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Exploring Graphic Analysis with GIS-based Computer Image Processing Technology

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Abstract- This paper investigates using computer graphics processing systems for graphic analysis. It introduces a GIS model computation method to formulate processing equations for 1D, 2D, and 3D graphics. Through a series of traditional and modern comparative experiments, it is demonstrated that the computer graphics processing technology based on the GIS model holds greater relevance and applicability to modern society's development than traditional approaches. Furthermore, the study enriches the theory surrounding graphics application technology within GIS through an in-depth examination of computer graphics processing technology within the GIS model. This research sheds light on the potential of integrating GIS-based computational methods in computer graphics, offering insights into how such technologies can be harnessed to meet the evolving needs of contemporary society.

Keywords- Computer Image processing systems, GIS model computation method, 1D, 2D, and 3D graphics, Comparative experiments, Graphics application technology

1. INTRODUCTION

Computer graphics processing technology represents a hallmark of this era. Emerging as one of the defining technologies in the computer age, it possesses robust vitality and expansive developmental opportunities. Its widespread adoption has significantly enhanced the efficiency of people's production, daily life, work, and education, becoming an integral part of our routine activities. Various electronic computer graphics processing software such as 3D, CAD, Photoshop, and CAG have become commonplace tools in our daily lives. Computer graphics and image processing technology describe and analyse specific geometric data and models conceptually and mathematically processed within a computer system [1[. Key aspects encompass geometric transformations such as translation, scaling steps involved in processing, eliminating hidden lines and surfaces, debugging, shading, texture mapping analysis, graphic, digital coding processing, and colour packaging modification processing. In the computer graphics processing technology based on the GIS model proposed in this paper, the network computer serves as the development platform. Incorporating GIS into the computer graphics processing system offers the unique advantage of providing users with an interactive, dynamic experience akin to "living graphics" [2]. The widespread recognition of computer processing technology's applications across various fields underscores its importance. With advancements in computer image processing technology, the quality and clarity of visual outputs continue to improve, promising considerable future development. However, realising the full potential of computer image processing technology necessitates comprehensive study and ongoing development efforts [3].

COMPUTER IMAGE PROCESSING SYSTEM

Computer imaging research encompasses a broad spectrum comprising graphics hardware, technology standards, virtual reality, and other structural components. A graphic processing unit, an electronic circuit capable of swift mathematical calculations, plays a pivotal role in graphic rendering, machine learning, and video editing tasks, necessitating similar mathematical operations on large datasets. The primary objective is to transmit real image information through computer systems. Technicians construct a geometric expression system to depict scenes graphically, collaborating with lighting models and conducting computation and analysis. It serves as a method and data tool for describing complex object graphics. It predominantly focuses on modelling technologies for curves, surfaces, solid modelling, natural modelling, and simulation processes such as textures, clouds, and waves. Generating raster graphics algorithms and wireframe graphics constitutes the 3D scene [4]. The representation of 2D or 3D scenes forms the basis of computer graphics display theory and algorithms, facilitating realistic graphics. It facilitates the description and input of object graphics data. Graphic information data storage primarily involves data compression and decompression processing. Object graphics data processing primarily employs mixed rendering of images and graphics, visualisation, graphical interface, and virtual display. Object graphics data output and display primarily rely on graphics hardware and interaction technology. Real-time animation and multimedia technology encompass hardware and software methods for high-speed animation, related development tools, animation language, and multimedia technology. It formulates technical standards and requirements related to graphics application software. The existing computer graphics processing technology relies on internal graphics software to complete graphic processing tasks. However, this traditional graphics processing system has limitations, posing inconveniences to computer users. In response, innovative designs are emerging in computer graphics processing technology. Research and development are underway based on the GIS model, leading to designing a computer graphics processing system with GIS at its core. This system is bifurcated into hardware and software processing components based on GIS. The hardware processing system establishes spatial coordinate positioning relationships for computer peripherals, allowing users to perform graphics processing anywhere with electronic signals. The software system constitutes the key technology in computer graphic processing, enabling the classification and processing of graphics into 1D, 2D, and 3D as users require.

Moreover, it enhances the overall storage capacity of the host computer, preventing program stalls during execution and ensuring a higher CPU smooth frequency for the entire computer operating system. The GIS-based hardware system provides technical support for the software system, ensuring the smooth execution of computer graphics processing. Its primary objective is processing 1D, 2D, and 3D graphics through the GIS model, categorising graphics based on spatial coefficients and executing processing steps such as filling, cutting, restoration, design, and operation accordingly. This GIS-based graphics processing technology showcases the benefits of scientific advancements for human welfare.

COMPUTATION METHOD BASED ON GIS MODEL

This paper explores the application of the GIS model in the computation of computer graphics software systems. The utilisation of the GIS model for processing graphics data has now reached the terabyte level, facilitating the quantisation of graphics processing data at an unprecedented rate, with computations performed every second. The key distinction between GIS-based graphics processing computations and traditional methods lies in the ability to input virtual graphics data into the software system and subsequently conduct virtual estimation computations, thereby maximising work efficiency. Moreover, comprehensive and efficient access to network resources is achievable within the virtual environment [5].

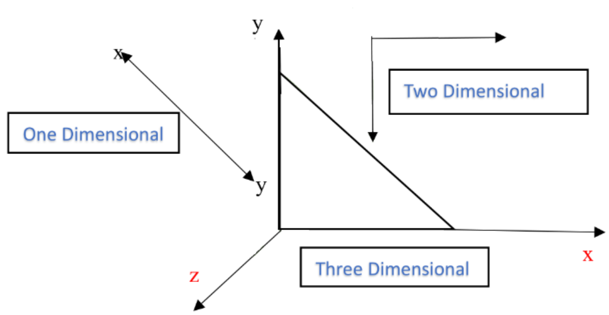

Figure 1. Represent 1D , 2D and 3D

1D GRAPHICS COMPUTATION METHOD

Applying the GIS model to 1D graphics computation primarily relies on the "block data addition" concept within the GIS model framework. In Equation 1, A represents the computation result of 1D graphics, where 'a' denotes the coefficient of points ranging from the first point of the 1D graphics processing in space to the nth point, and 'b' denotes the coefficient of lines from the first line to the nth line in space. The computation result of 1D graphics processing is obtained by adding the sum of points and lines.

$$A = (a_1 + a_2, ... + a_n) + (b_1 + b_2, ... + b_n) \quad (1)$$

We can determine from Equation (1) whether the arrangement of midpoints and lines in the 1D space is appropriate in the graphic design. If $A > 3.14n$, it indicates that the layout of dots and lines is unreasonable, necessitating a redesign of the 1D graphic. Conversely, if $0 < A < 3.14n$, it signifies that the layout of dots and lines is reasonable, and graphic processing for the 1D graphic is unnecessary.

2D GRAPHICS COMPUTATION METHOD

The computation method for 2D graphics using the GIS model primarily relies on the "step-by-step data addition" approach within the GIS model framework. In Equation (2), B represents the computation result of the 2D graph, where 'c' denotes the coefficient of the surface. The 'm' and 'n' represent sets of spatial and non-data spatial surfaces, respectively. Ultimately, the summation of these sets of spatial and non-data spatial surfaces yields the computation result of the 2D graphics processing in space.

$$B = \left(\sum_{i=1}^{m} c_i\right) + \left(\sum_{i=1}^{n} c_i\right) \quad (2)$$

In this Equation, the terms cici represent the coefficients of the surfaces within their respective sets. The summation of these coefficients from i=1i=1 to mm for spatial surfaces and from i=1i=1 to n for non-data spatial surfaces provides the overall computation result of the 2D space graphics processing. From Equation (2), we can determine whether the "surface graphics" in the 2D space align with the entire graphic layout in the design. If B>3.14n+3.14m, the configuration is unsuitable for the 2D space, and thus, the surface coefficients need to be adjusted. Conversely, if 0<B<3.14n+3.14m, it suggests that the configuration is suitable for the 2D space, and no graphics processing is required.

3D GRAPHICS COMPUTATION METHOD

The computation method for 3D graphics using the GIS model primarily relies on the "solid data addition" approach within the GIS model [6]. In Equation (3), the data operation sequence for each 3D graph is denoted by (XY), where the coefficient i≥1 in each pair of ordered operation sequences requires n_i=1,2,3,...,n−1, n. In this Equation, C represents the computation result of the 3D graphics, and X and Y denote the sequence number pairs.

$$C = \sum_{i=1}^{n}(X_i) + \sum_{i=1}^{n}(Y_i) + \sum_{i=1}^{n}(X_i + Y_i) \quad (3)$$

Here, the coefficients of X are summed separately, followed by the summation of the coefficients of Y. Finally, the sum of the total coefficients of X and Y is calculated again to obtain the computation result of the 3D graphics processing. From Equation (3), the "ordered number pair" computation results in 3D space can be obtained. The ordered number pair is the data that determines the structure of the 3D graphics; if C>33.14X+3.14Y, the structure of the 3D graphics is deemed unreasonable, potentially leading to chaos in the 3D space. Conversely, if C≤3.14X+3.14Y, the structure of the graphics space is stable, and no graphics processing is required.

EXPERIMENTAL ANALYSIS

Design and simulation experiments were conducted to validate the effectiveness of the computer image processing technology's design based on the GIS model. The experiment was conducted twice to test the graphics processing computation equations and the results of computer graphics classification and recognition. To ensure the experiment's effectiveness, we compared the traditional computer graphics processing method with the GIS model method proposed in this paper, yielding the experiment results. The comparison was made between the computation equations of the GIS model designed in this paper and the traditional computation equation method, with the test data standardised in the graphics processing process.

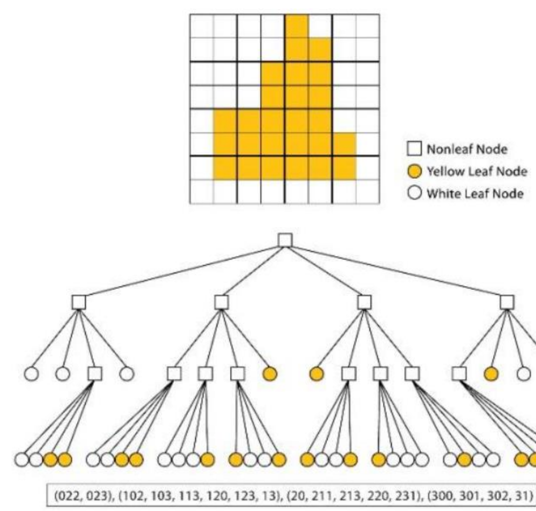

Figure 2. Represent the tree structure of the image

From the results of the graphics processing, it is evident that the computation equations of the GIS model designed in this paper achieve a processing degree of over 85% for one-dimensional, two-dimensional, and three-dimensional graphics. This illustrates the effectiveness of the graphics processing equations proposed in this paper. Therefore, the computation equations of the GIS model designed in this paper outperform those of the traditional method in the graphics processing computation represented in the equation experiment.

GRAPHIC CLASSIFICATION EXPERIMENT

The graph classification comparison results illustrate that the horizontal axis represents the strength of computer graphics processing capability, while the vertical axis represents the strength of graphics processing recognition. The figure demonstrates that the computer image processing technology based on the GIS model, as presented in this paper, outperforms traditional graphics processing technology. Notably, the strength of graphics processing ability and the recognition of graphics processing are significantly higher than traditional methods.

CONCLUSION

During its development, computer image processing technology has found extensive application in people's daily lives. With its foundation based on GIS, computer graphics technology has seen widespread adoption, greatly enhancing the convenience of people's work and lives. Furthermore, computer graphics processing technology has become a fundamental skill requisite for professional work and academic study. Its application extends beyond various industrial production fields to encompass the broader domain of social public infrastructure, reflecting its pervasive impact on modern society.

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