ISSN: 2688-9323

Modeling and Analysis of Vegetation Extraction based on Landsat 8

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Abstract

Vegetation occupies a large part of the earth's surface. At present, vegetation extraction from remote sensing images has become one of the important methods to study the geographical environment indirectly, and the main methods of vegetation extraction include normalized vegetation index method and ratio vegetation index method. In this paper, normalized vegetation index (NDVI), ratio vegetation index (NDVI) and difference vegetation index (DDVI) were used to conduct modeling experiments of Landsat8 OLI images in kunming city, Yunnan Province. The results show that: through the comparative analysis of vegetation extraction results of the three models, it can be found that different vegetation extraction models have certain differences in the extraction of vegetation, the experiment shows that the ratio vegetation index method is better.

Keywords

Landsat8 OLI; Vegetation; Different Vegetation Index Method; Ratio Vegetation Index Method.

1. Introduction

Vegetation is an important part of terrestrial ecosystem and plays an important role in maintaining and promoting regional ecological balance and sustainable development. In recent years, with the development of remote sensing technology, remote sensing image has become an important way to obtain vegetation information quickly. The methods and results of vegetation coverage extraction from remote sensing images vary with satellite remote sensing images and spatial resolution[1].Vegetation occupies a large proportion in the surface of the earth. Vegetation on the land surface is often the first surface layer of remote sensing observation and recording, which is the most direct information reflected by remote sensing images and the main object of people's research. As an important part of the geographical environment, vegetation is compatible with climate, landform and soil conditions[2]. The growth of vegetation is controlled by various factors, especially dependent on the geographical environment and sensitive to the changes of other factors. Therefore, vegetation information obtained by remote sensing can be used to analyze other information[3]. At present, with the gradual deepening of remote sensing and vegetation remote sensing, vegetation remote sensing research has been more practical, quantitative direction of development, now there are dozens of vegetation index model. Zhai Tianlin, et al based on the advantages of Landsat8 images in vegetation monitoring and other aspects, a study was carried out to extract vegetation information by combining a variety of derived data that could directly reflect vegetation information with band combination, and to judge whether adding texture would help improve the extraction accuracy of vegetation information [4]. Yang Liangyan based on Landsat satellite images, the vegetation index of Hengshan mountains was obtained by using remote sensing inversion method [5].

2. Study Area and Data

2.1. Study Area Overview

In this paper, the study area is in kunming, yunnan province, kunming is located in the yunnan-guizhou plateau central, north and liangshan yi autonomous prefecture, southwest and southeast yuxi city, honghe hani and yi autonomous prefecture, adjacent to the west and bordering chuxiong yi nationality autonomous prefecture, eastern border with qujing city, is the core of the urban agglomeration in the central yunnan, kunming city center is about 1891 m above sea level. Gongwang Mountain Ma Manling is the highest point in Kunming with an elevation of 4247.7m. The confluence of Jinsha River and Purdu River is the lowest point in Kunming with an elevation of 746m. The city is located in yunnan-Guizhou plateau, the overall terrain is high in the north, low in the south, from north to south in a step shape gradually lowered. Central bulge, lower east and west. The main landform is lake basin karst plateau, followed by red mountain primitive landform. Most areas are between 1500 and 2800m above sea level.

2.2. Research Data

Landsat8 was launched on February 11, 2013, carrying two primary payloads: OLI (Operational Land Imager) and Thermal Infrared Sensor (TIRS). OLI land Imager includes 9 bands with a spatial resolution of 30 m. The TIRS sensor contains two thermal infrared bands with a resolution of 100 m. Landsat8 OLI data were used in Kunming, Yunnan province, with a strip number of 130 and a row number of 43. The image was acquired on April 6, 2017, with an average cloud cover of 0.42, indicating good image quality. The image data came from the geospatial data cloud platform of Computer Network Information Center, Chinese Academy of Sciences, and the image was terrain correction image.

3. Research Program

In this paper, envi5.1 is used for experimental analysis. The experimental image is opened and displayed. When loading, the. MTL file is used. Select (4,3,2) and non-standard false color (5,4,3) respectively, as shown in Figure1.

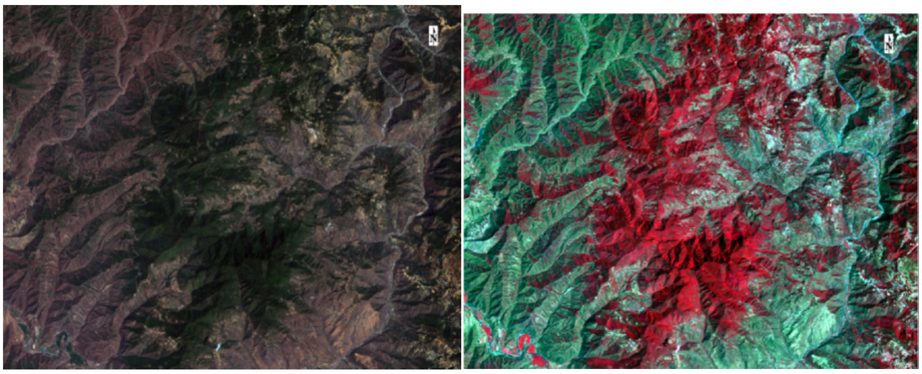

Figure 1. Vegetation information

ISSN: 2688-9323

3.1. Normalized Difference Vegetation Index (NDVI)

In view of the infinity of RVI with dense vegetation, Deering proposed the normalized vegetation index NDVI. The normalized vegetation index is the difference between the reflectance of the two channels divided by their sum. When the vegetation is in medium and low coverage, the index increases rapidly with the increase of coverage, and increases slowly after reaching a certain coverage, so it is suitable for dynamic monitoring of vegetation in the early and middle growth stages. In the envi software toolbox, select band ratio / band math, double-click the band math dialog box, enter the mathematical expression of NDVI in enter an expression: (float (B5) - float (B4)) / (float (B5) + float (B4)), and click Add to list, The expression appears in the previous band math expression. Click OK to enter the next step. In the pop-up variables to bands pairs window, select the corresponding band in the image file from the available bands list for band B4 and band B5, and select the file output path and file name. Click OK. The calculation result of NDVI is shown in Figure 2, in which white (high brightness) represents vegetation.

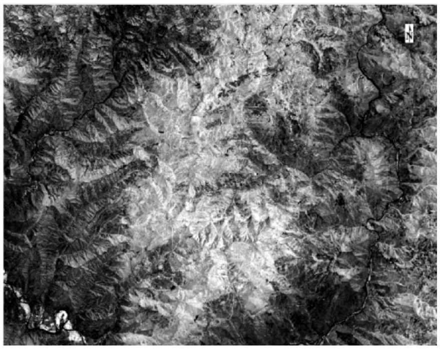

Figure 2. NDVI vegetation extraction results

3.2. Ratio Vegetation Index (RVI)

RVI is the first vegetation index proposed to be used, which is expressed by the ratio between the reflectance of two bands. The ratio vegetation index, also known as greenness, is the ratio of two channel reflectance, which can better reflect the difference between vegetation coverage and growth status. It is especially suitable for vegetation monitoring with vigorous vegetation growth and high coverage. Repeat in the toolbox, select band ratio → band math, double-click to pop up the band math dialog box, and enter float (B5) / float (B4) in enter an expression. Click Add to list, the expression will appear in the previous band math expression, and click OK to enter the next step. In the pop-up variables to bands pairs window, for band B4 and band B5, select the corresponding band in the image file from the available bands list, and select the file output path and file name. Click OK. The calculation result of RVI is shown in Figure 3, where white (high brightness) represents vegetation.

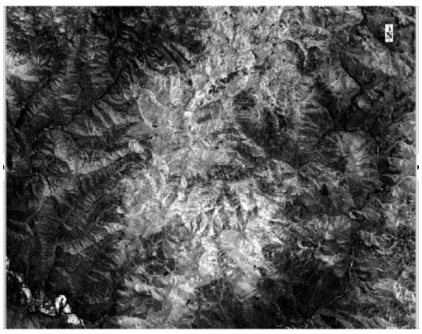

Figure 3. RVI vegetation extraction results

ISSN: 2688-9323

3.3. Difference Vegetation Index (DVI)

The difference vegetation index, also known as the agricultural vegetation index, is the difference of the reflectance of two channels. It is sensitive to the change of soil background and can identify vegetation and water well. The index increased rapidly with the increase of biomass. DVI is defined by the difference between two bands. Repeat the test steps. In ENVI software toolbox, select Band Ratio/Band Math, double-click the Band Math dialog box, and Enter DVI mathematical expression in Enter an Expression: Float (b5)-float(b4), click Add to List, Expression appears in Previous Band Math Expression, click OK to go to the next step, in the popup Variables to Bands Pairings form, For B4 and B5 Bands, select the corresponding Bands in the image file from the Available Bands list, and select the file output path and file name. Click OK. The DVI calculation result is shown in Figure 4, where white (high brightness) represents vegetation.

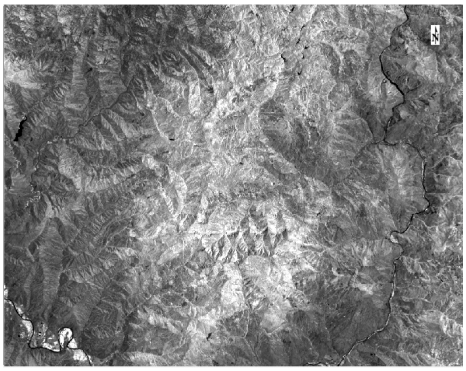

Figure 4. DVI vegetation extraction results

4. Comparison and Analysis of Results

In this paper, RVI, NDVI and DVI extraction methods were compared. In this study area, the effect of vegetation extraction by RVI is greater than that by NDVI method. In this experiment, the effect of vegetation extraction by RVI is obvious. In places where vegetation is well developed, the experimental results show that the image species are particularly white, which is significantly different from those in the experimental research area where there is no vegetation. The results of vegetation extraction by NDVI are more obvious, but not as obvious as that by RVI, which is in the middle of RVI and DVI. The DVI method was used to extract the vegetation in the study area, and the results showed that although the vegetation coverage information could be extracted, it did not form a particularly obvious boundary with other uncovered vegetation areas in the study area.

Acknowledgments

This paper was supported by Shanxi Province Land Engineering Construction Group Project DJNY2021-32.

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ISSN: 2688-9323

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