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Literature Review

Application of Big Data Geographic Information System to Spatio-Temporal Analysis of Coast Defense Cases: Smuggling Cigarette Investigation

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Abstract

Application of big data geographic information system to spatio-temporal analysis of coast defense cases for smuggling cigarette investigation is paramount. Big data is characterized by rapid change and high efficient. The value of a wide range of density and its performance and so on are obvious, but the fundamental difference between the concept of big data and massive data alone that big data is a high-tech mobile. The use of Internet is available at any time, simply the Internet, network connect, and information systems, etc. The development trend of big data itself, such as data that can be automatically obtained by big data itself, such as navigation and positioning data, mobile phone signaling data, search engine data, e-commerce transaction data, bus swiping data, social media data, transportation real-time sensing data, and so on. By means of deductive collection from the previous perspectives, the study discuss the results and show the practical implication to application of big data geographic information system for smuggling cigarette investigation.

Keywords: Spatio-temporal Analysis; Coast Defense; Smuggling Cigarette; Big Data; Geographic Information System

Background

Coast defense anti-smuggling work is an important work that serves the country's political security and economic construction, and promotes social harmony. In the implementation of the "One Belt, One Road" strategy, Guangdong coast defense anti-smuggling work is facing new development opportunities, risks and challenges in decades. Persist in proceeding from reality, firmly seize development opportunities, and actively promote coastal defense against smuggling with a solid foundation and advantageous conditions, and escort from Maritime Silk Road. Through scientific innovation and technology, the big data geographic information system tools, intelligent methods are integrated into coastal defense work. Guangdong is the main battlefield of anti-smuggling, coastal defense smuggling works are inevitably further strengthened, and the status of coastal defense smuggling in the economic and social development of the province is bound to be more prominent, coastal defense and anti-smuggling can make Guangdong Province a major province in China and a model province for the construction of the 21st Century Maritime Silk Road.

Geographic Information System (Geographic Information System, hereinafter referred to as GIS) is a set of information systems designed to establish geographic or spatial-related data. It has a database with spatial description and a system that combines analysis capabilities [1]. That is, it certainly combines geographic information and computer technology. A cross-disciplinary comprehensive discipline that can simplify specific phenomena and events [2,3], use digital space and other technologies, and use computer efficient data collection, storage, update, processing, and analysis.

Therefore, the display phenomena and events in features of geographic space [4] provide solutions to real-world problems (See figure 1) and are currently widely used in various fields. Any information related to space can be analyzed by geographic information systems, such as urban planning, National defense capabilities, police and disaster relief, engineering location, social culture, forestry management, transportation, land management, environmental ecology and other matters can be quickly calculated and analyzed to provide decision-making support [5,6].

Big data is characterized by rapid change, low body, large measurement, the value of a wide range of density and so on, but the fundamental difference between the concept of big data and massive data alone that big data is a high-tech mobile Internet at any time, simply the Internet, networking, information systems, etc. The development trend of big data itself, such as the above data that can be automatically obtained by big data itself, such as navigation and positioning data, mobile phone signaling data, search engine data, e-commerce transaction data, bus swiping data, social media data, transportation real-time sensing data, and so on. We can mine and analyze valuable laws and information from these data to help us assist decision-making in various industries, products and market applications, and even predict the future. However, due to the technical limitations of its IT framework, traditional GIS cannot efficiently deal with the technical requirements of big data for stream data processing, distributed storage and computing, and so on. On the other hand, IT technologies in the field of big data, such as distributed databases, distributed file systems, stream processing frameworks, distributed computing frameworks, etc., can allow us to use ordinary machines to process and mine big data, but they can only focus on Yu Tongfan's non-spatial data field completely limits the professional analysis and processing capabilities of spatial data.

Big data GIS is the deep adaptation of GIS technology and big data technology, and embeds the core capabilities of traditional GIS into the big data technology framework. The traditional GIS before big data was limited by data, there were technical problems such as large granularity, insufficient efficiency, and long feedback period. But after adopting big data, these problems can be solved effectively. For example, in the commercial site, it can only be implemented before the current field survey or questionnaire sample survey. Big data application space key GIS technology can quickly discern the precise distribution of the entire mobile population live. Superimposed inherent hotels will be able to grasp the real-time data needs to guide Hotels Considerations such as site selection and quantity. It is also applicable to many tasks such as public safety, urban planning, traffic congestion, and coastal defense wiring.

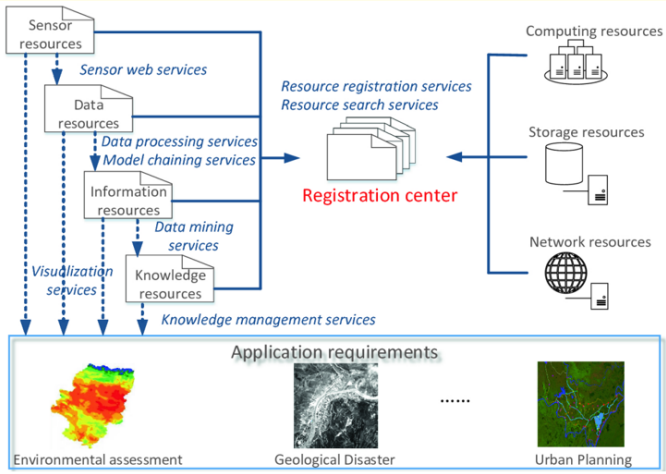

Figure 1: Various tasks involved in grip sequence [27].

The rise of geographic information system technology, based on geographic information technology, the extended spatial analysis has been widely used in various fields, such as accident and patrol analysis, free bus route adjustment, telephone base station setting, soil and rock flow potential determination, intersection monitoring system setting selection, tourism development strategy, location selection of department store, relationship between slope and collapsed land, etc.

Literature Review

Chen Zhili [9] investigated maritime accidents happen factors to 1987 -1988 maritime traffic accident data in the inner harbor of Keelung and their adjacent waters, what happened, the concept analysis and use of road traffic accidents, the application amount of exposure analysis marine traffic accidents, and use probability and quantified qualitative variables to construct a multiple regression analysis model of marine traffic accidents, as a comprehensive research tool for related factors. Huang Renbang [10] cross-analyzed the time, location, gross tonnage, accident type, ship age, wind speed, etc. and causes of collision, grounding, and sinking of maritime incidents in the Taiwan area, and used the wave-let regression

method to establish a maritime traffic model and discuss maritime traffic. The degree of influence of accident-related factors, and research and development measures to improve the software and hardware of marine traffic. Guo Fu village [11] Taiwan of 1982 -1991 years, Kaohsiung, Keelung, Taichung, Hualien, Suao five major ports maritime data, using computer software DBASE III PLUS characteristics of the relational database and analysis of shipwreck and salvage at sea It also evaluates the efficiency of search and rescue, and puts forward specific suggestions for the lack of China's search and rescue system. Zhang Shujing and Ji Jiayi [12] used the maritime distress data of Keelung Port, Taichung Port, Kaohsiung Port, and Hualien Port from 1982 to 1994 to study the risk of Taiwan›s maritime traffic accidents and search and rescue needs, and classified statistics based on merchant ships, fishing vessels and other ships. In addition, the navigation route, location of fishing grounds, and fishing vessel operating areas in the waters near Taiwan are added, and the geographic information system is used to conduct spatial correlation analysis to find out the main risk areas, and use this to evaluate the existing search and rescue resources. Ji Jiayi [13] as sophisticated shipwreck search and rescue operations, the establishment of rescue decision support system, with 1982 - 1996 during 2217 maritime cases for the object, using the C ++ program writing method, via NMEA (National Marine Electronics Association) data format, connect Global Positioning System (GPS), and use Dynamic Data Exchange (DDE), combined with electronic chart display system, use ODBC (Open Database Connectivity) connection method, evaluate search and rescue resources, draw up search and rescue plans, and provide maritime search decisions reference. Xu Guoyu [14] aims to improve maritime traffic safety in the port waters on the west coast of Taiwan, using the three major international commercial ports of Keelung, Taichung, and Kaohsiung between 1993 and 2004, which occurred during collisions, reefs or strandings, touches, fires or explosions The statistical data of six marine accidents including mechanical failure and tilting or overturning are applied to the analysis of grey relation matrix calculations to analyze the causes of marine accidents in areas such as commercial port seats, anchoring areas, ports, near ports, coastal areas and high seas. Zhong Xianghua [15] analyzed the factors of shipwreck accidents in the waters around Taiwan for reference for the related maritime industry to improve navigational safety. Using the data from 2005 to 2007 of the Service Command Center of the Coastal Guard of the Executive Yuan, analyzed the distribution of shipwrecks around Taiwan and the causes of shipwreck accidents. It also counts the types of shipwreck accidents and types of rafts, and evaluates and analyzes the factors and types of shipwrecks. Xu Yaosheng [16] used an internal set of Coast Guard "Coast Guard Investigation and Prevention Management System" from 2005 - 2006 Nian waters during the enforcement of the arms and ammunition, drugs, agricultural, fishery and livestock products and other pipe products seized illegally into abroad, the more area Seven performance statistics, including fishing, driving off ships, banning the destruction of oceans, and coastal resources, use geographic information systems to perform analysis, build digital maps, compare timing differences, and observe spatial characteristics to study the hardware and software requirements of the Marine Patrol Agency. LI Qing-zhong [17] from 2009 -2010 Nian criminal case owned offshore materials, building legislation seas criminal cases take place spot diagram, trends and evaluate the direction and everything mode, the final analysis hotspot location, Coast Guard authorities for service deployment reference. However, the above research is purely based on simple statistics or GIS tools, and it is known that it lacks the integrity, real-time and accuracy of the big data background. There is still no research report on the application of big data geographic information systems in coastal defense, so this research is triggered. Motivation to explore the traditional GIS before big data was limited by data, there were technical problems such as large granularity, insufficient efficiency, and long feedback period. The use of traditional GIS faces difficulties in data acquisition and integration of heterogeneous data, which requires strengthening the government, enterprises and academic institutions to jointly promote the formulation of relevant policies. At the technical level, spatial analysis methods for big data are in the ascendant. At present and for a long period of time in the future, we will strengthen the development of big data GIS to form a data-driven system to quickly acquire knowledge. This indicates that big data GIS should be used to strengthen the parameterization of social operations of models and methods. Especially when providing support for social management decision-making, big data GIS has achieved great results at present, such as the effectiveness evaluation of COVID-19 prevention and control [18,19], mineral resource management [20], urban-scale building energy management [21], social media management [22], and the temporal and spatial characteristics of drought [23].

Research structure

Big data includes data collection, cleaning, integration, storage, analysis, and data visualization for the data processing process of the management information system. The main contents include (1) Key information collection: the source of information, in

addition to the existing graphics, also includes on-site surveys And aerial photography, and related attribute data should be recorded together; (2) Input and processing: various image and database system data can be read, and the collected graphics, raster, attribute, vector and other data can be collected with computer input equipment. The input is converted and stored in a computer database. The space big data raster type includes satellite imagery, climate simulation, multi-camera and coordinated drone imaging system, and the vector type includes Uber taxi data, Twitter data of geographic location, GPS data, etc., Graphic data includes power grid data, road network data, supply chain network data, drone network data, etc.; (3) Information management: Provide clear graphic editing tools to facilitate the input of information to be assigned to coordinates, attribute data, and text descriptions Etc., and stored in a unified format for layer editing and overlay analysis; (4) Information conversion: all have a variety of projection functions, before information analysis, the use of intelligent algorithms for projection conversion function, the layer is converted first The same projection method is overlapped to avoid errors; (5) Information operation and analysis: The extended information analysis tool can be expanded, and the layer and attribute data to be processed can be processed through spatial data analysis, numerical topographic analysis, Network analysis, intelligent algorithm and other processing to obtain spatial information; (6) Information achievement output and display: the results of information analysis or simulation are output and displayed to graphic displays, high-resolution printers, three-dimensional printing, plotter output maps, etc.

In order to enable maritime patrol vessels to effectively intercept illegals, quickly rescue and avoid maritime disasters, and effectively crack down on coastal defense smuggling, the main research contents of this project are as follows:

- **Information expansion and management:** Through the collection of relevant information of government units and literature review methods, to explore the occurrence factors of sea cases, familiarity theory, sea area changes, etc.

- **Establish the spatial distribution of coastal defense cases:** Take the sea area under the jurisdiction of the coast of Guangdong Province as the research scope, and use the big data geographic information system to find out the connection relationship between coastal defense cases and the waters where they occurred.

- **Establish a digital map:** Make digital maps according to case types based on historical data on maritime cases, and use big data geographic information systems to convert maritime patrol units and port companies affiliated to Guangdong Province into graphic and attribute data, and make them digitized Maritime cases.

- **Finding the hot spots of maritime cases:** In view of the distribution of cases in the sea areas under the jurisdiction of Guangdong Province, the spatial tools of the big data geographic information system are used to analyze the relationship between sea space and maritime cases to find out the hot spots of maritime cases.

- **Analyze high-risk areas:** After the implementation of the "Belt and Road", the density of ships in the sea area will increase to avoid high-risk navigation of ships in the sea area, and analyze high-risk areas to reduce navigation risks.

- **Planning the best plan:** The implementation of the "One Belt One Road" strategy will bring opportunities and challenges to Guangdong's coastal defense to crack down on smuggling. This project will be able to plan the best maritime patrol routes and sea area case hot spots, which can be effectively used as patrol ship service fixed-point monitoring point.

Conclusion and Implications

- Science and technology help the country's coastal defense. The construction of a big data geographic information system is in great demand for the spatio-temporal analysis of coastal defense cases, and coastal defense patrols urgently need to be carried out scientifically. Through the implementation of this project, the practicability of existing regulations and cases can be verified, and a new and effective forecasting model can be developed. To protect the safety of people's lives and property, and coastal defense and smuggling work will be further strengthened.

- Helping China become a leader in international smart coastal defense. The United States and Japan have upgraded the hardware and software facilities of big data geographic information systems, and are actively seeking international cooperation partners. The research team currently has an excellent research team and perfect geographic information system technology. Cooperating with

the implementation of this project can greatly improve the empirical research environment. It will become the target of cooperation among all countries, enabling China to rise to the leading position of the international smart coastal defense community.

- Academic technology opens up new ways of diplomacy. All countries in the third world and international maritime areas are facing pirate attacks that cause major threats and losses to shipping companies and fisheries. The demand for smart coastal defense is increasing, and there is an urgent need for outsiders to provide necessary assistance. Through the implementation of this project, China can develop academic, technological diplomacy New ways to benefit.

- Promote the formation of a harmonious society. The applicant unit has different expertise in "geographic information" and "information science", forming a cross-professional integration and investing in related technology research and development, which will be able to grasp market opportunities and technology leadership. It is expected to take effect in Maoming City, Guangdong Province, and provide technology-leading services. The important work of national political security and economic construction, and promotion of social harmony.

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