

The Applications of Geo-Spatial and Emerging Technologies in Auditing

Biao Zhong

1. School of Engineering, Nanjing Audit University, Nanjing, JiangSu Province
211815; 2. JiangSu Key Laboratory of Public Project Audit, Nanjing Audit
University, Nanjing, JiangSu Province, 211815, China
Email: bongreat@gmail.com ,

Abstract

The objectives of this study are to introduce geo-spatial and emerging information technologies and its applications in resource and environmental auditing. This article presented characteristics of GIS applications and Artificial Intelligence Technology. Auditing application cases, implemented by National Audit Office of P.R. China, Nanjing Branch and Wuhan Branch, was introduced in the article. We also introduced trends and outlook of emerging new technologies, including Big Data, Internet of Things, Cloud computing, augmented reality, and their impacts on auditing. In the future, geo-spatial technology combining with emerging technologies, including Big Data, New database, Smart Mobile Phone, and quantitative tools will improve the reliability of audit evidences and enhance the auditing conclusions and functions.

Keywords: Geo-Spatial technology, Emerging technology, Geographic information system, National Audit Office of P. R. China

Introduction

Geo-Spatial and emerging technologies combines geographic information system (GIS), global positioning system (GPS), remote sensing (RS), Big Data, Internet of Things, Cloud Computing, Augmented Reality (AR) Technique, communication and network technology. It is also an information technology system that can make all these functions into one, including data observation acquisition from space, data processing, data analysis, and data application. People realize the space of world is stereo, in 3D, so information observed from space is different in nature, as territorial, multidimensional structure and dynamic changes. Compared to traditional two-dimensional data picture,

there will be a lot of multi-dimensional spatial data cannot be used, so more and more people begin to study the spatial information visualization system. The success of two dimensional data model and data structure theory, the progressive development of database theory and technology, graphics theory and other related computer technology, provided the atmosphere for the development of the 3D spatial information technology.

Overview and Development Direction of Spatial Information Technology

Nowadays, the information technology has developed continuously. As one of massive information source and state-of-the-art technology, geographic information becomes more and more important. Geographic Information System (GIS) is a system used to collect, store, check, operate, analyze, and display geographic data (Clarke,1986; Goodchild, 2010; Maliene etc., 2011). It is also a collection of tools used to collect, store, query, transform, and display spatial data. Currently, GIS has been successfully applied to fields of national defense, transportation, environment, etc. It also demonstrates the broad prospects in the area of practice, and gradually becomes one of the high-tech hot points.

In recent years, with the development of advantages of GIS, its application tends to be diversified, and gets a lot of attention and rapid development. At the same time, the rapid development of computer science and other sciences also offer GIS advanced research tools and analysis methods. A number of high-tech have been applied to GIS, including remote sensing, infrared and radar technology, three-dimensional technology, artificial intelligence technology and Geographic Position System, which greatly promoted the development of GIS and other related technology.

Artificial Intelligence Technology is the technology of theory, method, technology and application system that uses computer technology to simulate and expound human intelligence. It understands the essence of human intelligence, and then let the computer simulate and respond to external information by the way of human intelligence. The main research areas of Artificial Intelligence Technology are intelligent robots, voice and image recognition, etc. Image recognition technology is applied to GIS and other areas. Combined with GIS, it obviously enhances the ability of GIS in independent problem-solving, reasoning and decision-making, knowledge representation and application. In term of environmental protection, Artificial Intelligence Technology not only enables GIS intelligently process, analyzes and researches massive geographic data, but also makes GIS solve some complicated practical problems intelligently.

In short, GIS can be combined with a number of high technology and need the co-existence with various sub-technologies. Currently, it has achieved successful

application in many important areas related to national economy, such as national defense, planning, transportation, and monitoring. Nowadays, with the increasingly strengthening of people's awareness of environmental protection, environment auditing has risen to a more and more position, and all the advantages of geographic information technology will greatly promote the progress and development.

Cases of Geo-Spatial Information Technology Applications

With the help of GIS, the government can collect, store and analyze environmental information real-time, which enhances the efficiency and effectiveness of government in environmental monitoring. The information is also the important material and original evidence in the following environmental auditing. In addition, in other areas, such as the air quality monitoring and auditing, GIS also plays a very important role.

In the cases of 2009 and 2013, Nanjing Branch Office and Wuhan Branch Office chose ArcGIS as the main tool after comprehensively considering the actual situation and made the audit plan. In the case of land resource audit at Quzhou and Lishui of Zhejiang province in 2009, auditors of National Audit Office of P. R. China, Nanjing Branch Office analyzed the information demands according to the audit targets, and combined with the available database, the previous materials of the Second National Land Survey, so as to find out the direction of audit with GIS. National Audit Office of P. R. China, Wuhan Branch Office utilized GIS to assistant Audit of land resource auditing at HuBei Province in 2013. We used ArcGIS and Google Earth to locate the specific ore coordinates and verified values of ore and other resources at HuBei Province.

Trends and Outlook of Emerging New Technologies

In the future, Augmented Reality (AR) Technique, large distributed network and mobile information technology will develop rapidly. New spatial information products will follow the development of three-dimension. Three-dimensional data acquisition and detectable mass data in the dynamic visualization will have good prospects.

Based on the development of BIG Data, Internet of Things, Cloud Computing, and communications technology, combining with the advantages of satellite, aerospace, ground sensing, we can build a three-dimensional monitoring system with fully functional set of remote sensing, communications, navigation and positioning, which has become a modern spatial information technology development trend. Such a comprehensive multi-faceted monitoring system can acquire macro, precision remote sensing information to achieve a variety of topics and update the database quickly.

4.1 Big Data, Internet of Things, and auditing

Before the concepts of Big Data, personal data is usually ignored by people. Corporate data gets more attention. With the development of Internet and social network, data come from personal computer users has a booming trend, including network logs, traffic and telephone records, medical records, sensors and monitoring cameras. Huge amounts of data from various sources make the traditional hardware device unable to meet requirements. By digging into these data, people will produce a great intrinsic value.

Therefore, Chinese audit should establish large data utilization system. Fully analyzing the mass data storage, mining potential functions, simplifying the workload and improving audit efficiency.

4.2 Cloud computing and augmented reality technology's impact on auditing

Cloud computing is a combination of network and traditional method of calculation. It will change the basis of entire network calculating and optimize resources. Augmented reality technology is a technology which overlay the real world with scientific simulated taste and sound which is hard to feel by human sensory. By using GPS, orientation sensors, we can insert map into reality landscape directly and monitor the real environment. These techniques are changing the shape of information, definitions of information and methods of information dissemination, and even the structure of information. Cloud computing optimized information function, augmented reality technology and also provided a method for the use of complex information. In the future, information technology will continue to develop, and spatial information technology is one of the integral parts of it. It is the development of spatial information technology and scientific research applications that provides other cutting-edge technology with three-dimensional structure information.

Proposals for Future Research

In the future, we will continue to develop the applications of Geo-Spatial and Emerging Technologies in Auditing. The directions will be Big data, New database, Smart Mobile Phone, and quantitative auditing. Big data will cover multiple data format and parallel computation with Hadoop technology. New database will be the next generation database, supporting NOSQL (not only SQL). Smart Mobile Phone App will be the new small and popular applications. Quantitative auditing will enhance the scientific characteristics of auditing by utilizing more quantitative tools.

Acknowledgements

This research was supported by Basic Research Program (Natural Science Foundation)

Funded Project of JiangSu Province, China (Contract No.: BK2012473), a Project Funded by the Priority Academic Program Development of JiangSu Higher Education Institutions.

Reference:

- [1] Clarke, K. C., (1986). Advances in geographic information systems, computers, environment and urban systems, Vol. 10, pp. 175–184.
- [2] Goodchild, Michael F, (2010). "Twenty years of progress: GIScience in 2010". *Journal of Spatial Information Science*. doi:10.5311/JOSIS.2010.1.2.
- [3] Maliene V, Grigonis V, Palevičius V, Griffiths S, (2011). Geographic information system: Old principles with new capabilities. *Urban Design International* 16 (1). pp. 1–6. doi:10.1057/udi.2010.25.