

Implementation of Multi-layer Switching and Loading Technology for 3D Panorama Platform

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Abstract: Three-dimensional panoramic technology is an important area for the application of new technologies in mapping geographic information, and is the direction of the current development of urban informatization. The establishment of three-dimensional panoramic views of the city can intuitively and truly provide people with all kinds of information for a full range of urban scenes. It subverts traditional urban planning construction concepts and management methods by integrating high-tech tools such as GIS, network, multimedia and virtual simulation. The three-dimensional panoramic technology provides more control and management methods to the city's planning and construction department, and then predicts the future development trend of the city. The three-dimensional panoramic view can display all the image information of the 360-degree scene in a real-time manner, which can give the viewer an immersive feeling. Because of these characteristics, digital 3D panoramas have begun to be applied in such fields as urban planning, product display, construction real estate, clothes display, hotel and guesthouse display, tourism scenery display, automobile display, corporate and academy display, post-building effects, and planning and display.

1. Introduction

The development of virtual reality technology has greatly promoted the construction of virtual campuses and the digital construction of campuses. The immersive browsing viewing is more convincing than the straightforward promotion. The autonomous interaction of the three-dimensional panoramic campus and the traditional passive viewing has a huge difference. Experts from the education industry once pointed out that the development of new technologies will also bring us new thinking modes, bring new solutions to problems, and bring about significant changes in the digital construction of the campus. Especially in the research of science and technology, the construction of virtual campuses, the exploration of virtual teaching methods, the opening of virtual experiments, and so on, it brings great opportunities.

The digital 3D panoramic campus is more intuitive, vivid and realistic than the traditional 2D campus webpage. The existing campus webpage abstracts the real campus into two-dimensional text descriptions and picture displays to allow users to understand the campus. Visitors who have not been to the campus can only construct imagined campus scenes in their minds. The three-dimensional

panoramic virtual campus reproduces the campus's natural environment and humanistic environment on the Internet, enabling users to fully understand the school's teaching facilities, teaching environment, classrooms, libraries, scientific research equipment, laboratories, etc.

In order to build a panoramic 3D platform with full precision and high precision, a single data source can no longer meet the needs of this project. Relying on the existing high-tech surveying and mapping equipment such as airborne LiDAR, on-board mobile measurement systems, and aerial drones, the high-precision airborne LiDAR data and high-resolution satellite remote sensing data are mainly used to assist UAVs in close-range photogrammetry data and onboard vehicles.

Different data sources have the expressive advantages of the data itself, but because of the different data acquisition methods, the adopted coordinate standards are not the same. In the data preprocessing stage, the appropriate coordinate conversion model and data adjustment model need to be selected according to the scope and size of the collected data area, and the multi-source data is converted into a unified coordinate reference, and the data accuracy is guaranteed.

2. Proposed Methodology

2.1 Point Cloud and Rapid Matching Technology of Optical Image Data

According to the time synchronization, the correspondence between the point cloud and each line of the line camera is obtained. Then, the pixel corresponding to the laser spot on the scan line is obtained from the spatial position and posture. Finally, read the corresponding image file and read the corresponding pixel value, and assign the pixel to the corresponding spatial position point. In this way, spatial color point cloud data containing color information is obtained, and point cloud data that incorporates color attribute information is more intuitive in terms of visual display, automatic classification, and intelligent modeling, and has great advantages.

Airborne LiDAR can accurately represent the top information of buildings, but it lacks access to building facade information, and vehicle LiDAR can accurately describe the geometric position and texture information of building facades. Therefore, the comprehensive use of airborne LiDAR and vehicle-mounted LiDAR data fully exploits the different advantages of both data sources and expands spatial and temporal resolution.

The in-vehicle LiDAR data was taken as the object of research to extract the outline of the building's floor. The edge information of the building facade (edge line) is another important feature of the building. Given that most buildings are vertical to the ground, the building is The projection of the surface edge on the plane is the outline of the building's floor.

The outline of the building reflects the important features of the building and is the key to the three-dimensional reconstruction of the building. Using the top point cloud of the airborne LiDAR building and the corresponding image data, the top contour vector map of the building was extracted, and the region growth algorithm was used to realize the segmentation and extraction of the gable roof and complex roof.

2.2 Virtual Reality Technology

Virtual reality is a realistic three-dimensional virtual reality environment that people use computer technology to create, for the user's simulation of sight, hearing, touch, and other senses, new technologies that can be interacted with by computers through the computer's input devices. Based on the many features of virtual reality technology and the rapid development of computer technology and virtual reality technology. At present, VR technology has achieved great success. While changing people's lifestyle, it is also considered to be one of several major technologies that could make a huge difference in the world in the 21st century.

Virtual reality is a kind of three-dimensional virtual reality environment established through modern computer technology. In the virtual reality environment, it is possible to participate in the virtual environment through the user's operations, and to obtain the immersive feeling visually and auditorily. The computer virtual reality technology provides the user with an interactive virtual reality environment and can interact with the objects in the virtual environment autonomously, thereby producing a visual, auditory and tactilely integrated experience.

Immersiveness is the immersive experience of the virtual environment in virtual reality technology. Immersion is also the main criterion for measuring the virtual reality environment.

Interactivity is the main feature of virtual reality technology that is different from traditional 3D animation. When watching 3D animation, the viewer is in a passive state of acceptance. The interaction of virtual reality makes it possible for people to create a dynamic relationship with the virtual reality environment and objects. The interactive effects. In the virtual reality environment, viewers are no longer passive observers of information, but can also participate in it.

The construction of virtual reality environment is the research focus of virtual reality technology. Constructing a virtual reality scene with strong immersion, high fidelity, and strong interaction is the ideal requirement of virtual reality technology. In the construction of virtual reality environment, it can be divided into two kinds based on the geometric modeling technology of graphics and three-dimensional panoramic modeling technology based on images.

2.3 Image-based Panoramic Modeling

With the development of virtual reality technology, based on the emergence of the three-position panoramic technology of sequence images, the modeling technology of images has become a new method of virtual reality scene construction. It overcomes the defects of traditional graphic modeling to some extent. Based on the image sequence modeling method, a series of sequence pictures is captured by the camera, and the virtual scene is reproduced through the post-splicing combination. This method is based on the use of camera capture to complete the image collection, so it is not limited by the complexity of the scene object, and it is close to the real natural environment to a large extent, which can make the viewer get a better sense of immersion.

Compared with traditional flat images, 3D panoramic images can express more image information and can be freely controlled with good interactive performance. Compared with computer graphics modeling, 3D panoramas can generate complex landscapes. Traditional 3D modeling based navigation objects are often imagined through creation or design. The generated environment is very limited, and image-based navigation is mainly based on real scenes. It can be based on various landscapes that exist in the real world.

Based on the various characteristics of three-dimensional panoramic images, three-dimensional panoramic images possess an extremely wide range of applications. At present, digital 3D panoramas have begun to be applied to many areas such as virtual campus construction, tourism landscape display, commercial product display, real estate display, hotel guesthouse display, and automobile display.

2.4 Three-dimensional Panoramic Platform Loading Technology

Before studying the panorama generation technique, it is necessary to theoretically understand the camera imaging geometry model and the resulting inter-image transformation model. It is the basis for generating panoramic images. In simple terms, the image transformation model and the camera imaging geometry are intrinsically linked. They are different external manifestations of the same type of concept. The transformation model between the captured images can be obtained by the camera imaging geometry; similarly, the information of the transformation model between the images

generally also reversibly pushes out the geometric posture of the camera when imaging. They are the mathematical basis for image registration and image stitching. Before the image is stitched, it is necessary to select an appropriate image transformation relation model according to the geometric relationship of the camera imaging. Mastering camera imaging geometry is also a basic prerequisite for image stitching. Therefore, before introducing the panoramic image generation technology, the model of the transformation relationship between camera imaging geometry and images is introduced.

The camera's different ways of movement will cause the scene to produce different imaging effects. The geometric relationships between these different effects of the image can be described by different image transformation models. The image transformation model describes the coordinate transformation relationship between two two-dimensional images.

When two or more cameras share the same viewpoint or photograph a plane scene, the acquired two-dimensional images can be related by a perspective transformation. The solution of each parameter of perspective transformation matrix H is the key content of various image registration algorithms. Transform matrix estimation algorithms can be divided into four categories: algebraic methods, geometric methods, robust methods, and statistical methods. The algebraic method is linear, so it is often called a linear estimation method. It obtains the estimation result through matrix singular value decomposition. Its principle is simple and easy to implement, but it is very sensitive to noise, unstable, and its estimation accuracy is poor. Geometric methods, which are nonlinear and require iterative calculations, are also often referred to as iterative estimation methods. Iterative methods are usually solved using iterative optimization techniques, and their computational complexity is always higher than that of algebraic methods. The above two methods are only applicable to the case where the measurement data has only a small measurement error, and are not applicable to the case where the measurement data contains an outlier (wrong data point). Once there is an outlier in the input data, even if the number of outliers is small, if the first two methods are used, the estimation results obtained may also deviate greatly from the real values. Robust methods can be identified externally. Commonly used robust methods such as M-estimation, Least Mean Value (LMEDS), Random Sample Consensus (RANSAC). Among them, RANSAC is a robust and widely used method for solving perspective transformation matrices. The statistical method estimates the model parameters under the probabilistic framework, and its calculation is more complex and refined.

Image feature points are points with distinct characteristics in the image. It is usually different from the neighborhood points in properties such as brightness, color, curvature, or texture. For example, corner points, line intersections, discontinuities, and the maximum curvature point on the contour. The feature point extraction technique is to detect and describe the points in the image that have attribute differences with the neighborhood points. The selected feature points should be obvious, easy to extract, and have enough distribution in the image. In order to uniquely identify the requirements of each feature point and subsequent feature point matching module, a small neighborhood of the feature point is often selected as the center point, and a description sub-vector of the feature point is generated according to a certain measure.

Feature point matching is to find a special feature point formed by projection of a 3D field of view in an overlapping field of view in two two-dimensional images. A high-dimensional vector is used to describe feature point matching. Therefore, it is generally used between two feature vectors. The distance of several miles describes the similarity of two feature points. The two pairs of feature point pairs with the smallest and the second-smallest Euclidean distance are called the nearest neighbor and the second nearest neighbor respectively. Therefore, the feature matching problem is essentially a problem of searching for the nearest neighbor in a high-dimensional space. The simplest method of feature point matching is to use the exhaustive method to find the nearest neighbors of the matching feature points in the feature point set. However, the exhaustive method has a large time cost, and a

mismatch occurs when there is no corresponding matching point in the feature points to be matched. Lowe is based on the phenomenon that the Euclidian distance between the correct matching vectors in the high-dimensional space is generally significantly smaller than the Euclidean distance between the wrong matching vectors. The ratio between the nearest neighbor distance and the second nearest neighbor distance is used to determine whether the correct match point is effectively reduced. The probability of occurrence of the above mis-match is small.

3. Conclusion

The three-dimensional platform system is based on a three-dimensional data management platform to compile and publish three-dimensional modeling data, image data, and terrain data, and publish and manage data services and various types of query analysis services. The platform supports complete services such as sharing, publishing, browsing, editing, analysis and retrieval of massive three-dimensional geographic information data. It provides a complete solution for three-dimensional geographic information services that supports "data-software-service-application" integration.

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