ISSN: 2664-9640

Study on Land use Classification Based on Landsat8 Remote Sensing Image

Dan Wu[1,2,3,4], Hui Kong[1,2,3,4]

[1] Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd, Xi'an 710075, China;

[2]Shaanxi Provincial Land Engineering Construction Group Co., Ltd, Xi'an 710075, China;

[3]Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of natural Resources, Xi'an 710075, China;

[4]Shaanxi Provincial Land Consolidation Engineering Technology Research Center, Xi'an 710075, China

Abstract

Based on Landsat8 data, the data obtained after correction and band fusion are used as research data. Different classification methods are used for classification and recognition, and the effects and classification accuracy of different classifiers in remote sensing image classification are compared. According to the national criteria for the classification of land use present situation and the present situation of the hefei city land use, land of yan 'an mainly divided into construction land, water, agricultural land, forest land and grassland 5 classes, will adopt the parallelepiped method, markov distance method and minimum distance method, maximum likelihood method four supervised classification methods to classify, Combined with the actual situation of land use, the results of land use classification were summarized and analyzed, and the results and accuracy of land use classification were evaluated, and the results of various supervised classification methods were compared, in order to provide guidance and reference for the later land use classification. Land is an important basic resource for human development and the basis on which people live. Land use change is one of the important factors in the process of global environmental change, affecting the development of regional industry, agriculture, tourism, etc., and can reflect the development status of regional economy. Especially in recent years, with the rapid development of science and technology, the ability of human beings to exploit and utilize resources and transform the environment has been continuously enhanced, resulting in significant changes in land use types, prominent problems in land resource development and utilization, and serious impacts on the harmonious development of man and nature. The key to the study of land use status quo lies in the accurate and quantitative acquisition and analysis of ground feature information. Therefore, accurate monitoring of land use and classified research on land use are of great importance to the scientific management and rational utilization of land resources, which can help to timely grasp regional land cover change, rationally formulate land use planning, save land resources and improve land use efficiency. Remote sensing technology, as a non-contact and long-distance detection technology, plays an important role in both the study of land cover change and land use classification. Among them, the classification of remote sensing images is one of the main means to extract important information in remote sensing images, which is mainly to divide each pixel in the image into different categories according to certain rules or algorithms according to brightness and spatial structure characteristics in different bands. Remote sensing images have been widely used to monitor land use change. Landsat8 has become an important data source for the majority of scholars due to its

advantages of rich band information, high spatial resolution and easy access. With the development of remote sensing technology in China, high-resolution remote sensing images have also been applied to land use classification by virtue of their obvious internal differentiation, clear texture and rich details. Landsat8 satellite is the latest data support system of American Earth observation, providing 8 multi-spectral bands with a spatial resolution of 30m and a panchromatic band with a spatial resolution of 15m, as well as thermal infrared data. In this paper, parallelepiped method, minimum distance method, Mahalanobis distance method and maximum likelihood method are used to classify land use data from Landsat8 remote sensing images in August 2020 in Yan 'an city, Shaanxi Province, in order to have a certain understanding of the status quo of land use in Yan 'an city.

Keywords

Land use classification, supervised classification,Landsat 8.

1. Overview of the study area and data sources

1.1. Overview of the study area

Yan 'an is located in the hilly and gully region of loess Plateau, between 35° 21'N ~37° 31'N, 107° 41'E ~110° 31'E. It is connected with Yulin city in the north, Tongchuan , Weinan and Xianyang in the south, Linfen and Luliang across the river in the east, and Qingyang in the west. Yan 'an covers an area of 36,700 km^2 with an average altitude of 1200m. Located in the Yellow River basin, rich water system, there are yanhe, Luohe, Ju river and other large rivers in the region, the water system in the whole region is dendritic distribution, the river is generally narrow, the river bed is relatively large, the river fluctuation range is larger.

1.2. Data Sources

The remote sensing image data used in this paper is landsat8OLI image, from geospatial data cloud (http://www. Gscloud.cn /) in August 2020, with a spatial resolution of 30m. Data products through system radiation correction, geometric correction, image fusion and cutting, such as pretreatment, using visual interpreting selecting typical land use classification the training sample, respectively adopt parallelepiped method, markov distance method, maximum likelihood method, the minimum distance method, the method of the study area are classified, and the classification results were analyzed.

2. Research methods and sample selection

2.1. Classification Methods

Spectral image classification can be divided into supervised classification and unsupervised classification [1-8]. Supervised classification, also known as training classification, is simply a process of using the sample pixels of the confirmed category to identify other unknown categories of pixels. Before classification by visual interpretation and field investigation, some samples on the remote sensing image area feature category with a priori knowledge, and then select a certain number of training samples for each category, calculate the statistical information of each training sample area, at the same time use the subcategory of discriminant function training, when meet the requirements of subsidiary category classification, The trained discriminant function is used to classify other unfractional data. Each pixel is compared with the training sample, and finally divided into the most similar sample class, so as to complete the classification of the whole image. The commonly used supervision classification methods are as follows:

(1) Parallelpiped method: Parallelpiped method refers to the rule of judgment based on the spectral characteristic curves of ground objects and the assumption that the spectral characteristic curves of similar ground objects are similar. Its scale is determined by the standard deviation threshold calculated from the mean value of the class generated by the training sample learning

(2) Mahalanobis Dis- tance method: as a directional sensitive distance classifier, Mahalanobis Dis- tance assumes that the covariances of all classes are equal and takes into account the discreteness of pixel values in each class. By calculating the Mahalanobis distance between the pixel to be divided and the mean vector of each category, the pixel is classified into the category with the smallest Mahalanobis distance.

(3) Minimum Distance method: The Minimum Distance method is the Euclidean Distance between the pixel to be distinguished and the mean vector of the training sample as the classification scale. By calculating the Euclidean distance between all undivided pixels in the whole image and each kind of center, the Euclidean distance from the category is the smallest, and it belongs to the category.

(4) Maximum Likelihood method is established on the basis of probability discriminant function and Bayesian discriminant rule, and it is assumed that the fifth data of each class obeys gaussian normal distribution in feature space.

2.2. Sample Selection

Land use classification has been widely applied to land, water conservancy, environmental protection and other industries. In recent years, it has also been applied to the national dynamic monitoring of soil and water loss. Based on the Classification of Land Use Status (GB/T21010-2017) [9], combined with the distribution characteristics of Landsat8 data attributes and classification objects, In this study, the sample area was established by visual method and divided into five land use types: construction land, forest land, water body, agricultural land and grassland. The establishment of training samples requires good separability. Common judgment methods include Jeffries-Matusita and Tranesformed-Diver- CES. The value is between 0 and 2, and the closer it is to 2, the better the separability is. < 1.8, the sample needs to be selected again; When < 1, the combination of the two samples should be considered. The Jeffries-Matusita coefficient was used to distinguish the training samples, and it was found that all kinds of samples were between 1.8 and 2.0, indicating good separability of the samples. Specific coefficient values are shown in Table 1.

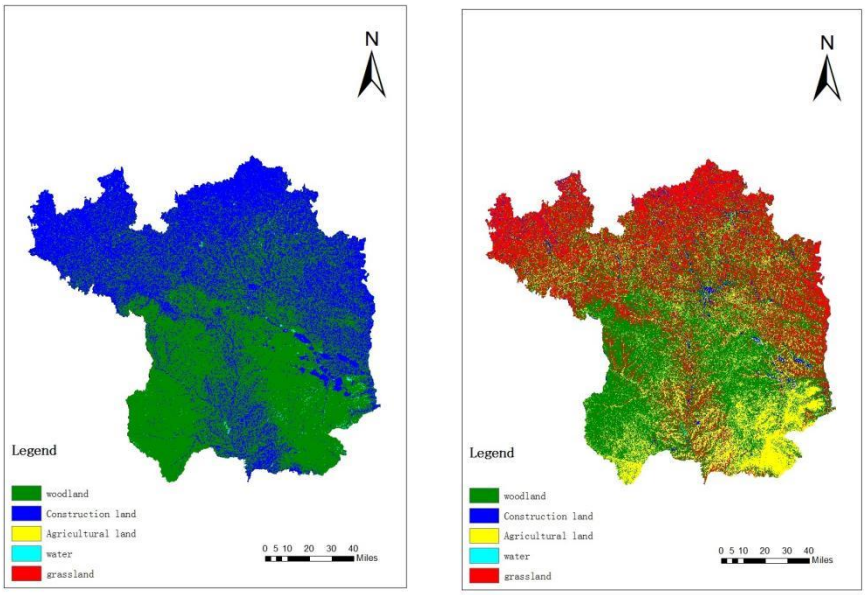
Table 1 Jeffries-Matusita coefficient values of training samples

	Construction land	woodland	Agricultural land	grassland	water
construction land	/	1.98836122	1.90320719	1.86207642	1.85672762
woodland	1.98836122	/	1.84801820	1.90397523	1.98554205
Agricultural land	1.90320719	1.84801820	/	1.80614043	1.95586888
grassland	1.86207642	1.90397523	1.80614043	/	1.97703730
water	1.85672762	1.98554205	1.95586888	1.97703730	/

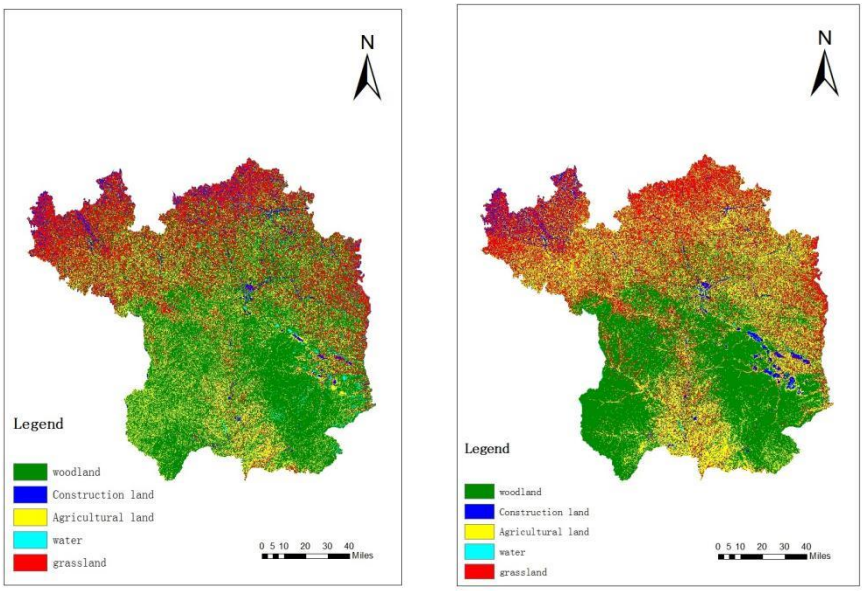
ISSN: 2664-9640

3. Results and analysis

According to the supervised classification method and principle, ENVI software was used to classify Landsat8 remote sensing image data of Yan 'an city, and the results are shown in Figure 1.



A. Parallelepiped classification B. Mahalanobis distance classification



C. Minimum distance classification D.Maximum likelihood classification

Fig.1 Supervised Classification Results

Figure 1 by contrast can be seen that parallelepiped method classification is equivalent to the multidimensional data in feature space into several non-overlapping parallelepiped block, according to the brightness of the sample values form a n d parallelepiped data space, other like yuan spectral values if fell on the parallelepiped any training sample area, is divided into the corresponding category. Due to the topography and geomorphology of Yan 'an city, forest land and construction land are relatively widely distributed, while grassland and agricultural land are only sandwiched between construction land and forest land, and the range is relatively small. According to the classification principle of parallelepiped method, samples of cultivated land and grassland are more likely to fall into the parallelepiped of forest land and construction

land. Therefore, parallelepiped classification method is not suitable for land use classification in Yan 'an city. Compared with the other three supervised classification methods, it misclassifies construction land and grassland, and fails to classify grassland and cultivated land. The classification effect of Mahalanobis distance method on cultivated land, grassland and forest land is poor, and the degree of confusion between cultivated land and forest land and grassland and forest land is large. Compared with the maximum likelihood method, the boundary of land use classification by minimum distance method is more fuzzy, and the confusion between grassland and cultivated land is more serious. In conclusion, the maximum likelihood method based on supervised classification has the best effect on ground object recognition of remote sensing images in the study area.

4. Conclusion

Based on the principles of four different supervised classification methods and taking Yan 'an city as the research object, this study compares and analyzes the classification results and accuracy of four methods: parallelepiped method, Mahalanobis distance method, minimum distance method and maximum likelihood method. The results show that:

The classification results of Landsat8 remote sensing image data differ greatly depending on the classifier selection. In this study, the classification accuracy based on Mahalanobis distance method and maximum likelihood method is relatively high, with the overall classification accuracy reaching 90.9705% and 83.7067% respectively, indicating that maximum likelihood method has a good effect in Landsat8 remote sensing image classification. After the band fusion of the original image, the resolution is improved. It is helpful to improve the accuracy of classification results. 2) remote sensing image classification for sample selection of quality requirements is very high, if the selected sample separability is not high, the classification results tend to be affected by a lot, a type of water body is relatively easy to identify, in this study, the classifier for classification accuracy is very high water, four kinds of classification methods were above 90%. In addition, it can be seen from this study that the effect of some types of classification is not ideal, and in the later stage, different methods can be used to conduct sensitivity classification research on the classification accuracy of different land classes.

Acknowledgements

This paper was supported by Shanxi Province Land Enginaeering Construction Group Project DJNY2022-28.

References

[1] Wang Min, Gao Xinhua, Chen Siyu, et al. Land use classification based on Landsat 8 remote Sensing images: A Case study of Anqu Demonstration Area in Hongyuan County, Sichuan Province [J]. Pratacultural Science, 2015, 32(5):694.

[2] Gao Linghan, Zhao Pengxiang, Zhang Xiaoli, et al. Research of Soil and Water Conservation, 2017, 24(2):6.]

[3] Zhou Lihong, Wu Hao. Classification and Analysis of land use in Nanchang County based on Landsat8 Remote Sensing Image [J]. Yangtze River, 2017(S2):4.

[4] Bai Wanqi, Bai Shuqin. Status and role of land use and land cover change in global change research [J]. Areal Research and Development, 1999, 18(004):13-16.

[1] Li Qing, SHI Minwei. Land use classification in Multi-temporal Landsat8 based on random forest [J]. Information Technology and Informatization, 2019(7):3.

[6] Houghton R A . Temporal patterns of land-use change and carbon storage in China and tropical Asia[J]. Science China life sciences, 2002(z1):11.

ISSN: 2664-9640

[7] Xu Hanqiu, Tang Fei. New features of Landsat8 remote sensing images and their ecological environment significance [J]. Acta Ecologica Sinica, 2013, 33(11):9.

[8] Du Peijun. Remote Sensing principle and Application [M]. Xuzhou, Jiangsu: China University of Mining and Technology Press, 2006.

[9] GB/T201010-2017.Land use status classification [S].2017.