The Design and Implement of a System Querying and Displaying RS Images Based on ArcEngine

WANG Ruifu[1], LIU Aichao[2], ZHAO Xiangwei[2], ZHANG Panpan[2], XU Xiao[2]

1. Geomatics College, Shandong University of Science and Technolog, Key Laboratory of Surveying and Mapping Technology on Island and Reef, State Bureau of Surveying and Mapping, QingDao, China

2. Geomatics College, Shandong University of Science and Technology, QingDao, China

e-mail: wangruifu@263.net, habylsc@163.com, zhaoxiangwei@163.com

Abstract: On the basis of introducing spatial database and the spatial database engine, ArcSDE, of ESRI, a solution of adopting ArcSDE to store huge image data is proposed in this paper so as to realize the united and integrated storage of remote-sensing image spatial data and attribute data. In the environment of Visual Studio, and based on ArcEngine, C# Language, this paper develops a prototype demonstration system for displaying the query of remote-sensing images. In addition, referring to the content-based retrieval and the metadata management mode a novel database management mode for remote-sensing image data, that is a remote-sensing image retrieval based on image interpretation contents and metadata, is designed so as to realize the quick query and locating display of images. In the paper the design of the system's database and the implementation methods of the system's main function, as well as some key technologies for realizing the system are presented emphatically.

Keywords: spatial database; ArcSDE; remote sensing images; ArcEngine; content-based retrieval; image interpretation

1 Introduction

RS image is widely used in land-use monitoring, the evaluation of agricultural production, and natural disaster assessment and monitoring, as well as in testing and updating the basic scale topographic maps (basic geographic information database) [1].Normally, traditional document management method is used to manage RS images, which takes advantage of the characteristics of relational databases to query and search all the image data. However, as image files are stored in a category outside the database, the security of data is not guaranteed when this method is used. Besides, the searching for massive images could be quite complicated. This article discusses the method and the line of technologies to establish a relational database of RS images, through which centralized control on data and convenient searching for target images (by inputing conditions for queries) can be realized. One system based on ArcEngine, the embedded GIS product, was developed to display RS images and simplify user operations. The system can be embedded in mobile terminal equipments, and can also be applied to the land planning of professional institutions like forestry bureaus.

The traditional method of managing images is conducted in the file system [2]. A user has to open all the files and browse them to find a particular image. As the amount of image files increases, the efficiency of searching decreases sharply. At present, file-based management method can only manage on file names, and is incapable of effective querying and searching of RS images [3].

At present, content-based querying has been researched by many scholars. The main thought is that images can be queried by visual performances, such as color、texture、shape、spatial relations etc, instead of by text notes. The problems such as the heavy workload of artificial noting images, and the subjectivity in making and understanding notes, which could lead to inaccuracies, can be solved by content-based querying [4]. However, the variety of RS image data types, the large amount of data, the different sizes and sources of data are all constraints that limit the development of content-based visual information retrieval technology, making it difficult to be widely used in practical RS image databases [5].

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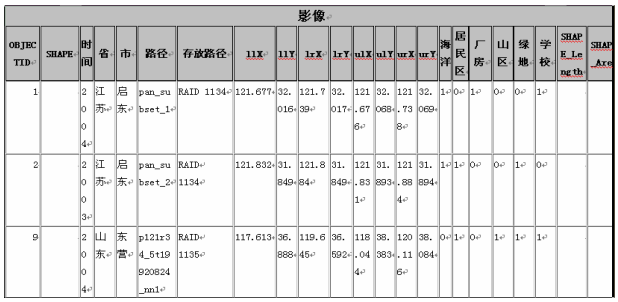

影像

OBJECTID	SHAPE	时间	省	市	路径	存放路径	llX	llY	lrX	lrY	ulX	ulY	urX	urY	海洋	居民区	厂房	山区	绿地	学校	SHAPE_Length	SHAPE_Area
1		2004	江苏	启东	pan_subset_1	RAID 1134	121.677	32.016	121.739	32.017	121.667	32.068	121.738	32.069	1	0	1	0	0	1		
2		2003	江苏	启东	pan_subset_2	RAID 1134	121.832	31.849	121.884	31.849	121.831	31.893	121.884	31.894	1	1	0	0	1	0		
9		2004	山东	东营	p121r34_5t19920824_nn1	RAID 1135	117.613	36.888	119.645	36.592	118.044	38.383	120.116	38.084	0	1	0	1	1	1		

Figure 1. Attribute table

For these reasons, we, in this paper, drew on experiences from both content-based retrieval pattern and metadata management of spatial data, we provided a new method to manage RS image databases, which is RS image retrieval and querying based on both metadata and the interpretation content of images.

The basic idea is to pre-interpret all RS images, and determine the categories of information contained in RS images. Taking coastal zone remote sensing survey as an example, the key attributes include harbor, reefs, culturing zones, tourist attractions, vegetation, and sewage outfall, as well as time and spatial information. These attribute and information can be used as key words in searching and quoted in image retrieval.

2 Database Design

2.1 Data Preparation

This is a demo system oriented to RS images. We have some demo data in the TM data model ready for use. These RS images are carried out in the ArcMap, and load of the National Administrative zoning map to determine where the images are taken; Then crude interpretation was conducted to judge whether the target objects exist or not. Acquiring the X, Y coordinates of our corners points of the image, obtaining the imaging time through the data.

2.2 Data Classification

There are mainly two categories of data contained in RS images, spatial data and non-spatial data. Spatial data consists of basic geographic information and image information. For spatial data, attribute databases can be created by layers according to the predefined attribute tables structure. Non-spatial data mainly consists of a set of data that contains RS data information, which is displayed as a set of texts, including the imaging time, the province and city where the images are taken, storage path, coordinates of the four corners points, and whether the existence of the a wide range of objects such as ocean, greenbelt, workshop, mountainous area, schools and residence area.

2.3 Building Process

In this system, we chose SQL Server 2000 database as management software, ArcSDE for SQL Server as spatial database engine, and the Geodatabase of ESRI as spatial database system model. Network databases was established in Client/Server mode. With SQL Server and spatial database engine ArcSDE for SQL Server on the server side, client software such as ArcGIS，ArcEngine，Microsoft Visual Studio were installed on the client side. The building process is shown as follows:

1) Storage spatial data

Use the SQL Server database management wizard to create a database, load data and start the database. In the installation of ArcSDE, enter PER for the database, and the instance name of the spatial data engine (esri-sde by default), so that engine instance can be created. When ArcSDE is connected to SQL Server, we imported spatial data using ArcCatalog module in ArcGIS Desktop. Image data is stored by Raster Datasets in spatial database. Then demo data is imported into Raster Datasets.

2) Storage attribute data

Feature Class is created in the database as index, then attribute texts and records are added.

As shown in Figure 1, 1 in ground objects cells indicates this kind of object exists, while 0 means it doesn't. X and Y coordinates of the four corner points are used to search for RS images according to spatial scope, while paths are used to load the selected images.

3 Functionality Design

3.1 System Structure

The system was divided into three parts, the client, server, and database.

1) The client realizes the following functionalities:

Loading and storage of data, and basic operations like

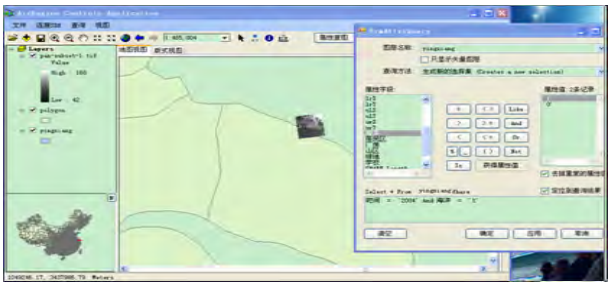

Figure 2. Inquiries of content by mult-fields

zooming in and out of maps, and roaming;

Switching between map view and layout view, and hawk-eye function;

Customization of toolbar;

Searching for maps by attributes, searching for attributes of maps, and SQL queries;

Content-based querying, searching by administrative areas, and by spatial scope.

2) The function of the server includes:

Receiving GIS service request from client;

Handling request for attribute data;

Connection to database.

3) SQL Server 2000 and ArcSDE are used to store image data and image attribute data.

3.2 Implementation of Major Functions

3.2.1 Querying by Attributes (for the Location of Ground Objects)

After setting the specific layer and words, click "tables". Attributes of all the elements will be displayed. Click "Values", the values for the present field will be displayed. Select a field, and click OK, the location of the ground object will be highlighted in the map.

3.2.2 Querying by Spatial Space (for Attributes by Object Locations)

Clicking a ground object, a dialog window will display with attribute data of the object. In this way, searching for various map elements can be realized. The IDentifyDialog in ArcGIS Engine can be used to join the record sets of MapLayer and Table, which will add all the attribute information into the searching results.

3.2.3 SQL Queries

Users might have further requirements other than searching for locations by attributes, and searching for attributes by locations. These requirements can be satisfied through SQL queries, which allow users to enter key words on their own to search for information they need. SQL queries enhance the practical values. The ISqlQueryDialog object in ArcGIS Engine can be used in searching for spatial ground objects by means of first searching for the related data in databases. All the SQL queries in this system are achieved in this way.

3.3 Querying for RS Image Data

Large amount of RS image data is stored in the database, it's neither realistic nor necessary to load into the cache of the software. We only need to load the data that we need. The administrative division map and the Feature Class that contains attribute texts are loaded in the first place. When connection to the database is established, users can conduct searching using the attribute texts in Feature Class, and load the particular images into Mapcontrol en route the database for further use.

3.3.1 Content-Based Querying

Content-based image searching is an integrated technique, which builds up the characteristics indexing and store into a particular bank by means of analyzing the image content, such as the color, the ground objects, the imaging time. As long as users can describe the images they want, they'll find them in the database.

Enter one or more key words to conduct SQL queries, and load the results images into the map. Users can conduct combined searching, for instance, combing time with ground objects. Enter the following SQL queries, Select * From yingxiang Where time = '2004' And ocean = '1', and you'll get one record, which you can load the corresponding image, as shown in Figure 2.

3.3.2 Querying by Administrative Divisions

Strictly speaking, querying by the administrative division is one of the Content-based query, but querying by the administrative division have more practical significance .In this system,we query by the remote sensing image of the scope of provinces or cities and add the remote sensing image to the map. For example, if we will get the remote sensing image of Shandong Province, we should input the SQL statement like this : Select * From yingxiang Where province = 'shandong', next add the

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Figure 3. Inquiries by geographical regions

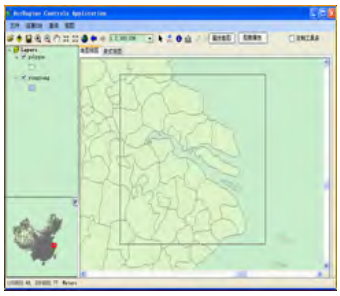

Figure 4. Inquiries by spatial dimension

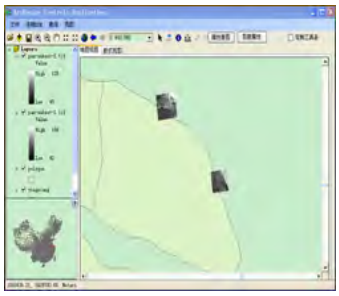

Figure 5. The results

image selected to the map. Results as shown in Figure 3:

3.3.3 Querying by Spatial Dimension

The attribute of the remote sensing image access the coordinates of the four points in the corner =, so that a function can be designed to load the image of which coordinates in the rectangular selected in the current layer. When selecting by rectangular, the system automatically records the coordinates of four vertexes of the Rectangular and compares with the coordinates of each table records in the property. When located coordinates within the framework of rectangular, select the records, load this image. Results as shown in Figure 4, Figure 5:

In addition, you can query by other means, such as querying by one ground feature or more, ect.

4 Conclusions

In this paper, based on in-depth studying of the data storage of the remote sensing image, I developed the model system to display and query spatial reference from the remote sensing image using. NET platform Microsoft Visual Studio 2005 and Embedded GIS Product ArcGIS Engine .In addition to the basic system with GIS software as well as the image data management functions, the system has a variety of ways to carry out the query, such as Content-based query, query by administrative division, query by special scale, you can also select part of the image you interesting a mass of remote sensing images, displays image data Through quick-view. The system uses a flexible, low cost, short development cycles, can be embedded in mobile phones, car navigation systems, GPS hand-held devices such as mobile terminals, demonstrating the power of embedded GIS.

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