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Review Article

Discussion on the Construction of Spatiotemporal Big Data Platform for Smart City

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Abstract: The so-called smart city is a new form of information technology that is achieved through the integration of the contemporary advanced big data technology, Internet of Things technology, cloud computing technology, and spatial geographic information. At present, the application of this technology is important for the urban construction, planning, and services as well as management. This technology also provides great convenience in these aspects, which has allowed the cities to develop and transform towards the direction of smart cities. Based on this situation, the construction of spatiotemporal big data platforms in smart cities was analyzed in this article, and this analysis may provide a reference for the construction and development of today's smart cities.

Keywords: Smart city, Space-time, Big data platform, Construction

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1 Introduction

In the current era that epitomizes informationization, the construction of smart cities will play a very active role in promoting the development and integration of informationization, industrialization, urbanization, and agricultural modernization in the present society. Therefore, the construction of smart cities has become the direction and goal of the construction and development of today's cities, and the construction of smart spatiotemporal infrastructure through the spatiotemporal big data platform will be an important foundation in the construction of smart cities.

2 Discussion on the data update of smart space-time

2.1 Update of the incremental area

In the process of updating the traditional basic surveying and mapping data, a fixed-cycle update mode that is filled with complete elements is usually applied. This update mode requires not only a long period but also a high cost, so this update method is no longer possible to effectively meet the data needs of the public and the departments in government today. Therefore, the translation technology of intelligent satellite remote sensing has begun to be applied to the update of surveying and mapping data. Through this technology, information changes on the surface can be quickly discovered. Therefore, if this technology is combined with today's grid-based field collection teams, drones, volunteers or video surveillance equipment, it will play a key supporting role in the integration of the mapping system[1]. In this way, the basic spatiotemporal data increments of the sky, ground, and people can be updated in real time and effectively.

In the actual application process, satellite remote sensing images from different phases can acquire the landmark information of the distribution node of each province and city from all domestic satellite image cloud platforms. With the integration of the network, not only can the surface information be automatically discovered in time, changes can also be shared through deep learning interfaces. Grid field collection teams, drones, volunteers, or video surveillance equipment can collect altered surface information, and then use the integrated mapping system for matching, uniformization, correction of the basic information, and processing such as shooting and splicing, in order to update the surface data in any area in real time and any time.

2.2 Multi-scale linkage update

The biggest application value of spatiotemporal big data is the systematic analysis of data at the micro level and visual expression and presentation of the data at the macro level. In this process, it is necessary to analyze the basic spatiotemporal data by applying different scales. In the traditional basic surveying and mapping construction process, the system is usually divided according to national, provincial, and municipal levels. Since there is not a sufficient synchronization update mechanism between various levels, it is very common to repeatedly collect the same geographical elements[2]. Therefore, with the continuous development of today's measurement technology and the continuous improvement of the collection accuracy requirements of physical geographic elements, in order to allow timely update of basic spatiotemporal data of different scales to be updated in a timely manner, the technical design can be mainly carried out through the following routes:

2.2.1 Scale-free definition of the product model of geographic elements

In order to achieve the goal of multi-scale linkage update of basic spatiotemporal data, we must first abandon the traditional sub-scale database model and rely on these intelligent technologies such as stepless synthesis and automatic mapping to build a scale-free, unified geographical element database scheme. Through this model, spatial data can be organized with the help of physical objects in the geographic elements. Considering the highest accuracy as an important principle, each geographic element is collected only once and marked with a unique identifier. Taking the theory of expression in the cartography process as an effective basis, the accuracy, identification and content of each geographical element in the map are defined under different conditions of the scale. In this way, automatic linkage updates of specified scales can be performed according to actual needs.

2.2.2 Clarification of classification, construction and sharing of the production model

In the practical application of this technology, all existing hierarchical construction surveying, mapping results and production systems should be comprehensively analyzed and sorted out, and the geographic elements that were collected and maintained at national, provincial, and municipal level are clarified in the correct order. In this process, the frequency of various geographic element updates and the integration and sharing channels of geographic elements among these three levels should also be clarified.

2.2.3 Using stepless synthesis as the basis to achieve linkage update

Based on the product model described above, the construction of a municipal-level geographic feature collection database of the pilot city site using this spatiotemporal big data platform will allow the integration and sharing of the geographic feature data of these three levels, and further allow the standardization of feature attributes and the integrity of content of this scale-free geographic feature database. On this basis, through the application of stepless comprehensive software, the comprehensive indicators such as the accuracy of geographical elements, semantic resolution, and spatial resolution are further optimized, and data accuracy that is based on the needs of users can also be determined, automatically integrating from the original high-precision data to the specified low-precision data. Using stepless, comprehensive linkage updates as the basis for data collection of geographic elements, not only can the data of residents, rivers, roads, and vegetation be automatically integrated, but also multiple types of geographic element data can be intelligently and comprehensively integrated[3]. Through this linkage update method, not only can the basic spatial data be further improved, but also the investment in repeated collection of geographic element data can be effectively reduced, thereby saving the costs.

2.3 Update of the convergence of network crawling

In the spatiotemporal big data, the real-time sensing data and special data of the Internet of Things of different departments in the government are collected. In the process of updating these original data, the update frequency needs to be determined according to the actual business needs of each department. In the analysis and decision-making process of spatiotemporal big data, it is necessary to aggregate these data in advance or in real time, and fuse them with the basic spatiotemporal data. In order to effectively safeguard the current status of these data, network capture technology needs to be used to aggregate and update data from different sources. In addition, the task scheduler of spatial data platform can capture the corresponding position, content, and update frequency according to the requirements put forward by the user. This can help achieve intelligent customization of various processes and processing methods, thereby realizing the capture scheme. With the help of the ETL server, the task executor can dynamically classify and crawl the discovered data flow according to the frequency, uniformly track and record the captured results, and then apply the data cleansing to form the thematic database coupled with continuous updates.

3 Implementation of on-demand services

3.1 Reasonable construction of the platform's task knowledge base

During the construction of the knowledge base, the metadata information should be used as a basis to build a keyword-based knowledge base, and the corresponding relationships between the data, business flows, functions, and keywords in the resource pool should be reasonably constructed.

3.2 Intelligent analysis of tasks

By intelligently analyzing tasks based on semantics, specific requirements of online users such as keywords, natural testimonies, mouse operations, and input can be comprehensively identified and the functions, task keywords, and business processes and data that the users require can be refined. In this way, related functional services, interface services, and data services in the existing knowledge base can be identified and located.

3.3 Self-learning of the knowledge base

This platform allows the submission of the lists of keywords and services that cannot be associated with the existing items in the knowledge base, and then aggregate missing functions or data by means of real-time sensing, intelligent search, interface verification, and online scraping. After using for many times, the task knowledge base will naturally be enriched.

4 Reasonable selection of application focus

4.1 Considering natural resources as service support

In the process of establishing the Ministry of Natural Resources, the principle of "land, water, forest and lake" was mainly maintained in the institution, and as a community, it was systematically managed, thereby allowing the unification of exploration and utilization of natural resources. In the actual platform construction process, a comprehensive survey of natural resources, rational planning of land and space, reasonable use of all space, and attention to the protection of natural resources and ecological restoration should be conducted. Only in this way can this platform show its good application value and provide more precise service support for it.

4.2 Emphasizing knowledge mining and refined management

During the construction of this platform, the emphasis of the overall construction planning of the smart city should always be centered on the actual needs as a guide to solve the practical problems in the construction and development of the smart city. At the same time, it is also necessary to carry out a comprehensive development of the application of spatiotemporal information demonstration. The demonstration fields can be used in the transportation field, security supervision field, and public security field. The space-time analysis function in the platform can be applied reasonably, and the relevant knowledge and laws behind big data should be explored so that this platform would gradually become the brain of the city, and then provide more convenience for the management of government affairs and the lives of residents in smart cities.

4.3 Open service demonstration of government affairs

In order to effectively enhance the functions of this platform in terms of local characteristics and services for residents, the open service demonstration of government affairs should be carried out reasonably for the public. In the process of platform construction, it should be combined with various advanced technologies such as the Internet of Things, intelligent terminals, and mobile Internet technologies to deeply explore the local needs of the model. A wide array of spatiotemporal services can be carried out according to the hot topics that concern the residents.

5 Conclusion

Taken together, under the context of the era of accelerated urbanization, the construction of smart cities is also constantly progressing. The application of the spatiotemporal big data platform to the construction of smart cities will further improve the governance effect of the city, and enable the good integration and sharing of various resource information in the cities. This will play a positive role in promoting the construction and development of contemporary smart cities.

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