In: Wagner W., Székely, B. (eds.): ISPRS TC VII Symposium – 100 Years ISPRS, Vienna, Austria, July 5–7, 2010, IAPRS, Vol. XXXVIII, Part 7B

Contents   Author Index   Keyword Index

LAND COVER REMOTE SENSING IMAGERY WEB RETRIEVAL IN CHINESE SECOND ROUND OF NATIONAL LAND USE INVENTORY PROGRAM

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ABSTRACT:

To facilitate land cover / land use interpretation of Chinese second round of national land use inventory program, a land cover remote sensing imagery retrieval system was constructed based on multi-source land cover classified remote sensing images, ASP.NET techniques and web service. This paper presents the details of the methodologies of national level land cover remote sensing image classification, the architecture and functions of the system, the methodologies of table construction of the database. The remote sensing images was classified into 8 top-level categories, and further classified into 38 second-level categories according to Chinese land cover standard classes provided by Ministry of Land and Resources P.R.C. The results of this work can be easily browsed, checked, edited by the public or experts.

1. INTRODUCTION

Chinese second round national land use inventory program (from July 1, 2007 to December 31, 2009) is a national conditions and power investigation, which is very significant to economy and social development, the target of which is to make a thorough investigation of land use details, to get exact land use data, to construct a management system based on web services (Leading group office of SRNLUIP, 2008).

To facilitate the process of the land use investigation, and to provide a system to verify the investigation results, a land cover remote sensing imagery web retrieval system is constructed, based on multi-time, multi-sensors, multi-resolutions, multi-terrain conditions land cover classified remote sensing images (Jixian Zhang, 2010). These images belong to 8 top-level or 38 second-level land use categories.

This paper designs and implements the land cover remote sensing imagery retrieval system based on the web service and the ASP.NET technology. The global objective of the system is to offer efficient web query service for the land cover remote sensing sample images based on the 8 top-level and the 38 second-level land categories. The System is used to facilitate the investigation work of the second round of national land use inventory program, especially for the interpretation of the remote sensing image and the verification of the inventory results.

2. THE DESIGN AND IMPLEMENT OF THE SYSTEM

2.1 The architecture and workflow

The system is divided into four subsystems: database constructing subsystem、data importing subsystem、querying subsystem、post-processing subsystem. The workflow chart is shown as Figure 1.

The database constructing subsystem is mainly to construct and organize the database, which will offer strict management of the user power limitation and the regular backup ability to ensure the security of the data. The database is designed according to the principles of relational database system, and Microsoft

Access database platform is chosen according to the size of the database and the capability of the system.
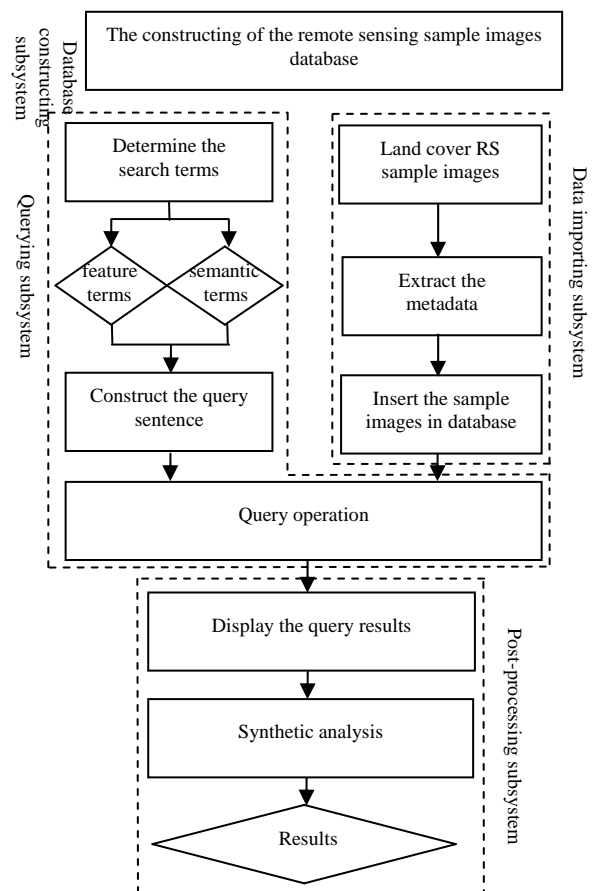

Figure 1. The workflow of the system

The data importing subsystem offers the full and strict function

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to insert the sample images and corresponding metedata in the database, auto-check the physical integrity and logical integrity of the import data, ensure the accuracy and completeness of the import data.

Querying subsystem not only supports the single term query but also supports the query based on group of multi condition.

Post-processing subsystem offers friendly user interface, which helps the users make rapid and exact synthetic analysis.

2.2 The organization of the data and the design of the database table

The main data of the system is property data, including the land categories information, the metadata information of the remote sensing image and the information of manual interpretation. The metadata of the remote sensing images include the category of the sensor, the time of imaging, the season of imaging, resolution, the geographic location, and so on. The manual interpretation information is the land category and the terrain of remote sensing sample image. Besides, there are other data in the database, such as the store location, the category code of every land category and the description information of the land category.

Excellent design of the database table could not only simplify the data flow，improve query efficiency, but also benefit the development and maintenance of the system. According to the requirements and functions of the system, three database tables constructed: the province and region table、land category table and sample image table(see Table1, Table2, and Table3).

Field Name	ID	Data Type
Province	A1	Char
Region	A2	Char

Table 1. Province and region database table

Field Name	ID	Data Type
Land Category	B1	Char
Category Code	B2	Integer
Category Description	B3	Char

Table 2. Land category database table

Field Name	ID	Data Type
Ordinal Number	C1	Integer
Province	C2	Char
Land Category	C3	Char
Terrain	C4	Char
Sensor	C5	Char
Imaging Year	C6	Integer
Imagine Season	C7	Char
Resolution	C8	Float
Store Location	C9	Char

Table 3. Sample image database table

The province and region database table records the relationships between all the Chinese provinces and the regions which they belong to, such as North China, Northeast China, East China, Middle China, South China, Southwest China, Northwest China. The land category database table records the names, codes, description information of the 8 top-level land categories, 38 second-level land categories.

The sample image database table is the main table of the database, all the information of the land cover remote sensing sample images stored in this table. The records number in the province and region table and land category table are fixed, but

the records in the sample remote sensing image table could extend or decrease by adding or deleting the sample remote sensing images.

The design of the database table separates the main table and the minor tables, reduces the redundancy of the data. This strategy will benefit database's query and update processing significantly.

2.3 Development

.NET is Microsoft's new generation development platform, which offers the foundation to quickly construct the mutual-communication application system. .NET Framework, as the soul and foundation of the .NET, provides many new features, such as mutual-operation ability, common language runtime, independent language, simple deployment, security, and so on. These features made .Net development widely used now. Any software system based on the powerful .NET Framework can be called .NET application program.

ASP.NET is a web application framework based on the .NET platform, it can be used to establish dynamic web page and offer web application service (John Sharp, 2006; G. Andrew Duthie, 2002)

To satisfy the need of running under the web environment, the system adopts the web service technology. The World Wide Web Consortium identifies the web service as the software system which offers the mutual operation among different machines by the Internet. The system adopts customer/server model to offer the web service, database stores in the server, which can be long-distance browsed and queried by the customers.

The land cover remote sensing imagery retrieval system was constructed based on the ASP.NET and web service technology, adopting the C# language as the development language under Visual Studio .NET 2005 development platform.

2.4 ADO.NET and XML

ADO.NET is a set of computer software components that programmers can use to access data and data services. It is a part of the base class library that is included with the Microsoft .NET Framework. ADO.NET supports the relational database system and the non-relational database system at the same time. Normally, it is considered that the ADO.NET is the upgrade from ADO, but actually the ADO.NET is quite different from ADO. ADO.NET can be considered as a completely new production for mutual data access.

ADO.NET includes two main parts: Data Provider and DataSets. The former can be separated into five parts: Connection, Command, Parameter, DataAdapter and DataReader. This system adopts ADO.NET technology as mutual-access engine for the database of remote sensing sample images. ADO.NET provides stable foundation for realization of the system.

To reduce the pressure of the server, decrease the unnecessary visit to the server, the system caches search result quickly in the customer with the XML technology (Dan Wahlin, 2002). The following is the storing sentences:

```
DataSet dsQuery = db.GetDataset(arraylist, strDbPath);
if (dsQuery == null)
    return;
dsQuery.WriteXml(strTempXmlFile);
```

When to load the search results, there is no need to access the server again, with the following sentence to get the search results:

```
dsQuery.ReadXml(strTempXmlFile);
```

3.   THE ABILITIES AND FEATURES OF THE SYSTEM

3.1   The management of land cover remote sensing sample imagers

With the expanding of the ability of remote sensing imaging, the size of the land cover remote sensing sample images that can be collected is increased progressively. At the same time, to accomplish the assistant interpretation of the land cover remote sensing images, the remote sensing sample images in different time and space are needed. Therefore, it is more important to manage the data of land cover remote sensing sample images efficiently. This system constructs strict and efficient sample images database in the server, provides the ability of adding record, deleting record, updating record, integrity check, auto-backup, and so on.

3.2   Land cover remote sensing sample image retrieval

To provide powerful and convenient querying functions, the system designs and realizes many query patterns: based on the top-level land category, based on the second-level land category, based on the sensor, based on the season, based on the province or region. Besides, the system supports the query pattern of combination of the above querying conditions.

Meanwhile, the system offers two kinds of querying interface: list style and grid style, see Figure 2 and Figure 3. The former mainly shows the feature information of every sample image, and the later mainly shows the sample image. Figure 4 shows the interface of inserting record in the database.

Figure 2. list style interface   Figure 3 grid net interface

Figure 4 Insert record in the database

3.3   Update of the database

The update of land cover remote sensing sample image database includes modifying, adding and deleting the database records. The database record's modification and deletion must be accomplished by the server, adding records can be operated

either by the server or the customer. If the customer requests to add the sample image records, it is necessary to ensure by the server. Putting the power of updating the database in the server is good to run the system stably and precisely.

3.4   The features of the system

This paper implements the land cover remote sensing sample image web retrieval system based on the Visual Studio .NET platform. This system adopts Visual C# development language and applies the web service, ASP.NET, ADO.NET and XML technology.

The system can be released by the internet, supports the extension of land cover sample image database, which can be based on the internet nodes. It realizes the auto-connection of local picture and the remote sensing sample image, it can accomplish the query work according to the land category, the sensor, the time and other factor, or the random combination of these features. It supports many commercial remote sensing sensors, such as SPOT5, QuickBird, IKONOS, ALOS, IRS-P5/P6, aerial images, and supports different terrain. The system divides the nation into 7 regions: Northeast China, North China, East China, Middle China, South China, Northwest China, Southwest China and 32 provinces.

4.   CONCLUSIONS

With the size of the remote sensing image data is progressively growth and the development of the interpretation technology of the remote sensing images, the issue of the remote sensing image retrieval is a research hotspot in the field of the remote sensing images' processing and application. According to the practical situation of the second round of national land use inventory program, this paper focuses on the problem of the land cover remote sensing image web retrieval. It introduces research results in the system's design, workflow, platform, data organization, database table, development skills, provides an effective resolution to remote sensing images retrieval based on web service. The system has been used to the second round of national land use inventory program successfully. It greatly improved the efficiency and accuracy of the remote sensing images' interpretation, promoted the progress of the results' checking work.

References:

Dan Wahlin., 2002. *XML for ASP.NET Developers*. Sams Publisher.

G. Andrew Duthie., 2002. *Microsoft ASP.NET step by step*. Microsoft Pres.

Jixian Zhang, 2010, Multi-source remote sensing data fusion: status and trends. *International Journal of image and data fusion*, 1(1), pp.5-24.

John Sharp., 2006. *Microsoft Visual C# 2005 step by step*. Microsoft Press .

Leading group office of the Second Round of National Land Use Inventory Program. The total project of the second round of National Land Use Inventory Program.[EB/OL]. http://www.mlr.gov.cn/pub/mlr/documents/P020070607579882 779005.doc (accessed 28 Sep. 2008)