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Remote Sensing Image Classification

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Abstract. Remote sensing data play an important role in production of Land Use and Land Cover map sand this can therefore be managed through a process called image classification. Image classification is a way of allocating land cover classes into pixels while image identification/recognition is a way of detecting and identifying an object or a feature in a digital image. This paper examines image classification and identification using Remote Sensing and GIS. An unsupervised classification based method was used for this study which involved image interpretation using image processing software and separates a large number of unknown pixels based on their reflectance values into classes. The objective of image classification is to identify and portray, as a unique Gray level (or color), the features occurring in an image in terms of the object or type of land cover these features actually represent on the ground. Three classes identify in this study are the Soil, Water and Vegetation. Landsat 8 ETM+ Satellite imagery with 512 x 512 dimensions was used in classifying the image into class type. Further analysis on classification and identification was done using IDRISI 17.0 (selva edition) and ArcGIS 10.2 (Arcmap 10.2) software. Composite map that classify the pixel in the image and their corrected band, Graphical relationship between atmospheric effect and signal wavelengths of the bands for the extracted region selected and chart for the brightness value were produced. It was concluded that water has the highest percentage in volume than others.
Keywords: Image Classification, image Recognition, land cover, Reflectance value,

1. Introduction

Image Classification is defined as the process of categorizing all pixels in an image or raw remotely sensed satellite data to obtain a given set of labels or land cover themes [1]. The purpose of the classification process is to group all pixels in a digital image into one of different land cover data can be used to produce thematic land cover maps present in an image. In a usual way, multi-spectral data are the best to use in carry out the classification. Indeed, the existing spectral pattern within the data for each pixel is used as the numerical basis for categorization [1]. The most important part of digital image analysis is image classification. A quality image shows a magnitude of colors illustrating various features of the underlying terrain. [2]. In image classification, supervised classification identifies the Information classes examples (i.e., land cover type) of interest in the image and these are known as training sites. A statistical characterization of reflectance for each information class will then be developed using image processing software and this stage is known as signature analysis stage and this involve the development of characterization as the rage of reflectance on each bands, or as complicated as comprehensive analyses of the mean, variances and covariance above all bands. Once a statistical characterization has been developed and achieved for each information class, then the image will be classified by examining the reflectance for each pixel and making a decision about which of the signatures it resembles most. [3] Till this present time, regional land use land cover maps is required to produce for the variety of purposes of government, public, private, and national security applications besides to support regional landscape planning and resource management [4].However, there are two broad types of classification procedure and each finds application in the processing of remote sensing images: one is referred to as supervised classification and the other one is unsupervised classification. These can be used as alternative approaches, but are often combined into hybrid methodologies using more than one method [5] CNN Algorithm In deep learning; a convolutional neural network (CNN/ConvNet) is a class of deep neural networks, most commonly applied to analyze visual imagery. Now when we think of a neural network we think about matrix multiplications but that is not the case with Convent. It uses a special technique called Convolution. Now in mathematics convolution is a mathematical operation on two functions that produces a third function that expresses how the shape of one is modified by the other.

2. What is Remote Sensing?

Remote Sensing is a technology to gather information and analyzing an object or phenomenon without making any physical contact. This technology is used in numerous fields like geography, hydrology, ecology, oceanography, glaciology, geology. A geographic information system is a tool that is used for mapping and analyzing feature events on Earth. The remote sensing and gis technology combine major database operations like statistical analysis and query, with maps. The GIS manages information on locations and provides tools for analysis and display of different statistics that include population, economic development, characteristics, and vegetation. It also allows linking databases to make dynamic displays. These abilities make GIS different from other systems and make it a wide range of private and publiremote sensing applications for planning and predicting outcomes from remote sensing satellites

3. History of remote sensing

technology of modern remote sensing began with the invention of the camera. Earlier photographs were "still photographs", but the idea of taking Earth's images for the purpose of topographic mapping emerged during the 1840s. Cameras were fixed in balloons for the sake of taking images. During WWI, cameras were mounted on airplanes to get an aerial view of lands which proved to bring revolution in the military. It was only during the space age, Satellite remote sensing evolved. They were used for the purpose of imaging Earth surfaces as well as sensor other spacecraft. The term "remote sensing" was first used in the United States in the 1950s by Ms. Evelyn Pruitt of the U.S. Office of Naval Research.

4. There are three essential elements for Remote Sensing

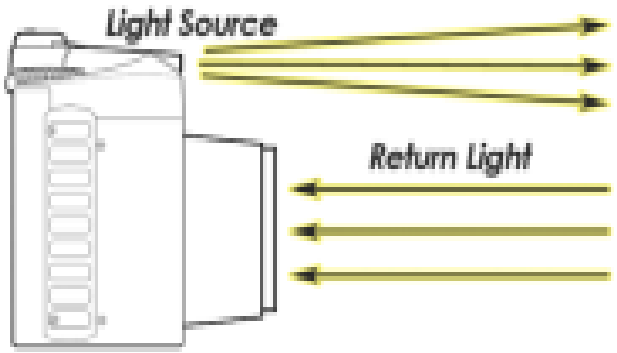
A platform to hold the instrument A target or object An instrument or sensor (to observe the target), Optical And Infrared Remote Sensing Optical sensors detect solar radiation reflected or scattered from the earth and thus develop images of Earth. This is known as the Optical and Infrared Remote Sensing. The images formed by these sensors resemble that of photographs taken by a camera.

5. Satllite Remote Sensing

Satellites are objects that revolve around planets and are also part of the solar system. The Earth's satellite is the Moon. Satellites equipped with sensors observing earth are known as the remote sensing satellites. These satellites go round in a specified orbit and are called the "eyes of the sky"

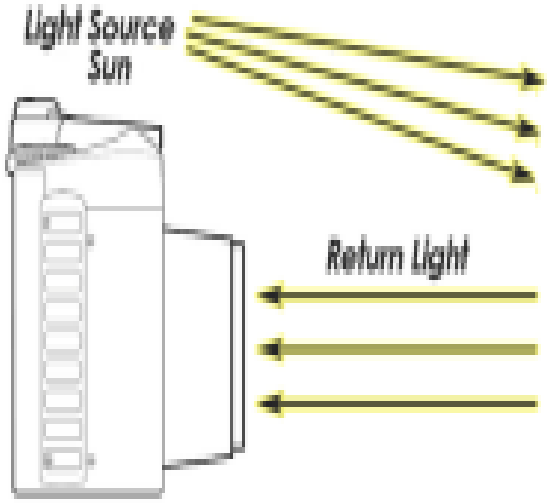
6. Active sensors

When you take a picture with the flash turned on, the camera sends its own source of light. After it illuminates the target, the camera captures the reflected light back to the camera lens. So, cameras are active sensors when the photographer uses flash. It illuminates its target and measures the reflected energy back to the camera. "You can think of active sensors like a handheld camera with the flash turned on."But active remote sensing comes in many forms. For example, they can be satellites orbiting the Earth, helicopters in the air, or anything on the ground too. Just as long as it has an active sensor.



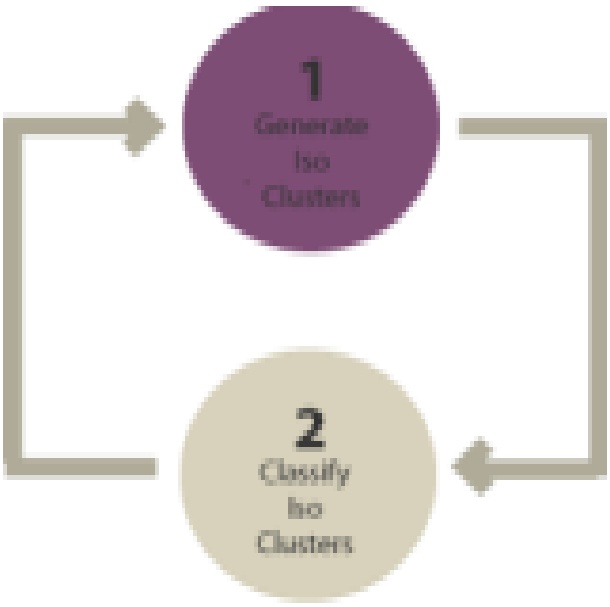
7. Passive sensors

Cameras are ***passive sensors*** when the photographer does not use the flash. Because the camera is not sending the source of light, it uses naturally emitted light from the sun. Passive sensors use naturally emitted light from the sun. Without the sun, there wouldn't be passive remote sensing.



8. Image classification techniques in remote sensing

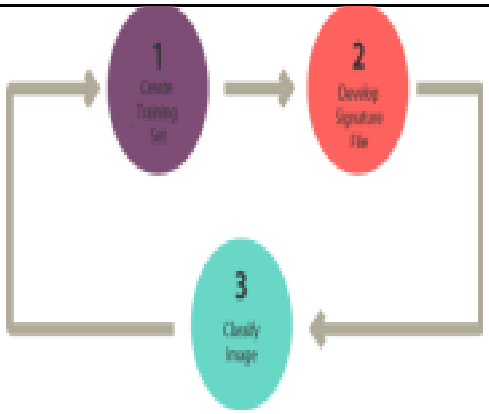
Unsupervised image classification, Supervised image classification, object-based image analysis Unsupervised Classification In unsupervised classification, it first groups pixels into "clusters" based on their properties. Then, you classify each cluster with a land cover class. Overall, unsupervised classification is the most basic technique. Because you don't need samples for unsupervised classification, it's an easy way to segment and understand an image. The two basic steps for unsupervised classification are Generate clusters Assign classes



Using remote sensing software, we first create "clusters". Some of the common image clustering algorithms is K-means ISODATA

9. Supervised Classification

In supervised classification, you **select representative samples** for each land cover class. The software then uses these **"training sites"** and applies them to the entire image. The three basic steps for supervised classification are:Select training areas • Generate signature file Classify

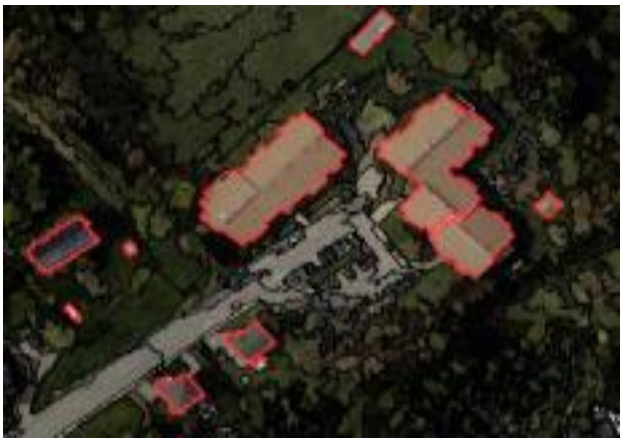


For supervised image classification, you first create training samples. For example, you mark urban areas by marking them in the image. Then, you would continue adding training sites representative in the entire image.

10. Object-Based Image Analysis (OBIA)

Supervised and unsupervised classification is pixel-based. In other words, it creates square pixels and each pixel has a class. But object-based image classification groups pixels into representative vector shapes with size and geometry. Here are the steps to perform object-based image analysis classification: Perform multiresolution segmentation, Select training areas Define statistics, • Classify

Object-based image analysis (OBIA) segments an image by grouping pixels. It doesn't create single pixels. Instead, it generates objects with different geometries. If you have the right image, objects can be so meaningful that it does the digitizing for you. For example, the segmentation results below highlight buildings. • Multi-resolution segmentation in recognition the segment mean shift tool in **Arc GIS**



In Object-Based Image Analysis (OBIA) classification, you can use different methods to classify objects. For example, you can use: shape if you want to classify buildings, you can use a shape statistic such as "rectangular fit". This tests an object's geometry to the shape of a rectangle. Texture is the homogeneity of an object. For example, water is mostly homogeneous because it's mostly dark blue. but forests have shadows and are a mix of green and black. Spectral: you can

use the mean value of spectral properties such as near-infrared, short-wave infrared, red, green, or blue.

11. Conclusion

One of the most important uses of remote sensing is the production of Land U se / Land Cover maps and thus can be done through a process called "Image Classification". (1) producing land cover map at regional and global scale; (2) development and use of advanced classification alorithms, such as subpixel, pre-field,and knowledge-based classification algorithms; (3) use of multiple remote-sensing features, including spectral, spatial, multitemporal, and Multisensor information; (4) incorporation of ancillary data into classification procedures, including such data as topography, soil, road, and census data. Accuracy assessment is anintegral part in an image classification procedure. The success of an image classification in remote sensing depends on many factors, the availability of high-quality remotely sensed imagery and ancillary data, the design of a proper classification procedure, and the analyst's skills and experiences.

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