creativity in the simulation process [1]. It can not only be used for rapid design effect evaluation, but also can be directly output to the real stage mechanical system to achieve the combination of virtual and real, and provide strong performance for stage presentation. Strong support.

Master the law of creativity through computer modelling and automatically generate ideas by computer, and then use computer simulation technology to reproduce the ideas in three dimensions and integrate the system, and complete the realization process of the concentrated emergence of performance elements through experiments. Experiments have verified the feasibility of this intelligent emergence method of performance creativity,

2. System design and implementation

The design purpose of the digital performance arrangement system in this article is to quickly simulate and display the creativity of the editors in the computer, so that the editors can understand and master the visual effects of the formation creativity before rehearsing on the spot, and be timely to the creative formation [2]. Make adjustments to avoid waste in the field rehearsal due to the lack of understanding of the formation effect during the rehearsal of large-scale performances.

2.1 System implementation technical route

The system uses the visual development tool 3dsMax to model the virtual performance environment and virtual actors. Use motion capture equipment to collect the performance data of real actors, import them into 3dsMax, and drive the virtual actors to perform as individual motion data after optimization. The virtual development platform Vitriols is used to build the system framework, and the function modules provided by it are used to realize user interface control and process control

between various parts of the system. Based on the Vitriols framework, C++ programming language is used to write custom modules such as data access, virtual actor behaviour control and rendering control (Figure 1 is quoted in Potential for ITS/ICT solutions in urban freight management).

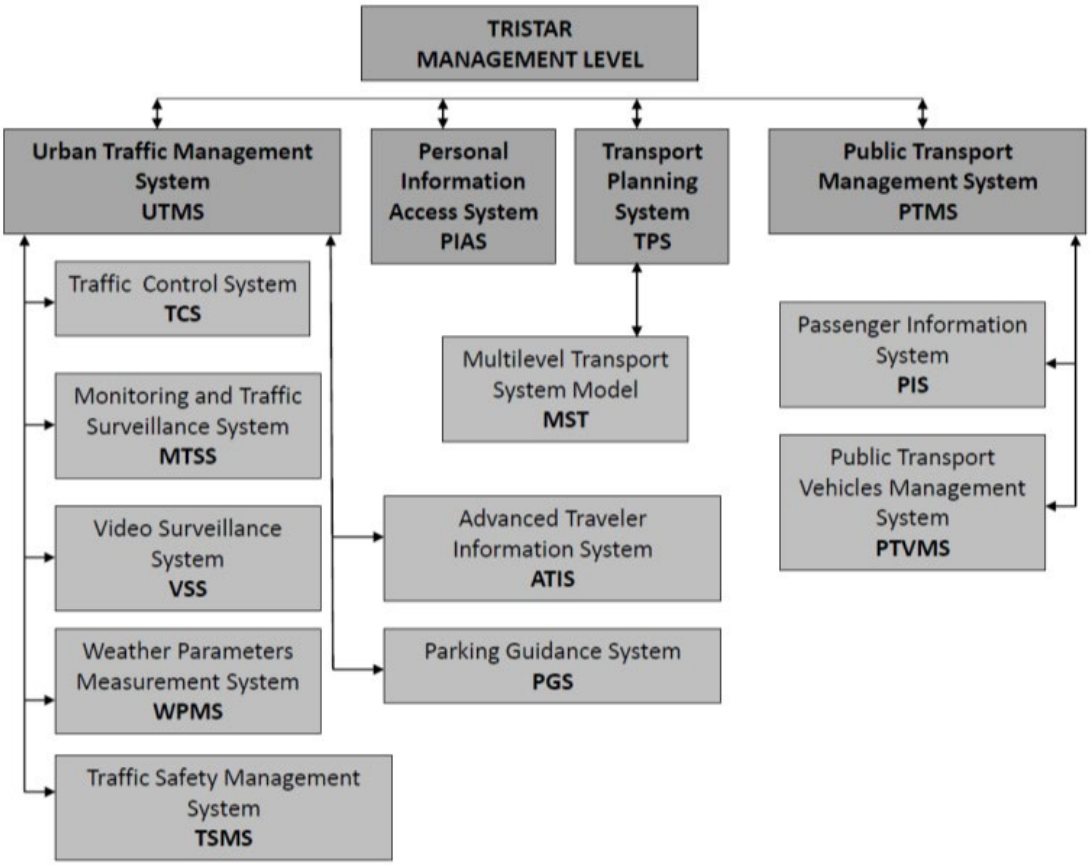


Figure 1. System implementation technical route

2.2 System composition

The digital performance simulation system consists of a three-dimensional arrangement module and a three-dimensional display module (Figure 2 is quoted in Evolving Connectionist Systems for Adaptive Sport Coaching).

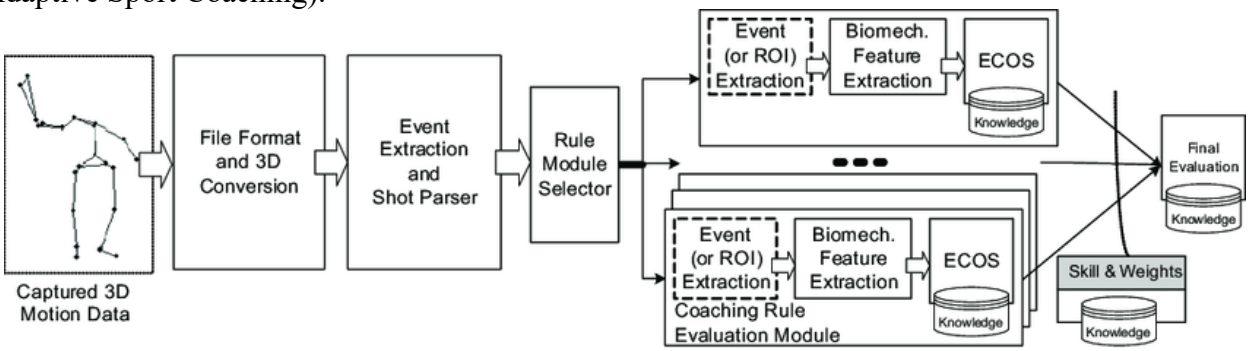


Figure 2. Three-dimensional choreography process

2.2.1 Three-dimensional layout module

The main function of the 3D arrangement module is to simulate the formation effect in the 3D virtual environment by adding three-dimensional elements, and to generate the actual formation formed by the virtual actors. According to the performance effect of the formation in the three-dimensional virtual environment, the editors can further edit and modify the performance formation, and add the three-dimensional constituent elements to the performance formation [3]. The technical route for the

realization of the 3D layout module is to add a 3D real scene operation area, an interactive operation interface and a formation converter to the system framework. These components jointly complete the orchestration function.

2.2.2 Three-dimensional display module

The position of the actors participating in the performance is determined by reorganizing the simplified geometric shapes. In the Vitriols 3D virtual scene display window, the current new queue composition form appears in front of the podium in real time. In this way, the director can have an overall and convenient understanding of the performance phalanx by using the three-dimensional arrangement tool in the two-dimensional interface at the stage of creative prototype [4]. The digital performance system in this paper performs real-time rendering of the scene and the performing crowd, and is based on Vitriols software with a high-tech human-computer interaction function, which makes the overall performance of the square array more realistic and the process of controlling the performance more convenient.

2.3 System functional structure design

According to the functional design requirements of dynamic stage digital simulation and control system, the system mainly includes video analysis, spatial analysis and calculation, core calculation, video output, three-dimensional simulation and other modules, as shown in Figure 3 (picture quoted in Potential for ITS/ICT solutions in urban freight management).

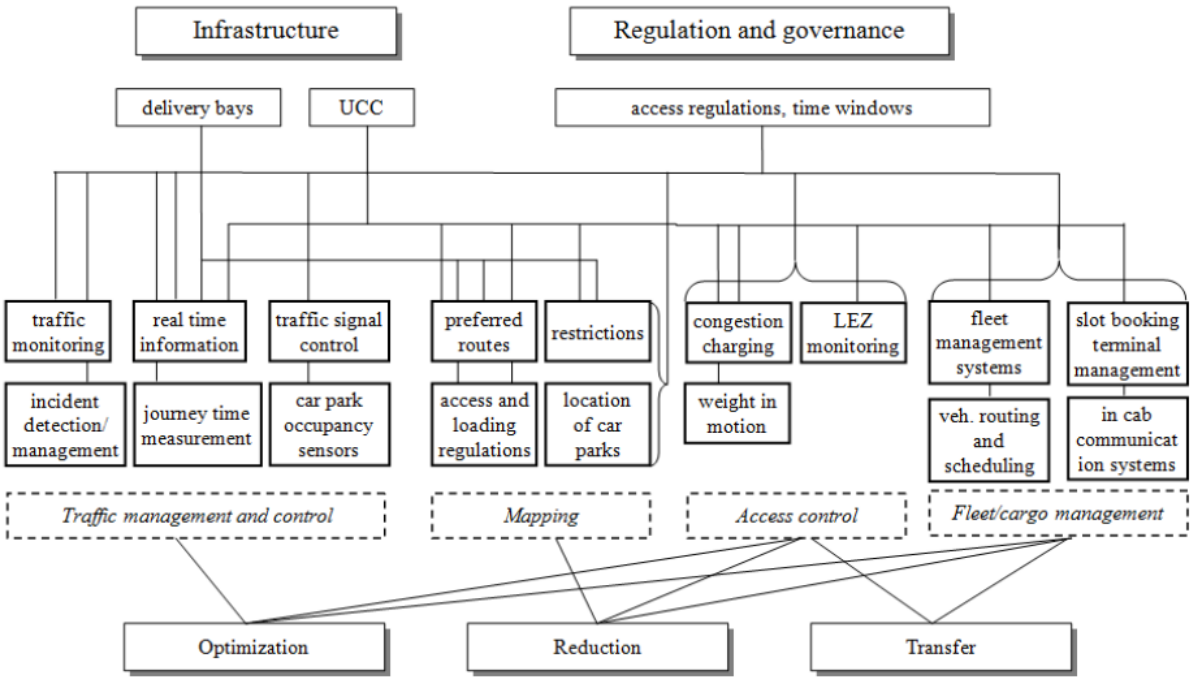


Figure 3. System function module design

The system first analyses the input video sequence through the video analysis module to complete the analysis and synthesis of the video image sequence. At the same time, the spatial analysis and calculation module analyses the basic geometric modelling data in the stage scene file, calculates the space position relationship of the stage, and uses the stage simulation data module to output the results. Then, according to the perspective projection law, the core computing module calculates the parsed video image sequence in accordance with the specified rules, using a parallel pipeline method to calculate frame by frame, and generates the final video file in the video output module [5]. During the operation of the system, the 3D simulation module reads the data output by the stage simulation data module, and maps the segmented and reorganized video image sequence in the core computing module to the stage simulation model to preview the stage scene modelling and creative effects in

real time. At the same time, Verify the accuracy of the stage scene data calculation and the editing and processing of the video data frame.

2.4 Three-dimensional simulation

The system uses VC++ and OpenGL technology to achieve a three-dimensional rendering and control engine to establish a dynamic three-dimensional simulation model of the stage in the virtual scene. According to the control principle of stage mechanical movement, by reading stage scene program data, namely cue file data, calculating the spatial position relationship of stage modules, performing behaviour modelling on stage movement changes, and real-time display of stage scene dynamic effects. At the same time, the image data of the core computing module reorganized and reorganized is mapped to the stage simulation model, so that the simulation effect is consistent with the actual stage effect, so that the stage effect can be used as a reference in real time.

3. Symbolic modelling of creative elements of performance

3.1 Analysis and realization of symbolic modelling of music elements

Music is an abstract and complex sound form that is different from language. It is composed of multi-layered sounds containing different time domain forms, frequency distributions and harmonic components: changes in characteristics constitute complex characteristics. The overall characteristics of music are formed on the basis of complex characteristics: Musical structure, musical style and emotional connotation. Where f is the original music signal and f_{mel} is the Mel scale.

$$f_{mel} = 2595 log_{10}\left(1+\frac{f}{700}\right) \tag{1}$$

3.2 Analysis and realization of symbolic modelling of stage beauty elements

Stage art design is the most important part of stage performance art. Stage art design depends on the script. Different scripts have different stage forms, stage wind halo, stage characters, stage costumes, stage lighting, stage props and other stage designs. So, the stage concept is closely related. Use light colour, light intensity and light movement to represent the state of stage lighting [6]. The light colour and light intensity can be identified according to the image, and the hue H in the HSV mode can be used to represent the light colour f_{color}. The brightness V can be used to represent the light intensity $f_{intensity}$. f_{move} represents the movement of the light. The more changes in two adjacent frames, the faster the light movement.

$$f_{light} = \left(f_{color}, f_{intensity}, f_{move}\right) \tag{2}$$

3.3 System interactive image processing algorithm

Through simple interface interaction, the system transfers the video image sequence into the memory frame by frame, reads the pixel data of the image, and divides it into several unit sub-blocks according to the row and column coordinates according to the perspective and projection rules, in a parallel pipeline manner, The pixel data of all images is edited through GDI according to the specified rules, and the data in the subdivision area of the source video image is copied to the corresponding position of the target video image, so as to realize the segmentation and reorganization of the video data frame [7]. Next, take the front part of the stage module as an example to introduce the calculation method of video data frame editing.

$$\begin{aligned} souX &= (col-1) * desW \\ souY &= \frac{m_Height - height}{Pn} + 0.5 \end{aligned} \tag{3}$$

In formula (3), souX and souY represent the coordinates of the area in the source video image where the data is re-divided. col represents the column value of the stage module. desW represents the width of the re-divided area of video image data. M-Height represents the maximum lift of the stage module. height represents the current movement height of the stage module. Pn represents the specification of the projection screen installed on the stage module.

4. System simulation experiment

Under the simulation environment of Core (TM)i7－2630QM8 core processor 4.0G memory, analyse the performance of the system from the processor utilization, the reading time of video image data, the processing time and the writing time (in seconds), See Table 1. To obtain performance test data, the system inputs 9 video files, each of which is 14 seconds long and contains 370 video image frames.

Table 1. System performance analysis

Number of threads	CPU utilization	Read time	Processing time	Write time
1	30%	100.498	19.850	154.882
5	61%	53.814	13.764	151.697
10	86%	48.463	12.308	151.494

Analysis of the data in Table 1 shows that compared to single-threaded processing, parallel multi-core processing can effectively improve system operating efficiency, increase processor utilization, reduce task switching time, and increase system throughput and concurrency. System operation consumes a lot of time in the process of disk accessing data.

5. Conclusion

This paper studies the existing theories in the field of digital performance simulation, and designs and implements a digital performance simulation system based on the virtual reality platform Vitriols. The system uses large-scale crowd simulation technology to realize the transformation of the performance formation, and simulates the formation transformation elements in the large-scale group performance; uses the methods of level-of-detail rendering, image-based rendering, pre-rendering light and shadow, and geometric instantiation to achieve real-time and efficient rendering. The elements of actors in large-scale group performances were simulated. Various performance elements in large-scale group performances have been well simulated and reproduced in this system, which provides the possibility for editors to make rapid creation, real-time rehearsal, and real-time modification, so that artistic creativity can be better reflected in large-scale group performances. When the system performs simulation rehearsal simulation on an ordinary PC, when each virtual actor in the scene is composed of 930 models, the number of virtual actors is 1000, and the frame rate of 3D rendering is 12 frames per second, which meets the needs of real-time simulation.

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