Exploration of the Potential Copper Areas in Khoy City, Ghezel Dash, Using Hyperion Images

Mehdi Belvasi*
MA in Remote Sensing and Geographic Information Systems (GIS), University of Tabriz, Tabriz, Iran
Sayyad Asghari Saraskanroud
Assistance Professor of Geomorphology, Department of Geomorphology, Faculty of Literature and Humanities, Urmia University, Urmia, Iran
Batool Zeinali
Assistance Professor of Climatology, Department of Climatology, Faculty of Literature and Humanities, Mohaghegh Ardabili University, Ardabil, Iran
Saiedeh Sahebi Vayghan
MA Student in Remote Sensing and Geographic Information Systems (GIS), Kharazmi University, Tehran, Iran

Received: 28 September 2014 Accepted: 11 April 2015

Extanded Abstract

Introduction

In recent decades, a large variety of science experts, including geology and mine scientists, have considered remote sensing technology as one of the most important instruments to receive information. Access to hyper spectral data is one of the main evolutions in the remote sensing technology. The main feature of the technology is its application in identification of minerals and detection of the minerals. Existing narrow and spectral bands of hyper spectral images provide the possible for geologic and mineralogy examination of an area. Paying attention to existing maps of the mineral distribution has been provided by classic method. Therefore, new sensor such as Hyperion has provided new capabilities in planning of biophysical and biochemistry features.

Materials and Methods

Ghezel Dash area is located in longitudes 44° 28′ – 44° 41′ and latitude 38° 43′ – 39° 06′ that is in 68 Km of Khoy City, Northwestern part of West Azerbaijan. The Satellite image employed in this research is Hyperion sensor of EO-1 satellite with 242 spectral bands. Satellite images of

* E-mail: belvasi1@yahoo.com Tel: +98 9166592641

Landsat 7, ETM sensor, band 8 has also been used for geometric correction of the Hyperion sensor images. In this research, after necessary preprocessing including geometric and radiometric corrections on Hyperion images was performed, we used SAM and Spectral Information Divergence (SID) Algorithms for detection of minerals. Spectral angular mapper (SAM) is an automated method of algebraic that calculates similarity of the spectra between the spectrum of a pixel and the reference spectrum. The similarity between the two spectra is expressed as their mean angle. The SID is a probabilistic method that calculates spectral similarity between two pixel vectors based on the difference in the probability distribution obtained from their spectral signatures. The smaller the divergence, the more is the probability of similarity of pixels.

Results and Discussion

In this research Spectral Library of United States Geological Survey (USGS) was used for matching of unknown spectrum. Then, resample was performed by hyper spectral data of Hyperion with 142 bands. Minerals map was detected after running the algorithms of SAM and SID by spectral signatures of USGS spectral library and Hyperion images spectra to detect minerals. Results of this research indicate that Chalcopyrite, Pyrite and Bornite have the maximum value in both methods, respectively, but their amounts are different in two algorithms. In these maps, secondary minerals such as Malachite and Azurite are very slight. In order to assess the accuracy of these algorithms, the results of these two algorithms were compared with the maps produced in this region. The results indicate that the maps of SAM and SID methods have accuracy of 85 and 76 percent, respectively.

Conclusion

Comparison of the maps produced by the algorithms used in this study with available maps indicates that the minerals are present in the study area. Map of West Azarbaijan province confirmed the effects of industries and mines. The minerals of malachite and azurite were not confirmed in the Geological Organization report. Based on the results of the present study and evaluation of the overall accuracy, Spectral Information Divergence method (SID) can be used as an efficient method in classification based on exited minerals for detection of metal mines. The results of this research also is consistent with the results of Amer et al. (2012) that had used classification methods of SAM and SID for classification of alteration zones associated with gold.

Keywords: hyperion, hyperspectral remote sensing, spectral angular mapper, Spectral Information Divergence (SID).