ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 4, Issue 5 , May 2017

Classification in Image processing: A Survey

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ABSTRACT: Remote sensing is the technology of obtaining information about an object in which characteristics are identified, measured and analysed. Landsat-1 the first earth observation satellite was launched in 1972. Remote sensing has become widely used image classification of these remote sensing is the basis of image processing which refer to the extracting information classes. Very High Resolution (VHR) satellite images can be captured in various methods like QuickBird, Ikonos, Worldveiw-1 to Worldview-4, GeoEye, Landstat-1 to Landstat-8, Advanced Land observation satellite, TerraSAR-X, Radarsat1, Envisat, Terra, ErosB, Cartosat, Thros and many more different types of satellite images are become increasingly available. Classification in image processing is required to categorize all pixels in a digital image into one of several classes or themes. Normally, multispectral data are used to perform the classification. The main objective of image classification is to identify and portray as a unique grey level and the features occurring in an image. This paper presents the different types of image classification techniques in image processing.

KEYWORDS: Image classification, Very High Resolution (VHR), Remote sensing, Classification

I. INTRODUCTION

Digital image processing methods which exists from two different areas of interest, improving of pictorial representation and processing of image for storage, transmission and representation. An image is defined as two dimensional function f(x,y) where x and y are spatial (plane) co ordinates and the amplitudes of f at any pair of co ordinator (x,y) is called the intensity or gray level of image at that point when x,y and the intensity values of f are all finite, discrete quantities then all the image as digital image.

Digital image processing which deals with the processing digital images by means of a digital computer. Digital image is made of a finite number of elements, each of which has a particular location and value. These elements in the image termed as picture elements, image elements and pixels. The most relevant and widely used term to represent the elements in digital image in pixels.

Digital image processing techniques began in the late 1970s to be used in medical imaging, remote sensing and many more. Fig 1 shows the fundamental steps of digital image processing:

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 4, Issue 5 , May 2017

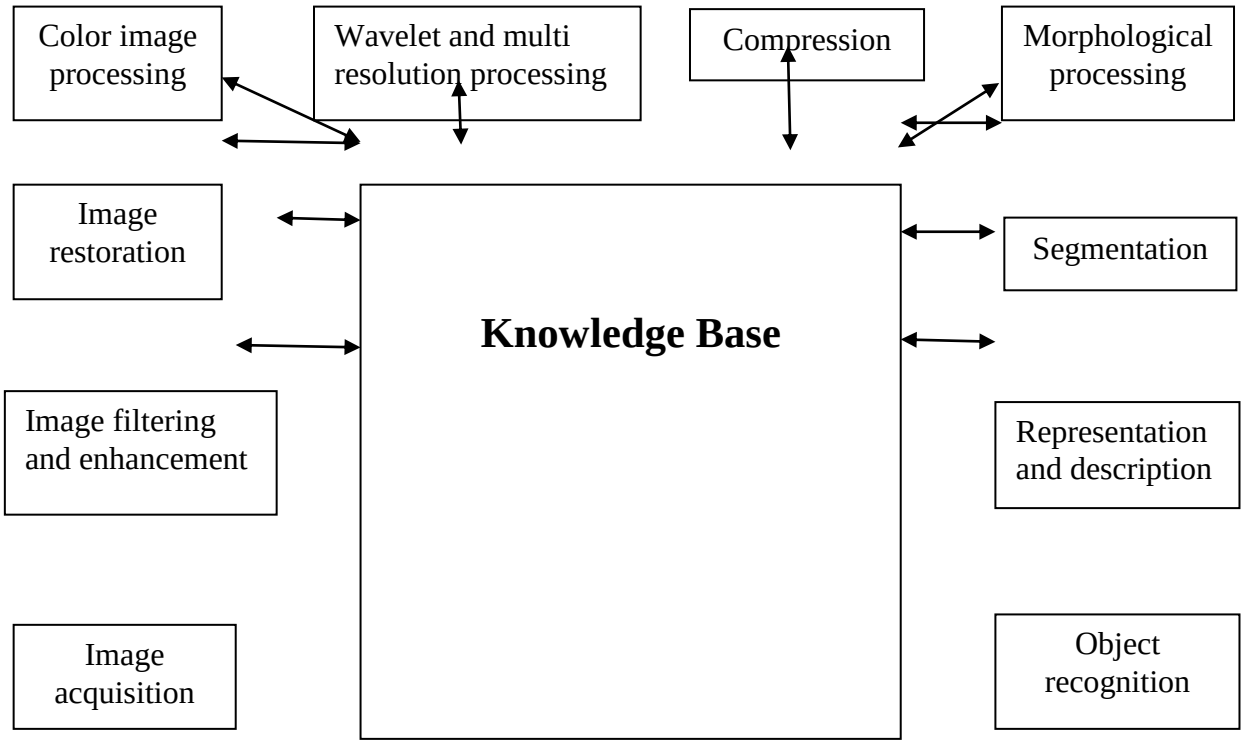

Fig 1 Fundamental steps in digital image processing

1. Image Acquisition: This step involves generally a pre processing such as scaling. The first step in fundamentals of digital image processing is image acquisition, where the image that has given that is already in digital form.
2. Image filtering/Enhancement: This idea behind this technique is to bring out detail description or to highlight certain features of interest of an image.
3. Image restoration: This step helps to improve the appearance of an image.
4. Color image processing: This includes color modelling and processing in a digital domain.
5. Wavelet and multiresolution processing: Wavelet is the foundation for representation images in various degrees of resolution. Multiresolution is about the sub division successively into smaller regions for data compression.
6. Compression: It deals with techniques for reducing the storage required to save an image or the bandwidth to transmit it.
7. Morphological processing: It deals with tools for extracting image components which can be used in the representation and description of image.
8. Segmentation: This segmentation procedures partition an image into its constituent objects or parts. The goal idea behind segmentation is to simplify or change the representation of image.
9. Representation and Description: Representation is part of solution for transforming raw data into a form suitable for subsequent computer processing. Description deals with extracting attributes results in some quantitative information of interest.
10. Object recognition: Recognition is the process that assigns a label to an object based on its descriptors.
11. Knowledge base: Knowledge is the detailed regions of an image where the area of interest is located.

II. RELATED WORK

Various approaches were proposed to represent textures for the classification of Very High Resolution (VHR) image data. Grey Level Co occurrence Matrix (GLCM) proposed in [1] is very popular within remote sensing group. Instead of directly characterizing the texture in the image domain some others suggested to proceed with the texture analysis in

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 4, Issue 5 , May 2017

a transform domain the original data by applying filter banks. Gabor filter, wavelet filter offer a multiresolution and multiorientation framework for the texture analysis. Statistical features such as energy and entropy [2] or GLCM descriptors [3] can be extracted from each wavelet subband to characterize the texture. In this paper survey on different classification of image processing and introduced some features which they said in their approach.

Classification in image processing:

The image classification technique is a process to categorize all pixels in a digital image into one of several land cover classes. The objective of image classification is to identify as a grey level (or color) the features occurring in an image in terms of object. Multispectral data are used to perform the classification and for numerical basis for categorization, spectral pattern which is present within the data. There are many types of categories in which the image can be separated which are discussed below.

A. Supervised and Unsupervised classification

In image processing, these are the traditional methods of classification which follows two approaches: supervised and unsupervised classification. In supervised classification spectral signatures are developed from specific locations are given the generic name 'training sites' and are defined by the user. It is defined as the process of samples of known identity to classify pixels of unknown identity. Samples of known identity are those pixels located within training areas. Pixels located within these areas term the training samples used to guide the classification algorithm to assigning spectral values to appropriate informational class. The Fig below depicts the general scenario of supervised classification.

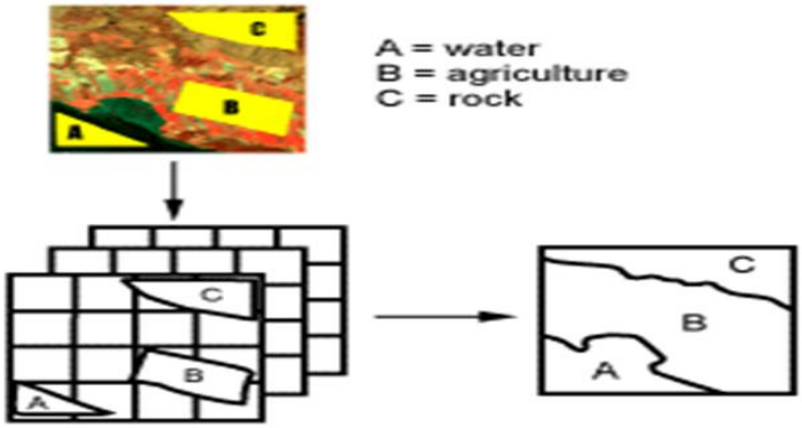

Fig 2 General scenario of supervised classification.

The classification is based on the spectral signature defined in training set. The steps followed in supervised classification are:

1. Create training set
2. Generate signature file
3. Classify the image

In unsupervised classification the output image in which a number of classes are identified and each pixel is assigned to class. These classes may or may not correspond well to land cover types of interest and the user will need to assign meaningful label of each class. It does not contain any training data as the basis of classification, but it examines unknown pixel in the image and consolidated them into number of clusters. The first step is to identify the list of informational classes based on region of interest. Next step is to cluster the image into spectral classes. The analyst will analyze each class then develop a list of the spectral class numbers. The Fig 3 below depicts the general scenario of unsupervised classification.

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International Journal of Advanced Research in Science, Engineering and Technology
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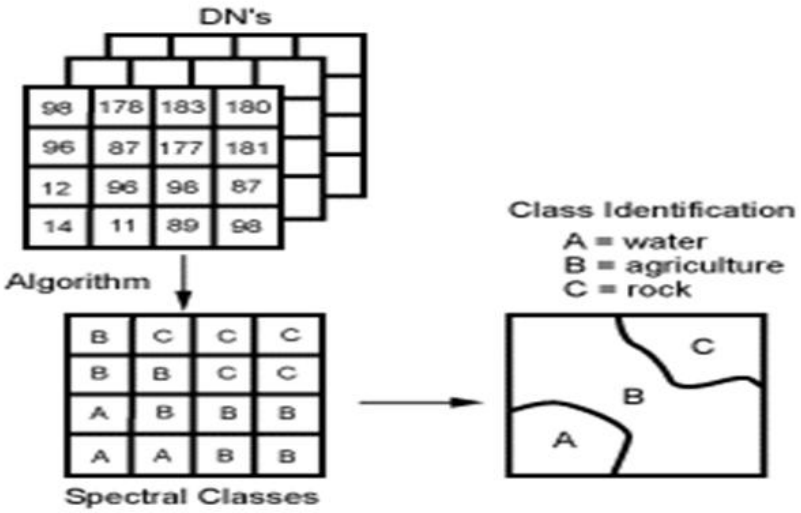

Fig 3 General scenario of unsupervised classification.

The steps followed in unsupervised classification are:
1. Develop list of informational classes
2. Group pixels into spectral classes
3. Determine each informational group each spectral group nearly belongs
4. Reassign each spectral group to an informational class
5. Update the table with respective classes

B. Parametric and Non parametric classification

In parametric classification it assumes some finite set of parameters. All parametric densities are uni model (have a single local maximum), whereas many practical problems are local whereas many practical problems involve multi model densities. So the complexity of the model is bounded even if the amount of data is unbounded. This makes them not very flexible. Parametric classifier is based on the statistical probability distribution of each class. There exists a large number of classifier exists to perform the classification task. The advantages are simpler, speed and less data.
The steps followed in parametric classification are as follows:
1. Select a form for the function
2. Learn the co efficient for the function from the training data

Non parametric classifier is used in unknown density function and estimate the probability density function. It selects the best suitable training data in constructing the mapping function which leads to generalize the unseen data. Also they are able to fit a large number of functional forms. The advantages are flexibility, power and performance.

C. Per pixel and Object oriented classification

Per pixel based analysis is popular way to extract different categories. The classification of per pixel is obtained from selected groups of pixels that represent the selected features. This type of classification is complex because segmentation and classification of high resolution is carried out task on a pixel by pixel basis. Object oriented is implemented by using radial based kernel function. It involves segmentation of input image. In this method of classification firstly aggregates image pixels into spectrally homogenous image object then classifies the individual objects. It is determined by both positive and negative effects because of the usage of image objects as classification units.
The combination of both per pixel and object oriented classification is useful in analysis of VHR satellite data which results in higher per class accuracy. Compare to per pixel classification object oriented contains some additional features in the process of classification. Classification units and classification features are the parameters which distinguish per pixel and object oriented classification.

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International Journal of Advanced Research in Science, Engineering and Technology

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III. CONCLUSION

In remote sensing spatial and spectral resolutions which results in high resolution image data and using image compression techniques it will reduce the size and image data volume. The resulted number of clusters generally degrades as compression ratio becomes higher. In this paper totally presented six different types of image classification which each one of its explanation. Compare to per pixel classification object oriented classification gives the result accuracy more because of its type of classification.

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