

ARAPID METHOD OF ILLEGAL MINING INFORMATION EXTRACTION

Lin Aihua^{a,b,c}, Yue Jianwei^{a,b,c*}, Pan Xiaojun^{a,b,c}, Wang Bin^{a,b,c}, Chen Luyao^{a,b,c}

¹Institute of Resources Technology and Engineering, College of Resources Science and Technology, State Key Laboratory of Earth Surface Processes and Resource Ecology, (Beijing Normal University), Beijing 100875, China;

²National Remote Sensing Center of China, Beijing 100036, China

^aCollege of Resources Science and Technology, Beijing Normal University, Beijing, 100875, China;

^bAcademy of Disaster Reduction and Emergency Management Ministry of Civil Affairs & Ministry of Education, Beijing Normal University, Beijing 100875, China

^cState Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing 100875, China

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ABSTRACT:

The method of IHS transformation and remote sensing image data is made good use of extracting mining change regions in this paper. After overlaying change region with land use data or mining property right register data using GIS analysis functions, the disturbing regions can be able to be found and removed, which are legalized. The system, developed based on above method, can extract the illegal information automatically. Taking full advantage of image data and vector data, not only image data, we can still get the information avoid supervised classification, which is manual and fussy. Therefore the method can be used to extract the illegal information rapidly, at low cost and is useful for stopping illegal mining in time. The method can be mastered easily even the man has no professional technology.

1. INTRODUCTION

At present, the key method of monitoring land and mine is supervised classification based on the remote sensing image and it is effective to detect the land use change, and information of the mine environment and change region. But there still exist some problems in extracting the illegal information of mine, as follows:

1) The method of change information extraction is complex. Supervised classification on image is comparatively complicated to study and operate, so information processing personnel must have higher professional knowledge, therefore it cannot be used widely.

2) The cycle of gaining information is long. The cycle of gaining change information using the complex extracting method is so long that it is not available to controlling illegality in time.

In practice, the method has been explored which can extract illegal mining information fast, and realize the method by the automatic programming. The illegality could be found fast by the program.

2. EXTRACTING THE ILLEGAL MINING INFORMATION

The illegal mining information mainly concludes mining beyond the boundary or exploitation without mining licenses. Regarding these two kinds of situations, the following method

can be used in the article:

Firstly, the changed area can be extracted through contrasting two images of different time, and vector graph can be gained the by vectorization. Secondly, overlay the vector graph with current land use graph to eliminate the change region which is resulted by urban expansion or roadway expansion. Finally, overlay with the information such as property right register data, prospecting, mineral planning data, and so on, analysis and estimate illegality.(Figure 1).

2.1 Extracting the Change Information of Mine

During the actual law enforcement, much information like illegality character can be only got on the spot. Therefore, illegal location and illegal property (such as mining beyond the boundary or exploitation without mining licenses) need to be extracted and other information is not needed during the process of extraction. However, these data must be high timeliness. So the method should be simple and convenient.

Based on the above discussion, the changed regions can be obtained through the difference of intensity of two remote sensing images in different periods. The gray values of the remote sensing images in different periods are contrasted, using the intensity value to extract the changed region in the design of this method, and it is easy and feasible. The principle and method as follows:

In the remote sensing images, the color, the texture, the figure, the location and the other characteristics of the mining region are obviously different from the other features. The mining

* YUE Jianwei, postdoctoral researcher, Main research interests are GIS, E-government, and land and resources informatization. College of Resources Science, Beijing Normal University ,E_mail:yuejw@ires.cn.

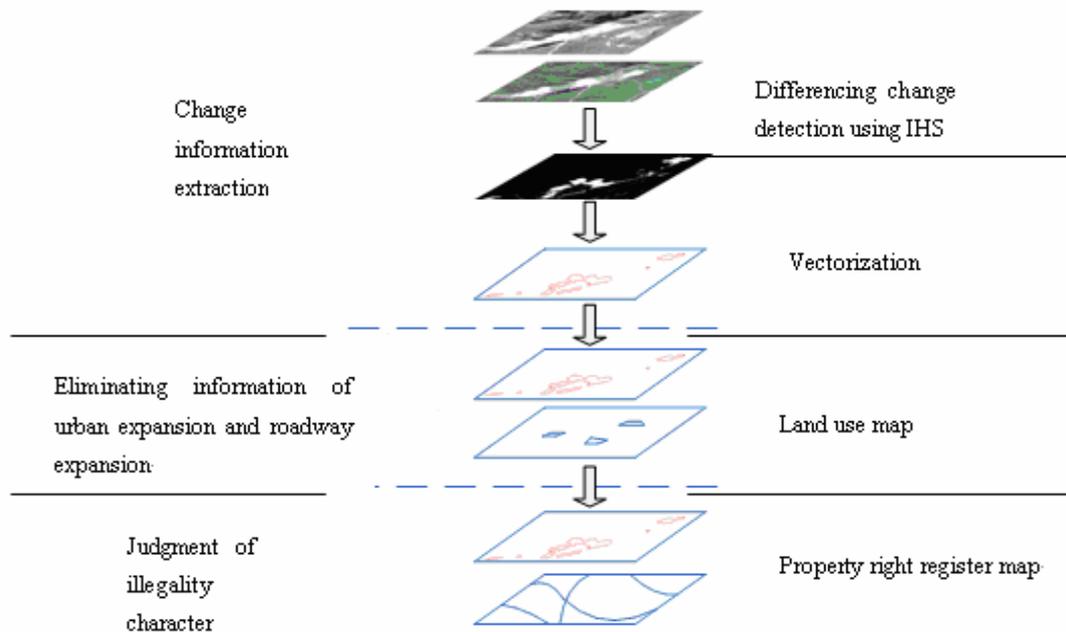


Figure 1 The method of illegality information extraction

region is more bright, and the vegetation is scarce, the texture is random, the region is coterminous and its position is generally in remote mountainous areas. Based on the above features, the IHS transformation method of remote sensing digital image interpretation methods can be used to detect the changed mining areas. With the difference of the intensity of the two different time remote sensing images, the change information can be extracted through setting thresholds. The main principle of algorithm as follows:

- 1) In the RGB Pseudo-color image with three bands, every pixel in three bands with a three values holds a maximum value M and a minimum m.
- 2) Normalize each pixel of the RGB three bands, the formula as follows:

$$R_n = (M - R) / (M - m)$$

$$G_n = (M - G) / (M - m)$$

$$B_n = (M - B) / (M - m)$$

(Notes: R_n 、 G_n and B_n are the pixel value through normalization; R、G and B are the gray value of original image)

- 3) Extract the information of the intensity. Sum up maximum and minimum of each pixel value of R_n , G_n and B_n , and then calculate the average value of each pixel value, which can result to an intensity image with single band which gray value between 0 and 1, that is the intensity image. Shown as Figure 2(a) and Figure 2(b)
- 4) Attain the difference of the intensity. The difference of intensity value can be obtained by subtract the intensity value of one IHS image from another IHS image, which is the result of step 3 to find the changed region, this is presented in Figure 2(e).
- 5) Extracting the change region. Since the image during the two periods with different time, weather, illumination and the other conditions, so large-scale changes must be brought.

However, these changed region have different intensity, unchanged region can be eliminated according to setting the appropriate threshold of the intensity. For instance, the pixels value which is greater than threshold can be set for 1, and the other can be set for 0, consequently, the changed region can be extracted automatically. Furthermore, the threshold can be revised to optimize the result. Figure 2 (f) is display the result which threshold is 0.52.

Vectorization. After the change region extracting, vectorize the image, overlay with images during the two period, data of mining property right register, mine exploration, mine planning or other data, afterward, user can analyze and judge there are illegality and its character

Remote sensing image is a large quantity of data, in order to improve the pace of implementation of the procedures, user can set the image resolution while resampling without influencing the detected result (Figure 2 show the process). The method can not only be applied to the original image, but also the TIFF or IMG which are treated with.

2.2 Eliminating the information of urban expansion or roadway expansion

The method of extracting the change information which is discussed above is only based on the intensity, so the change information due to urban expansion or roadway expansion must be eliminated which is not cared about by the tipstaff.

For example, the scenario that urban expansion or roadway widening always based on the original urban or road can be always found through analyzing the information of the images. These original information of towns or roads, such as cadastral data, land use data, etc, is known. Therefore, whether the information is urban or road information can be recognized according to the neighborhood relationship of the changed region and urban or road in the land use image. For the new road, the length-to-width ratio of the shape can be used to determine whether the information is recognized as road.

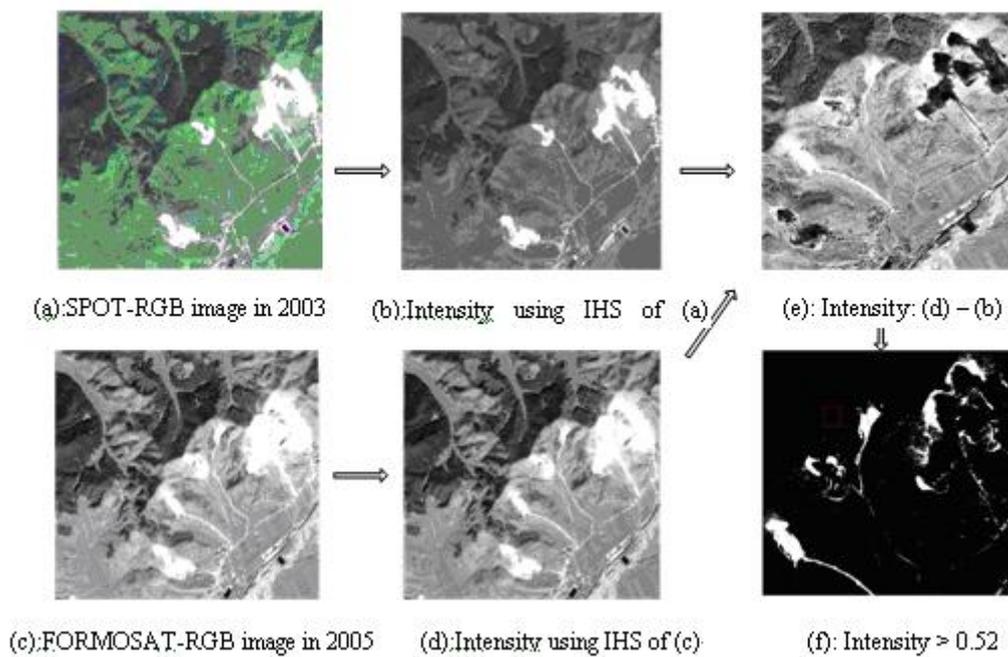


Figure 2 Change information extraction

2.3 Determining the Character of the Illegal Activities

When the interference information has been eliminated, overlaying the changed region with the data of mining property right register map, mine exploration, mine planning, or other data, and then making a buffer zone, the system can automatically decide whether mining license information is on the region, and decide whether mining activity is overstep the boundary or exploitation without mining licenses. Sequentially, the illegal information can be achieved automatically. If mining license information is on the region, and the activity is mining overstep the boundary, otherwise the activity is exploitation without mining licenses. The character also can be determined by direct eyeballing.

3. SUMMARY AND CONCLUSIONS

The method proposed on the paper can extract illegal mining information fast, and has been fulfilled by the automatic programming. The illegality could be found fast by the system that can gain the illegal information automatically without supervised classification. The office clerks are enabled to process it easily even if they had no professional knowledge. The method can help lawmen find out lawbreaking actions of mining beyond the permitting edge or without law permission efficiently. The method is useful to stop illegal mining in time.

The method and the system were applied in mine law enforcement of Liaoning province, which has proved that this method is simple and convenient. The method can be used by general staff to detect the information of the mining overstep the boundary or undocumented illegal mining or other change information around the mine.

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