ON THE QUALITY INSPECTION SOFTWARE SYSTEM OF SURVEYING AND MAPPING GEOGRAPHIC INFORMATION ACHIEVEMENTS UNDER MULTI-DIMENSION SYNERGY

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ABSTRACT:

Quality inspection software is an important means of quality inspection and an important factor affecting quality inspection work. Facing the current situation and problems of quality inspection software for surveying and mapping geographic information achievements, and combining existing means and new technology, this paper puts forward a software system for quality inspection of surveying and mapping geographic information achievements under "Multi-Dimensional Synergy", which is composed of achievement dimension, project dimension, big data dimension, intelligence dimension and history dimension, expounds the work contents of surveying and mapping geographic information results quality inspection in various dimensions, introduces the relationship of business process and data flow between the multi dimensions. It provides the idea for the future research content and development direction of Surveying and mapping geographic information results quality inspection software.

1. BACKGROUND

With the increasingly rich spatial data achievement, various means, methods and sources, and increasing accuracy (Shen Tao et al., 2005), the time of data update is shorter and faster, the content and form of data are more and more diverse, and the organization and logic of data are becoming more and more complex, which puts forward higher requirements for quality inspection (Zhang Libo et al., 2020). At present, the quality inspection methods mainly rely on in-house inspection and field inspection. Limited by natural conditions, manpower, material resources, financial resources, construction period and other conditions, many projects mainly adopt internal inspection. In house inspection is mainly the use of quality inspection software to complete the inspection of all aspects of the product, supplemented by manual investigation. Therefore, the level of quality inspection software affects the effect and efficiency of in-house inspection.
The paper should have the following structure:

2. PRESENT

With the expansion of surveying and mapping geographic information application business and the development of IT technology, the existing quality inspection software reflects the deficiencies, which are mainly manifested in the following aspects.

2.1 Single inspection content

Lack of joint quality inspection among multiple products. Although the existing quality inspection has made great breakthrough in the accuracy, automation and operation efficiency, but most of the inspections focus on the internal constraints of a single type of product, such as the features of one layer cannot intersect the features of another layer, the features of one layer cannot be inside the features of another layer, etc. Modern surveying and mapping geographic information project has the characteristics of multi types and multi specification products. It is difficult to meet the quality control requirements by only checking a single type of product. On the basis of meeting the quality inspection of single product, it is necessary to consider the quality problems from the project level or the dimension information described by different types of products, explore a new method of interactive inspection of different types of products, and find the conflict and contradictions between different types of products.

2.2 Underutilization of reference data

Lack of usage and means for multi kinds of reference datas. With the enrichment of collection means, the current surveying and mapping geographic information has entered a period of data explosion. Most surveying and mapping geographic information projects need to refer to many existing data in the process of product production. These data involve many kinds, various forms, wide industries, and even include some open source, crowdfunding data and many non spatial data. The maturity of big data and cloud computing technology brings opportunities to the integration of these data. After cleaning, classifying, structuring and versioning these data, they are stored in relational and non relational databases to serve quality inspection and support quality inspection.

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2.3 Lack of Intelligent Technology

Lack of usage of Artificial intelligence technology. In recent years, the rapid development of artificial intelligence technology has made a great impact on all aspects of life. As an important branch of artificial intelligence, deep learning has been the most popular in the fields of image classification, object recognition, speech recognition, remote sensing application and so on. Extraction of buildings, road networks and other features based on deep learning has been a hot topic for decades. The quality inspection of Surveying and mapping geographic information has a strong demand in the classification, recognition, retrieval and extraction of remote sensing images. We can use deep learning to improve the accuracy of quality inspection and reduce the workload of manual review.

2.4 Lack of utilization of inspection achievements

Lack of usage of quality inspection achievements. The information of error location, scope, classification, description and screenshot produced in the quality inspection of various surveying and mapping geographic information in the past years are a collection of quality inspection knowledge and quality inspection cases. It can be fully utilized to analyze the situation of the inspection results in the geographical distribution, element type and quality problems, so as to check the current project in sampling area, sampling results, geographical elements and quality problems Reference basis is provided in the inspection.

3. MULTI-DIMENSIONAL SYNERGY

"Multi-Dimensional Synergy" is based on the summary of the existing process, method and means of quality inspection of surveying and mapping geographic information products, it is using all kinds of data in the process of quality inspection, combined with the current big data, cloud computing and artificial intelligence technology, the collaborative inspection method of surveying and mapping geographic information products is formed from the perspective of achievements, projects, big data, intelligent methods, historical achievements and experience, guided by inspection methods.

Figure 1. Multi-Dimensional Synergy.

3.1 Achievement Dimension

Achievement dimension is to find the internal quality problems of achievements from the dimension of single type of achievements, mainly based on the quality standards, relevant regulations and quality requirements of project achievements. This dimension has clear inspection process, strong basis, clear content and mature means.

3.2 Project Dimension

Project dimension is to find out the conflict points and contradictions between various achievements in the project according to the objective knowledge and project requirements. The inspection content of this dimension is uncertain and highly dependent on work experience. Quality inspection software has been explored in this dimension, but it is often customized, lacking in-depth research, summary and practice.

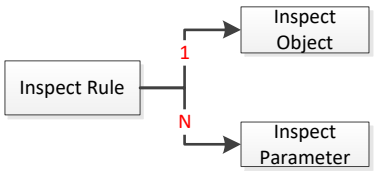

Figure 2 Inspect Rule Under Achievement Dimension

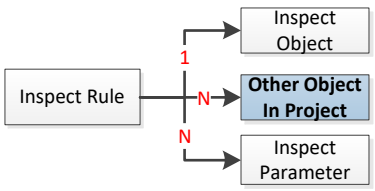

Figure 3 Inspect Rule Under Project Dimension

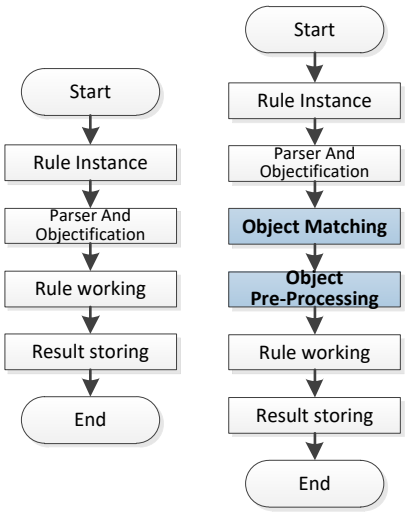

Figure 4 Inspect Rule Working Under Achievement Dimension And Project Dimension

At present, in some geographic information projects with large regions and multiple achievement categories, through reasonable organization, we have established links with different types of achievements in the same region and built a multi achievement joint quality inspection model, including between vectors, between vectors and grids, and between grids and grids.

3.3 Big data Dimension

Big data is also known as massive data. Generally speaking, the data that the amount of data exceeds a certain size, resulting in the failure of conventional software to capture, manage and

process it in an acceptable time range can be called big data (Mayer-Schönberger et al., 2013).

The relationship between big data and cloud computing can be summarized as follows: the core of cloud computing is business model, and its essence is data processing technology. Big data is its asset, which is the upgrading direction of cloud computing.(Xia JingBo et al., 2016)

In the quality inspection technology of Surveying and mapping geographic information achievements, we should use big data and cloud computing technology to establish big data dimension, effectively organize spatial data, non spatial data, open source data and crowdfunding data, and use them as reference data to establish the association between multi-source geospatial data, literature (Wu Ye, 2014,Wang Na et al., 2016, Jiang wei 2014) proposed an analysis system or association method for spatial entity relationship. On this basis, we can find the conflict and contradiction points between the inspection object and these data. Quality inspection software has explored this dimension, such as Wang Jindong and Han Wenli's literature(Wang JingDong et al., 2017), but due to the limitation of the technology at that time, no in-depth research and practice has been carried out. This dimension is based on the idea of inheriting the project dimension, and realizes the operation process of quality inspection software under the cloud framework to build the quality inspection cloud platform. Figure 5 shows the architecture of the quality inspection cloud platform. Based on the collection, cleaning and processing of open source and crowdfunding data, the effective cloud storage of spatial data including vector, image and metadata with geometric elements is carried out, and a multi-level, multi-feature class, multi method spatial index model is established; Non spatial data is organized and stored by IT common practice to form a data warehouse. Using the advantages of cloud platform in parallel computing, we can mine and verify the conflict points and contradictory points between data.

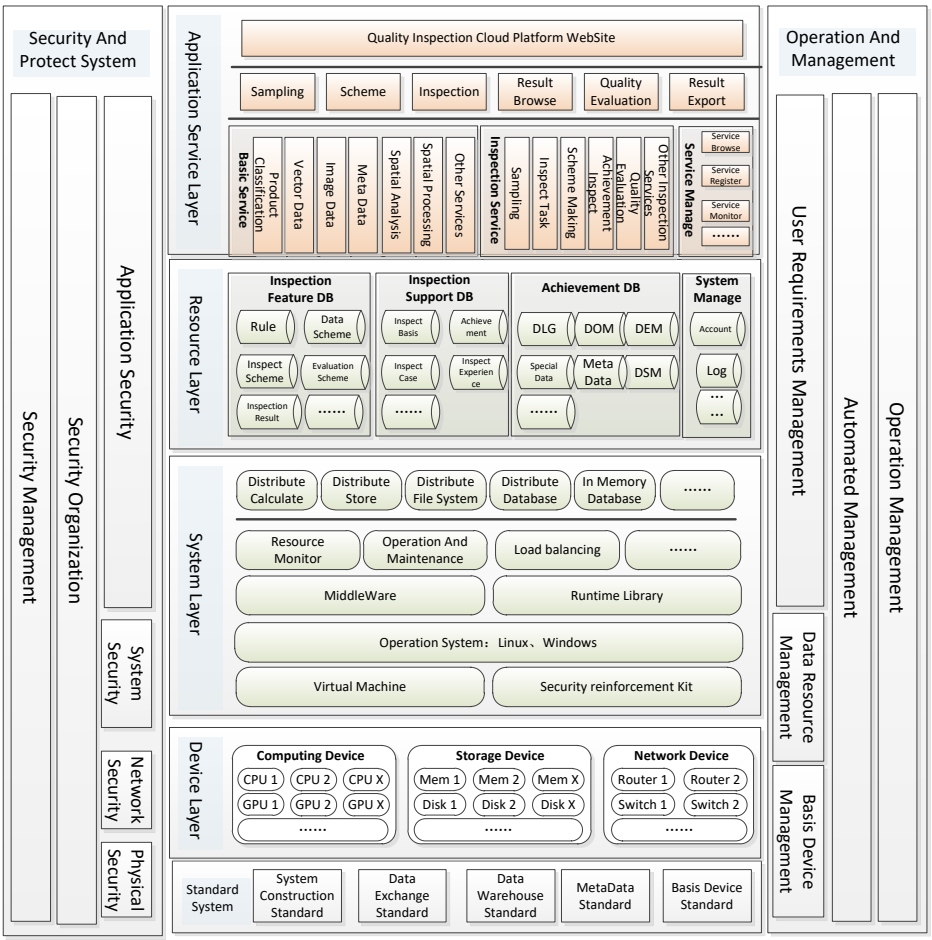

Figure 5 Quality Inspection Cloud Platform Framework

3.4 Intelligent Dimension

Artificial intelligence technology is an important technology in the fifth industrial revolution based on the development of big data technology, cloud computing technology and Internet industry.(Gao JingXiang et al., 2019) It mainly includes computer vision, deep learning, natural language processing, robotics, image recognition and speech recognition. For the surveying and mapping geographic information industry, the development of artificial intelligence technology will inject new blood into the industry's intelligence,(Yao ChengKuan, 2018) and speed up the process of Surveying and mapping geo information industry from the era of information mapping to the 4 era of intelligent surveying and mapping.(Huang ZhiHua, 2019)

The quality inspection of Surveying and mapping geographic information results should apply artificial intelligence technology to the whole process of data sampling, data inspection, evaluation output and other quality inspection business (Figure 6), providing data support, information support and functional support for each link of quality inspection business.

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At present, data sampling is mainly based on human experience. In the face of massive data sampling, it mainly depends on the work experience of experts, and lacks data and means support in comprehensiveness, purposefulness and historicity. Therefore, it needs the help of artificial intelligence from the aspects of project characteristics, topography distribution, sample distribution, road accessibility, inspection history and so on It is a new method of intelligent sampling.

At present, data inspection is mainly based on manual preset quality inspection scheme in terms of inspection content, lacking support in terms of depth and breadth of inspection content, and mainly based on automatic inspection and manual inspection in terms of inspection methods. Automatic inspection is mechanical, inflexible and false positive; manual inspection has a large amount of work, especially for the inspection of image data. Due to the lack of automatic inspection means, it is mainly manual inspection. Quality inspection scientists try to use deep learning method to classify remote sensing images, so as to solve the problem of classification accuracy in quality inspection, For example, Dang Yu and Zhang Jixian's research on land cover classification and evaluation of remote sensing image based on deep learning alexnet. Therefore, the data inspection needs the intervention of artificial intelligence in content and method, and the difficulties in data inspection need to be solved.

At present, the evaluation output is mainly manual. The evaluation of results and project quality needs to be carried out on the basis of review, classification and classification of inspection results. It requires higher requirements on personnel professionalism, work experience and control of overall quality of the project, which is one of the bottlenecks to improve the efficiency of quality inspection; The statistical analysis of quality is often ignored by quality inspection work. Because the quality inspection work is mostly task-based, the staff often take the issue of inspection report as the end point of the task, and the collection and statistical analysis of quality information such as the type, level and distribution of errors and omissions are less. All these need to be solved and improved by artificial intelligence.

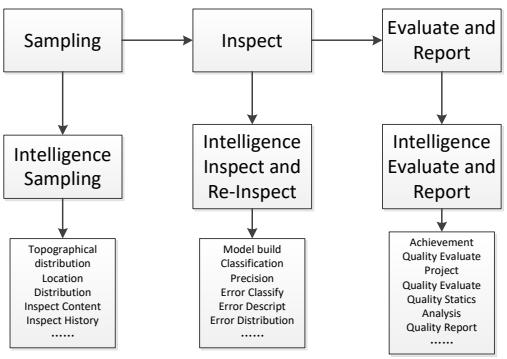

Figure 6 Intelligent In Different Inspect Step

Intelligent technology needs to be based on a large amount of data, and the calculation of a large amount of data can not rely on traditional methods. The quality inspection of Surveying and mapping geographic information products involves a large number of spatial operations. At present, it is still dominated by stand-alone computing, and cloud computing technology needs to be introduced. According to the characteristics and processes of quality inspection business, the existing cloud computing does not have a framework with high availability. Therefore, it is necessary to build a quality inspection software cloud platform based on the existing technology, break the constraints of the underlying and system environment of the existing quality inspection software, and build a quality inspection rule cloud engine with stronger function, better robustness and higher expansibility. Based on network connection and cluster operation, it can meet the needs of mass spatial data quality inspection and operation, and realize all kinds of storage resources Intensive and efficient operation of computing resources.

3.5 History Dimension

The historical dimension is to collect and organize the data, data and quality information generated in the past quality inspection work, including batch data, sample data, reference data, inspection records, evaluation records, quality statistical analysis, inspection reports, etc., so as to form knowledge and reference, and apply it to all links of the current quality inspection work, providing data sampling, data inspection, and quality evaluation Price output plays a supporting role (Figure 7). Quality inspection software has little exploration in this dimension. For example In China ZheJiang Province, quality inspector has improved the efficiency of Surveying and mapping results quality inspection by building resource database system of surveying and mapping quality.(Huang Changdi et al., 2020)

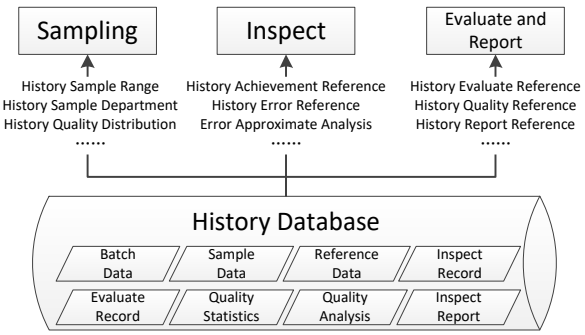

Figure7 History Support In Different Inspect Step

4. MULTI-DIMENSIONAL SYNERGY FRAMEWORK

The quality inspection software system of Surveying and mapping results under the "Multi-Dimensional collaboration" is composed of five dimensional software platforms. One dimension constitutes a software platform. The platforms adopt low coupling and can operate independently or cooperatively. The framework is shown in Figure 8. In the specific engineering practice, flexible configuration should be carried out around the project situation and demand, combined with the functions, technical level and hardware conditions of each unit and department. The traditional quality inspection methods have involved achievement dimension and project dimension. As the basic dimension, achievement dimension and project dimension can meet the work needs of quality inspection departments and professional quality inspection institutions of most production units, as well as the needs of quality control of most project results; Big data dimension relys on big data support library and quality inspection cloud platform, it can accelerate quality inspection efficiency and build inspection support, Intelligent dimension and historical dimension can provide support for fruit dimension, project dimension and big data dimension in sampling, inspection, evaluation means, data and data warehousing, query, statistics, analysis, etc.

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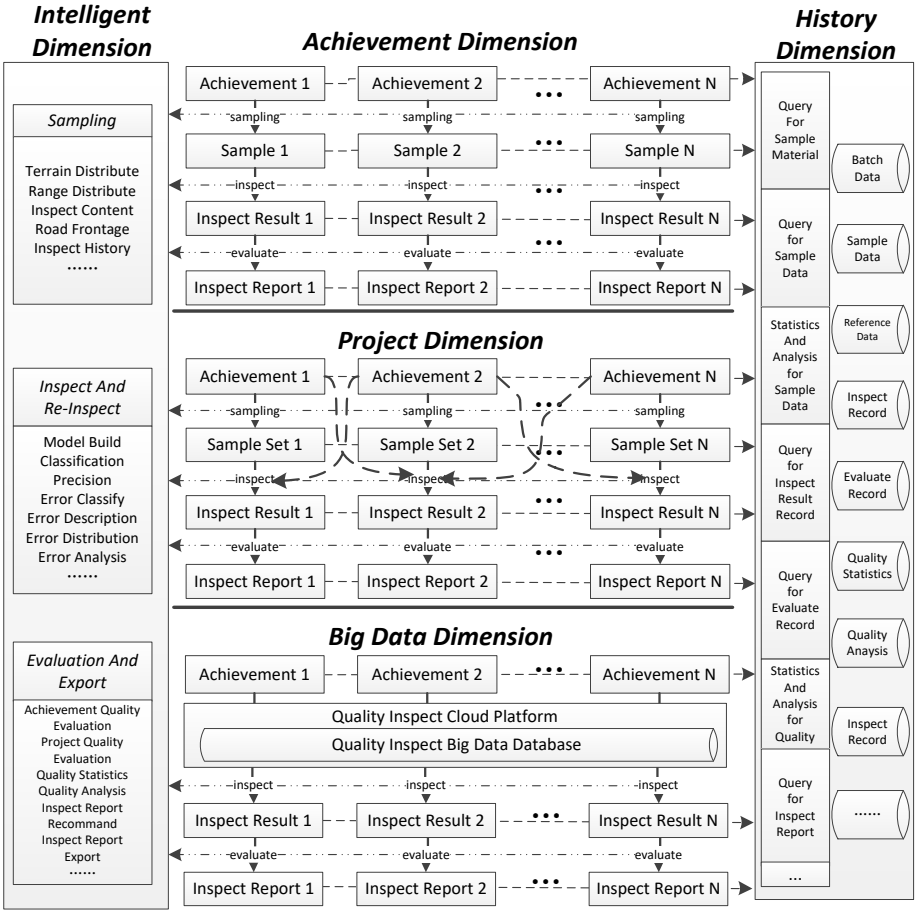

Figure 8 Multi-Dimension Synergy Framework

5. CONCLUSION

The quality inspection software system of Surveying and mapping results under the "multi-dimensional coordination" is a unified framework, clear and complete function division, block level management, seamless connection and efficient operation software system guided by the "multi-dimensional coordination" quality inspection method, It is the second innovation of quality inspection method by using big data, cloud computing, artificial intelligence and other advanced technologies, which opens up a new direction for the development of quality inspection software, and lays a foundation for improving work efficiency and intelligence.

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