

MONITORING OF MOUNTAINOUS AREAS USING SIMULATED IMAGES TO KOMPSAT-II

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ABSTRACT:

More than 70 percent of terrestrial territory of Korea is mountainous areas where degradation becomes serious year by year due to illegal tombs, expanding golf courses and stone mine development. We elaborate the potential usage of high resolution image for the monitoring of the phenomena. We made the classification of tombs and the statistical radiometric characteristics of graves were identified from this project. The graves could be classified to 4 groups from the field survey. As compared with grouping data after clustering and discriminant analysis, the two results coincided with each other. Object-oriented classification algorithm for feature extraction was theoretically researched in this project. And we did a pilot project, which was performed with mixed methods. That is, the conventional methods such as unsupervised and supervised classification were mixed up with the new method for feature extraction, object-oriented classification method. This methodology showed about 60% classification accuracy for extracting tombs from satellite imagery. The extraction of tombs' geographical coordinates and graves themselves from satellite image was performed in this project. The stone mines and golf courses are extracted by NDVI and GVI. The accuracy of classification was around 89 percent. The location accuracy showed extraction of tombs from one-meter resolution image is cheaper and quicker way than GPS method. Finally we interviewed local government officers and made analyses on the current situation of mountainous area management and potential usage of KOMPSAT-II images. Based on the requirement analysis, we developed software, which is to management and monitoring system for mountainous area for local government.

KEY WORDS: Monitoring, tomb, KOMPSAT-II, Local government

1. PURPOSES AND RATIONALES

Tombs have had a negative effect on the landscape and caused an ineffective use of national land recently. For this reason, the systematic management of the tombs is necessary. One of the purposes of this project is to identify tombs' geographical coordinates from ortho-image and to analysis algorithms for extracting tombs on the satellite image. Illegal tombs, golf courses, stone mines and other activities degrading the values of mountainous areas may be monitored by satellite imagery instead of GPS surveys or field works.

So this study aims to verify the accuracy of position of tombs and that of classified land uses using KOMPSAT-II simulated images and to design database for officers in local governments to apply the new method to business work as routine and finally to develop monitoring system for mountainous areas with GIS data.

2. STUDY SCOPES

First, the geographical coordinates from ortho-image was compared with those of GPS survey. The digital maps were used to produce Digital Elevation Model and ortho-rectify raw satellite image. And ground control points were extracted from digital maps. We ascertained that the location residual error was about from 2m to 3m.

As taking a mound over grave into consideration, the location residual error will be about from 4m to 5m.

Second, the classification of tombs and the statistical radiometric characteristics of graves were identified from this project. We think those procedures will be necessary to extract tombs with semi-automatic method from satellite imagery. The graves could be classified to 4 groups from the field survey. As compared with grouping data after clustering and discriminant analysis, the two results coincided with each other.

Third, object-oriented classification algorithm for feature extraction was theoretically researched in this project. And we did a pilot project which was performed with mixed methods. That is, the conventional methods such as unsupervised and supervised classification were mixed up with the new method for feature extraction, object-oriented classification method. This methodology showed about 60% classification accuracy for extracting tombs from satellite imagery. The extraction of tombs' geographical coordinates and graves themselves from satellite image was performed.

Fourth, we classified mountainous areas for golf courses and stone mines using different image processing software to compare the accuracy of classification modules. Most of classification modules have similar values of accuracy for the golf courses, which means that

it is not necessary for us to develop a new additional logic for the classification at this time.

Fifth, we gathered some list of questionnaire to local government officers and interviewed them to find out the reality of problems of mountainous areas. Each local government has different problems. For example, small volcano mounds have been degraded by Telecommunication Towers in Jeju province.

Sixth, we have designed and built new software to integrate all the forms of official report related to tombs, golf course and stone mine management with background of ortho-rectified satellite images and GIS data. The functions of the software were tested by officers of Taean Gun.

3. RESULTS

Table 1. the First year

targets	contents	results
analyses of work and design for software	tombs monitoring for sample site	- field work and GPS measuring for Gyunggi Province Goyang city Paju City. - work for verification of position accuracy
	preview of previous studies on monitoring change on base point and technologies	- Check out all the new materials and new policies of National Geographic Intelligence Agency which is in charge of national geographic information data
analyses of algorithms	feature extraction algorithms	- result comparison by different classification methods - content report step by step during the classifications
making simulated ortho-imagery	ortho-photos generation	- with accuracy of less than two meter error
	verification of outside	- article presentation in annual conference of Korean Geographic Association - article delivered on coastal management using IKONOS data with some field work - presentation in ACRS 2003
field work and interview	interview on the reality	- GPS and imagery recognition - current stage of law reinforcement on the tomb management

	analysis of local government response	review and analysis on the questionnaire
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Table 2. the Second year

targets	contents	results
spectral signature extraction of golf course, stone mine and hiking and tracking routes	golf course monitoring	- six different methods applied to IKONOS images with naked eye analyses - fair way of golf course is much easier than rough area which is confused with nearby forest and agricultural areas. - benchmarking test result for classification
	tracking and hiking route monitoring	- Bukhansan National Park was chosen because of the lack of tracking area and of access limitation for National Safety reason in the sampling site - review of algorithms for tracking areas
comparison test for efficiency	stone mine monitoring	- NDVI and GVI was good to distinguish stone mines - limitation for edge-cutting areas for National Safety reason in the sampling site
	efficiency test for extraction	- make a comparison table of time and accuracy and potential for vectorizing using ortho-photo generation from satellite images and from aerial photographs
database and prototype for tomb management	building and designing database	- report on the management of tombs for local government officers
	prototyping	- Graphics User Interface building for the software
additional works	requirements analysis for local government	- Check the potential local governments for applying the software of four research groups including KIGAM, KONKUK UNIV, FRI and 3GCORE. - Symposium and seminar on satellite imagery for officers of Taean Gun

Table 3. the third year

targets	contents	results
complete integrated management system	finish management system	- current information system for local government is being transferred from Client/server Program to web based program - separate standalone program finished and expected to connect the upgraded system later
	try expert system	- shade and road in mountainous area are not critical for spectral signature, so the semi-automatic methods applied
	integrate the previous results	- GUI integration for the two years' results
	feature extraction and pattern extraction	- point base tomb extraction - the other features are extracted by the existent algorithms
	friendly GUI development	- reporting form provided - access Database was used for database - register the software patent

4. FURTHER APPLICATION OF THE RESULTS

The ways to apply all the results of this study are as follows.

This monitoring system will provide the decision support system for land use and facilities and land cover which keep changing through the time. Not only city officers but only officers in rural areas will able to figure out spatial reconstruction in the future and to decide the ways not to degrade the natural landscapes.

High-resolution imagery will enable people whoever to see changing land instantly and timely and to support national policy with some scientific foundation. It is possible to reduce the unintended overdevelopment of new city development and construction of roads and harbors and expect people to make an appropriate planning and to execute the plan later with concrete background.

The ultimate goal of this study is to make local government officers use the high resolution data for preventing mountainous area from degrading and make policies efficiency. Therefore, classification of urban land use planning should be done with some imagery data regularly and the results should be compared to check the effects of policies on land developments.

5. REFERENCE

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