A Simple Shadow Area Processing Method

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Keywords: Remote sensing, shadow area, ratio analysis, image processing

Abstract: Shadow is an important factor that restricts remote sensing information extraction. How to use simple and effective image processing method to display the remote sensing information of shadow area has been a difficult problem in the field of remote sensing. In this paper, a simple ratio analysis method is applied to study the shadow area remote sensing image processing, which shows the remote sensing information hidden in the shadow area better. The method lays a good foundation for further remote sensing information extraction. This method is simple and effective, not only can solve the problem, but also easy to operate, even the non-remote sensing image processing professionals can also be used flexibly.

1 INTRODUCTION

Shadow is an important factor that restricts remote sensing information extraction. How to use simple and effective image processing method to display the remote sensing information of shadow area has been a difficult problem in the field of remote sensing. There are many research findings about shadow processing, in recent years. A shadow processing method based on normalized RGB colour model was proposed by Yang and Zhao (Yang and Zhao, 2007).A shadow compensation method based on linear stretching, smoothing and principal component was proposed by Wang and Wang (Wang and Wang, 2010). By improving the Wallis filtering shadow compensation strategy, the ground information in the shadow area was highlighted by Gao et al. (Gao et al., 2012). The shadow vegetation index SVI was constructed to discuss the problem of image shadow removal by Xu et al. (Xu et al., 2013).Combining the wave band regression model and shadow vegetation index SVI can be effective, according to Liu et al. (Liu et al., 2013). Gao et al. (Gao et al., 2014) believe that in order to compensate the model as the foundation, through the mean brightness shadow and non-shadow region statistics and variance, it is possible to use the method of feature extraction and matching of automatic acquisition of model parameters, automatic compensation and shadow comprehensive regional overall level of compensation and compensation for the two level local window. Deng et al. (Deng et al., 2015) explored the use of blue light suppression algorithm and statistical information of shadow homogeneity to compensate for H, I and S components, respectively and converted the results to RGB colour space to achieve shadow compensation. Based on ArcGIS Engine platform, Matlab and GDAL development tools, Yang et al. (Yang et al., 2015) integrated shadow detection and compensation systems designed according to the shadow detection and compensation algorithm of high resolution remote sensing images. Shadow removal of remote sensing images based on inhomogeneous regularized texture-preserving was proposed by Fang et al. (Fang et al., 2015). The shadow removal model of traditional HSV space by integrating one step information, based on it, a shadow removal algorithm of moving objects based on reflectance ratio invariants, was proposed by Zhang and Yang (Zhang and Yang, 2016). Improvement of image shadow tracking and elimination algorithm based on texture loss least constraint was proposed by Yan et al. (Yan et al., 2016). Methods of pattern recognition and image enhancement are used to discuss the problem of shadow removal by Zhao et al. (Zhao et al., 2016). Methods used shadow extraction, envelope removal, similar pixel search and shadow brightness reconstruction to explore the shadow

Wang, H.
A Simple Shadow Area Processing Method.
In *Proceedings of the International Workshop on Environment and Geoscience (IWEG 2018)*, pages 507-510
ISBN: 978-989-758-342-1

information reconstruction experiment of Landsat 8 OLI image in hilly area of southwest China were proposed by Zhang et al. (Zhang et al., 2017). Shadow removal algorithm based on improved Gaussian mixture model and texture was proposed by Wang and Zhang (Wang and Zhang., 2017). A method of target detection and shadow removal based on the combination of improved adaptive hybrid Gaussian model and colour space was proposed by Wang and Tong (Wang and Tong, 2013). These shadow removal methods are more suitable for remote sensing researchers, and master software professionals, however for remote sensing interpretation and information extraction of personnel engaged in the application of remote sensing, these software are often not good, and need a lot of energy to carry on the software programming, it is also difficult to extract remote sensing information of a shadow area. If a simple, effective, easy to understand and easy to operate shadow area processing method could be found; it will solve the problem of remote sensing shadow for interpreters and information extraction personnel.

2 AN OVERVIEW OF THE STUDY AREA

The study area is located in the middle of Qinghai Province, in the southeastern side of the Qaidam Basin. It is a part of Kunlun mountain, Burhan Budai Mountains in China, the highest peak of which is 5000 meters above sea level. The study area is located at an elevation of 4000 meters. Under the action of plate movement, the ground surface continues to uplift, the erosion is sharp and the terrain is rugged where it is located at the southern margin barrier of the Qaidam Basin. The remote sensing image of the mountain slope often has shadow, causing a lot of trouble to the remote sensing information extraction and interpretation work, need a simple and effective treatment method of shadow zone.

3 REMOTE SENSING DATA AND PRE-PROCESSING

In order to improve remote sensing image of shadow area, the GeoEye-1 and Worldview-2 remote sensing data of the study area were obtained (Table 1).

In order to ensure that the research work will be carried out smoothly, first of all remote sensing data quality was checked for the vegetation cover, the amount of snow and ice, cloud cover, distortion, and noise. Inspection shows that the remote sensing data is characterized by rare cloud and snow, low vegetation cover, no distortion, no noise (Table 2).

Table 1: List of remote sensing data and their characteristics.

Number	Data Type	Band Name	Band Number	Resolution(m)	Spectral Range(nm)
1	GeoEye-1	Pan	Pan	0.5	450-800
		Blue	1	2	450-510
		Green	2	2	510-580
		Red	3	2	655-690
		Near Infrared	4	2	780-920
2	Worldview-2	Pan	Pan	0.5	450-800
		Coastal	1	2	400-450
		Blue	2	2	450-510
		Green	3	2	510-580
		Yellow	4	2	585-625
		Red	5	2	630-690
		Red Edge	6	2	705-745
		Near Infrared 1	7	2	770-895
		Near Infrared 2	8	2	860-1040

Table 2: List of remote sensing data inspection

Number	Data Type	Vegetation	Snow and Ice	Cloud	Distortion	Noise	Strip
1	GeoEye-1	Very Sparse	No	<5%	Not Obvious	No	No
2	Worldview-2	Very Sparse	<5%	<5%	Not Obvious	No	No

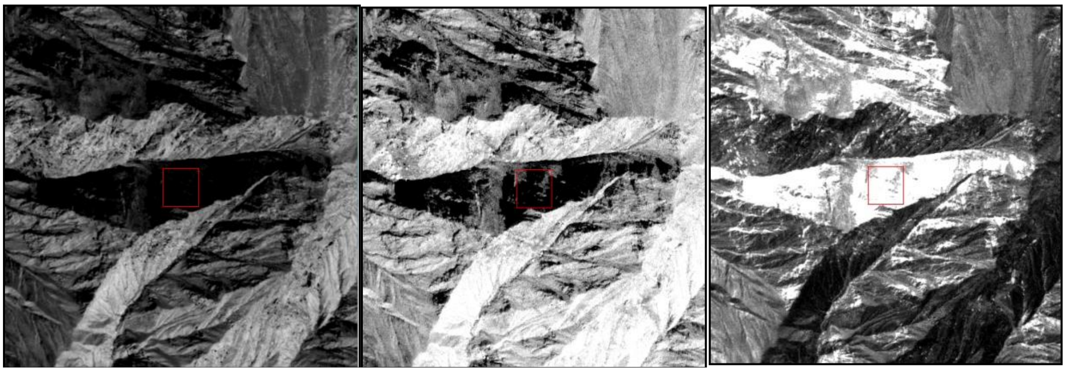

Figure 1: Image contrast of GeoEye-1 before and after data ratio operation (Left: B1; Middle: B3; Right: B1/B3).

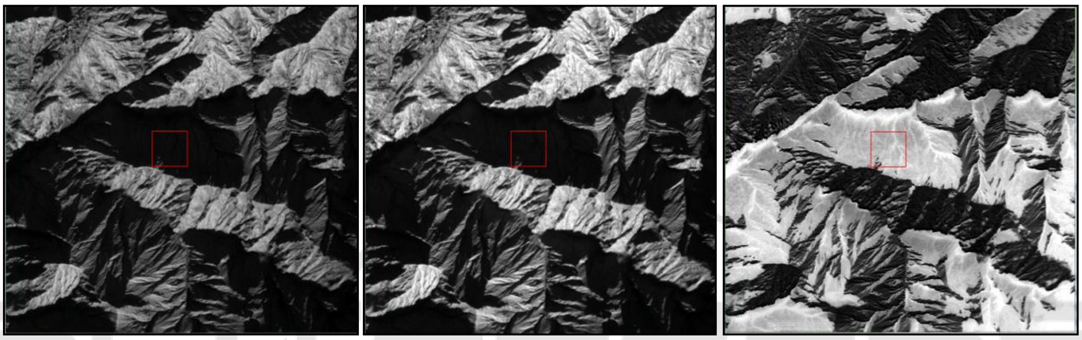

Figure 2: Image contrast of Worldview-2 before and after data ratio operation (Left: B3; Middle: B8; Right: B3/B8).

Remote sensing data pre-treatment includes raw data normalization, image rectification, band registration, image mosaic, data fusion, removal of interference and tailoring of black edges. The processed remote sensing data are more suitable for subsequent research.

4 IMAGE PROCESSING IN SHADOW AREA

In order to display remote sensing information hidden in the shadow area, a variety of remote sensing image processing methods had been tried, and it was found that the method of using band ratio operation is simple and effective.

Using GeoEye-1 remote sensing data to conduct shadow area remote sensing image processing method, it was found that after executing B1/B3 band ratio operation, the hidden information in the shadow area can be displayed, which is convenient for remote sensing interpretation (Figure 1).

Using Worldview-2 remote sensing data to conduct shadow area remote sensing image processing method, it is found that after B3/B8 band ratio operation, the hidden information in the shadow area can be displayed, which is convenient for remote sensing interpretation (Figure 2).

5 CONCLUSIONS

It is concluded that by using GeoEye-1 and Worldview-2 remote sensing data, B1 to B3 and B3 to B8 band ratios respectively can make the hidden information in the shadow area appear, which makes the interpretation of the remote sensing images easier.

This method is simple and effective, not only to solve the shadow problem, but also easy to operate, even for the non-remote sensing image processing professionals.

ACKNOWLEDGMENTS

China Geological Survey Project: national mineral resources development environment remote sensing monitoring (DD20160075, 121201003000172705), national mine new restoration and treatment monitoring in 2017 (DD20189805, 121201003000172718) support.

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