Chapter 38
Identification of Geospatial Objects Using Spectral Pattern

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ABSTRACT

Solar radiation on hitting a target surface may be transmitted, absorbed or reflected. Different materials reflect and absorb differently at different wavelengths. The reflectance spectrum of a material is a plot of the fraction of radiation reflected as a function of the incident wavelength and serves as a unique signature for the material. In principle, a material can be identified from its spectral reflectance signature if the sensing system has sufficient spectral resolution to distinguish its spectrum from those of other materials. This premise provides the basis for multispectral remote sensing. Nguyen Dinh Duong (1997) proposed a method for decomposition of multi-spectral image into several sub-images based on modulation (spectral pattern) of the spectral reflectance curve. The hypothesis roots from the fact that different ground objects have different spectral reflectance and absorption characteristics which are stable for a given sensor. This spectral pattern can be considered as invariant and be used as one of classification rules.

INTRODUCTION

Through the use of satellites, we now have a continuing program of data acquisition for the entire world with time frames ranging from a couple of weeks to a matter of hours. Very importantly, we also now have access to remotely sensed images in digital form, allowing rapid integration of the results of remote sensing analysis into a GIS. The development of digital techniques for the restoration, enhancement and computer-assisted interpretation of remotely sensed images initially proceeded independently and somewhat ahead of GIS. However, the raster data structure and many of the procedures involved in these Image Processing Systems (IPS) were identical to those involved in raster GIS. As a result, it has become common to see IPS software packages add general capabilities for GIS, and GIS software systems add at least a fundamental suite of IPS tools.

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DIGITAL IMAGE

A digital remotely sensed image is typically composed of picture elements (pixels) located at the intersection of each row i and column j in each K bands of imagery. Associated with each pixel is a number known as Digital Number (DN) or Brightness Value (BV) that depicts the average radiance of a relatively small area within a scene. A smaller number indicates low average radiance from the area and the high number is an indicator of high radiant properties of the area. The size of this area effects the reproduction of details within the scene. As pixel size is reduced more scene detail is presented in digital representation.

COLOUR COMPOSITES

While displaying the different bands of a multi spectral data set, images obtained in different bands is displayed in image planes (other than their own) the colour composite is regarded as False Colour Composite (FCC). High spectral resolution is important when producing colour components. For a true colour composite an image data used in red, green and blue spectral region must be assigned bits of red, green and blue image processor frame buffer memory. A colour infrared composite 'standard false colour composite' is displayed by placing the infrared, red and green in the red, green and blue frame buffer memory. In this healthy vegetation shows up in shades of red because vegetation absorbs most of green and red energy but reflects approximately half of incident Infrared energy. Urban areas reflect equal portions of NIR, R & G, and therefore they appear as steel grey.

There are three steps to generate colour composites from panchromatic images:

1. Read the panchromatic images using *geotiffread* function.
2. Channel the panchromatic images into a RGB image frame as required.
3. Visualise the RGB image using *imshow* function.

NORMALIZED DIFFERENCE GEO-SPATIAL INDICES

When dealing with images, the knowledge of the techniques of basic image processing always comes handy. Image processing, itself being a vast domain, we mentioned only those methods which are mainly related to our work, in the previous chapter. However, these methods can be applied to the multispectral satellite images with one band at a time. To enhance or extract features from satellite images which cannot be clearly detected in a single band, you have to use the spectral information of the object recorded in multiple bands. These images may be separate spectral bands from a single multispectral data set, or they may be individual bands from data sets that have been recorded at different dates or using different sensors. The operations of addition, subtraction, multiplication and division, are performed on two or more co-registered images of the same geographical area (Sreenivas & Chary, 2011). This section deals with multi-band operations.

The following operations will be treated: