LAND COVER CHANGE AUTOMATIC DETECTION BASED ON PARCEL-KNOWLEDGE INTEGRATED RS WITH GIS

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ABSTRACT: Automatic land cover change detection via remotely sensed imagery has a wide application in the area of LUCC research, nature resource and environment monitoring and protection. Under the condition that one time (T1) data is existed land cover maps, and another time (T2) data is remotely sensed imagery, how to detect change automatically is still an unresolved problem. This paper developed a land cover parcel-knowledge guided method for automatic change detection under this situation. Firstly, the land cover map in T1 and remote sensing images in T2 were registered and superimposed precisely. Secondly, the remotely sensing knowledge database of all land cover classes was constructed based on the unchanged parcels in T1 map. Thirdly, guided by parcels in T1 land cover map, obtained RS image statistical information corresponding to the parcel in land cover map. Finally, land cover changes were detected and the change parcel was recognized through the automatic matching between the database of land cover classes and the extracted statistics of parcel. Experimental results and some actual applications show the efficiency of this method.

1. INTRODUCE

To accurately and quickly obtain the space-temporal information of land cover change by Remote Sensing is the key technology of resource and ecological environmental monitoring and the international LUCC research, and it has become the focus of the international remote sensing studies. Considering that multi-temporal remote sensing data is used as information source for change monitoring, several methods have been developed, such as Image Differencing, Principal Component Analysis, Post-classification Comparison and Change Vector Analysis etc. to automatically detect the changed information[1,2,3,4]. However, while changes are automatically monitored, the case that time one (T1) data are land cover maps, and another time (T2) data are remotely sensed image is very common. The frequently adopted method is registering and superimposing T1 data and T2 data, which is time consuming and has a big workload. In fact, the unchanged information is the main information; therefore T1 data has a great deal of land cover information consistent with T2 data. If the useful information is mined by the computer, and the knowledge database of land cover classes based on the statistic information is established, the changed information can be automatically and quantitatively detected via the guide of the parcel-knowledge.

2. PRINCIPLES AND TECHNICAL PROCESS

While using T1 data (land cover map) and T2 data (remote sensing image) to monitor changes, there are a large number of unchanged parcels in T1 data, which are consistent with the ground surface information presented by the remote sensing image. These parcels can provide enough information. By mining the information, the effective knowledge used for change detection can be obtained. When T1 data and T2 data are registered and superimposed precisely, the region and the class of the unchanged land cover in T2 image partitioned by parcels in T1 data are easily known.

Take the parcels in T1 data as the unit, then select the land cover sample data class by class. After calculating the statistical data, the database of each land cover class can be established. When T1 data is superimposed precisely on T2 data, take the parcels in T1 data as the unit and its land cover class as the reference, then calculate the corresponding feature statistical values in T2 data. After comparing it with the class knowledge information class by class in T1 data, the changed and unchanged positions and the regions can be detected, and the changed class can be recognized by matching the knowledge information of each class in the knowledge database.

3. KEY METHODS

3.1 Construction of the Knowledge Database of R

changed. (See Fig. 1.)

Besides the parcel, the pixel can also be used as the computing unit in T2 data. The statistic Z value of each pixel can be calculated based on the following equation:

$$Z_{jk} = \sum_{i=1}^{N} \left(\frac{r_{ijk} - \mu_{ic_{jk}}}{\sigma_{ic_{jk}}} \right)^2$$

Where, i is the image band number, N is the total number of the bands, c_{jk} is the specified class, r_{ijk} is the pixel value in (j,k) in i band□ μ_{ic} is the mean value of the class C in i band, σ_{ic} is the variance value of the class C in i band, and j,k are the column number and the raw number of the image respectively.

3.4 Recognition of Changed Classes

The changed class can be recognized through the automatic matching between the remotely sensed knowledge database of all land cover classes and the extracted statistics in that parcel. Multiple criterions and the Decision Tree are the effective methods.

3.5 Detection and Recognition of Crossing Parcels

In the case that the changed region in T2 data is corresponding to a part of a parcel or corresponding to several parcels in T1 data, the image segmentation method can be used to divide the specific region in T1

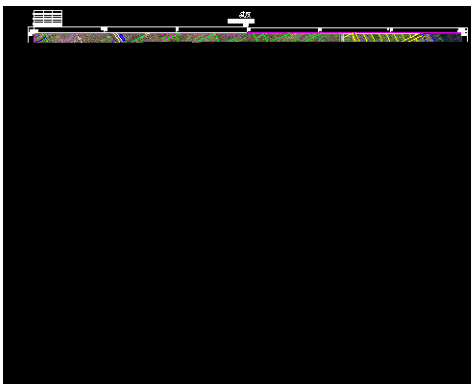

Fig. 2. Updated Land Use Map

data into several uniform parcel units, and the same method described above can be applied in each divided unit to fulfill the change detection and the class recognition.

4. EXPERIMENTS

Based on the method presented in this paper, the software for class knowledge-oriented automatic land cover change detection was developed using AUTOCAD and VC++6.0, and the land cover maps of Shenzhen city, China were updated using TM 30m multi-spectral data, SPOT 10m Pan data in 2000 and the land cover maps in 1999. Compared with the change detection using multi-temporal RS images, the method presented in this paper has the better class recognition accuracy up to 90%. Fig. 2 is an example of the updated land cover map.

5. CONCLUSIONS

The approach, that automatically detect the land cover changes in the case that time one (T1) data is existed land cover map and another time (T2) data is remotely sensed imagery is put forwarded in this paper. Experimental results and the actual applications show the efficiency of this method. It could be enriched and further improved in the later research.

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