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MINERAL MAPPING IN THE REGION OF LONAR SAROVAR

Gore Ranjana Waman
Assistant Professor
Marathwada Institute of Technology
Aurangabad.

Abstract

Multispectral Remote Sensing is a new technology which is useful in the detection and identification of minerals, vegetation, materials and backgrounds. The camera captures the images at various frequencies. With multirspectral imaging we can obtain the spectrum for each pixel in the image to identify objects, identify materials, or minerals. A normal color camera acquires three different spectral channels corresponding to the visual primary colors while multispectral images provide detailed information about the scene. Hence, with multispectral imaging we can classify the objects in the scene more efficiently than the normal camera. Spectral characteristics can be used to classify such objects.

Keywords: Multispectral data, Mineral mapping, SAM

Introduction

There are many minerals present on the earth's surface which adds in the wealth of a country. The mineral findings will helps in the development of the nation. But they are lacking behind because there are no new methodologies or techniques to easily find out the minerals. Now there is demand for minerals to sustain and develop economy which has caused the world to dig and consume more minerals. To tackle these high demands and necessities new technologies have certainly helped to find out the new mineral resources. There are number of methods for mineral exploration. One of the most common techniques mineral exploration prospecting is the Remote Sensing.

Remote sensing is the science with which we can obtain the information about different objects or areas from a longer distance. Remote sensors uses energy reflected from earth and collects the data. These sensors can be on satellites or mounted on aircraft. Remote sensing has a wide range of applications in various fields[1].

The data is collected from USGS for this study and contains EO-1 ALI data files in Hierarchical Data

Format (HDF) or Geographic Tagged Image-File Format (GeoTIFF). Earth Observing-1 (EO-1) spacecraft is a pushbroom imaging spectrometer. The EO-1 ALI is the first Earth-Observing instrument to be flown under NASA's New Millennium Program (NMP). The ALI employs novel wide-angle optics and a highly integrated multispectral and panchromatic spectrometer.EO-1 is a technology verification project designed to demonstrate comparable or improved Landsat spatial and spectral resolution with substantial mass, volume, and cost savings. The EO-1 ALI is a technology verification instrument under the NMP. The focal plane for this instrument is partially populated with four sensor chip assemblies (SCA) and also covers 3° by 1.625°. Operating in a pushbroom fashion at an orbit of 705 km, the ALI provides Landsat type panchromatic and multispectral bands. These bands have been designed to mimic six Landsat bands with three additional bands covering 0.433-0.453, 0.845-0.890, and 1.20-1.30 µm. The ALI also contains wide-angle optics designed to provide a continuous 15° x 1.625° field of view for a fully populated focal plane with 30-meter resolution for the multispectral pixels and 10-meter resolution for the panchromatic pixels[2] .

The EO-1 satellite was launched on November 21, 2001 as part of a one-year technology validation/demonstration mission. The Hyperion satellite data was ordered from the USGS Earth explorer website and it was delivered within two months.

ImageJ is a public domain Java image processing and analysis program inspired by NIH Image can display, edit, analyze, process, save and print 8–bit, 16–bit and 32–bit images. It can read many image formats including TIFF, GIF, JPEG, BMP, DICOM, FITS and 'raw'. It supports 'stacks' (and hyperstacks), a series of images that share a single window. It is multithreaded, so time-consuming operations such as image file reading can be performed in parallel with other operations[3].

The datasets composed of about 3 to 10 spectral bands. The spectral bands provides unique spatial/spectral datasets for analysis of surface mineralogy. Each band is acquired using a remote sensing radiometer.

As Different minerals have a unique reflectance and absorption pattern across different wavelength the minerals can be uniquely identified. Two main causes for the absorption features include electric processes and vibrational processes.

The primary aims and objectives of the present work is spectral analysis for mineral abundance mapping in the part of Lonar, Buldhana district, Maharashtra, India. This study focuses on the various minerals present in the exposed rock surface in the study area.

Address/Place	**Latitude**	**Longitude**
Lonar, Maharashtra 443302, India	19.9848	76.5224

Study area

The study area is a part of Buldhana District, Maharashtra, India near lonar lake with latitude 19.9848 and longitude 76.5224. **Lonar Lake** is a

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saline soda lake located at Lonar in Buldhana district, Maharashtra, India, which was created by a meteor impact during the Pleistocene Epoch and it is the largest and only hyper velocity impact crater in basaltic rock, anywhere found on earth. This lake, which lies in a basalt impact structure, is both saline and alkaline in nature.

Data used & methodology

The data on board EO-1 satellite acquired on 08-12-2015 is used for this study. The data used for study is obtained from USGS which Level 1Gst dataset is radiometrically and geometrically corrected data. This dataset is having same details as level1R data.

With the help of remote sensing we can understand the effects of atmosphere on the electromagnetic radiation. Due to these radiations image quality gets hampered. So there is need to have preprocessing.

Preprocessing of Input data

Preprocessing of multispectral data is complex and challenging task. Figure 1 (a,b,c)shows the statistics of input image with graphs.

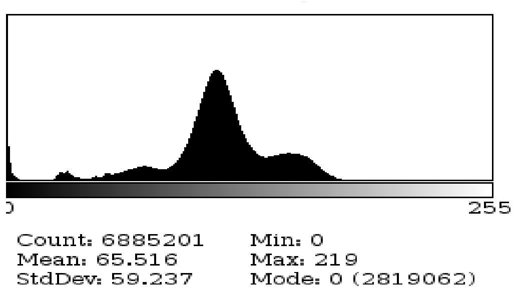

Fig. 1.a Histogram

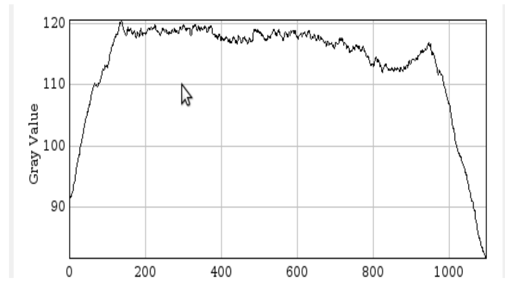

Fig. 1.b Plot of region

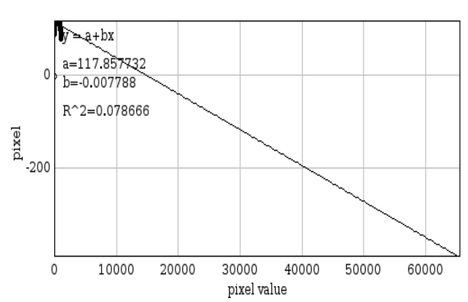

Fig. 1.c Calibration

The input dataset is preprocessed for smoothing. This filter replaces each pixel with the average of its 3×3 neighborhood. After smoothing sharpening is performed which increases the contrast and accentuates the detail in the image or selection. This filter uses the weighting factors to replace each pixel with a weighted average of the 3×3 neighborhood. Figure 2 shows the output image after preprocessing.

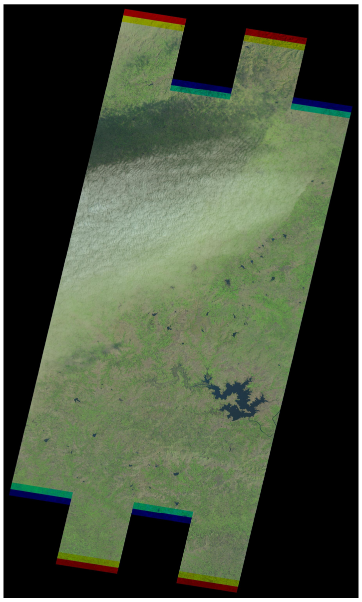

Fig. 2 After preprocessing

Spectral angle mapping

Spectral angle mapper (SAM) determines the similarity between a pixel and each of the reference spectra with the help of spectral angle between them [4]. This method treats both known and unknown spectra as vectors and finds the spectral angle between them. Initially images are read into vectors. Then these vectors are compared and the angle between them is found out. A small angle means vectors matches more. SAM determines the similarity of an unknown spectrum to a reference spectrum. The result of the SAM is an image which gives best match at each pixel. This method is very useful for finding minerals. The USGS maintains a large spectral library which consists of number of minerals and soil types with which image spectra can be directly compared.

After proprocessing SAM is applied on the images. Input dataset can be compared with the reference spectra available at USGS and minerals can be mapped in the region of Lonar sarovar. Figure 3 shows the different steps for mineral mapping.

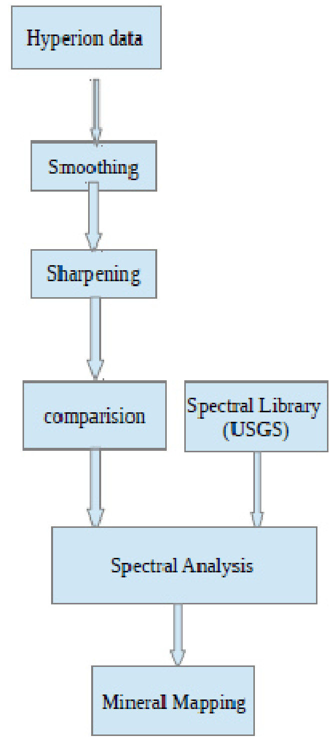

Fig. 3 Steps for mineral mapping

Conclusion

Multispectral data can be used to find out the minerals at the lonar lake, Maharashtra. Initially preprocessing can be done on the dataset to remove noise. The dataset is obtained from USGS. The preprocessed data can be compared with the reference spectra and mineral mapping can be done with SAM. Thus we can find out various minerals available near the lonar lake.

References

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