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Studies of different Image Processing Techniques

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ABSTRACT

Image Processing is a technique to improve raw images received from cameras placed on satellites, space probes and aircrafts or pictures taken in normal life for various applications. Basically, all image processing operations can be grouped into some techniques: Image representation, Image preprocessing, Image enhancement , Image restoration , Image analysis, Image reconstruction, Image data compression. The past deals with initial processing of raw image data to correct for geometric distortion, to standardize the data radiometrically and eliminate noise present in the data. The aim of the information extraction operations is to replace visual analysis of the image data with quantitative techniques for automating the identification of tone in a scene. This involves the analysis of multispectral image data and the application of statistically based decision rules for determining the earth cover identity of each pixel in an image. The objective of categorization process is to classify all pixels in a digital image into one of several earth cover classes or themes. This paper entails the various image processing techniques and algorithms.

Keywords: Image Processing, JPEG, Satellite image, Image enhancement, Digital Image.

I.INTRODUCTION

Image Processing is a technique to improve raw images received from cameras or sensors placed on satellites, space probes and aircrafts or pictures taken in normal life for various applications. Various techniques have been developed in Image Processing during the last five decades. Most of the techniques are developed for enhancing images obtained from unmanned spacecrafts, space probes and military inspection flights. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size memory devices, graphics software. Image Processing is used in various applications such as Remote Sensing, Medical Imaging, Textiles, Material Science, Military, Film industry, Document processing, Graphic arts The common steps in image processing are image scanning, storing, enhancing and interpretation. The block diagram of digital signal processing of Image diagram is shown in figure 1.

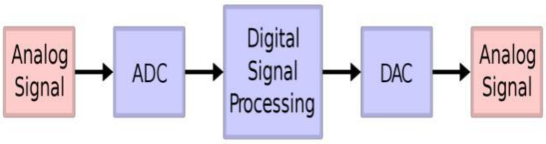

Figure 1.Digital signal processing of Image.

II.IMAGE PROCESSING METHODS

Image Processing are given two methods as follow

2.1 Analog Image Processing

Analog Image Processing is refer to the alteration of image through electrical means such example is the television image. The television signal is a voltage level which varies in amplitude to represent brightness through the image. By electrically varying the signal, the displayed image appearance is altered. The brightness and contrast controls on a TV set serve to adjust the amplitude and reference of the video signal, resulting in the brightening, darkening and alteration of the brightness range of the displayed image.

2.2 Digital Image Processing

In this case, digital computers are used to process the image. The image will be converted to digital form using digital conversion method [6] (Figure 1) and then process it. It is defined as the subjecting numerical representations of objects to a series of operations in order to obtain a desired result. It starts with one image and produces a modified version of the same. It is therefore a process that takes an image into another.

Digital image processing is refer to processing of a two-dimensional picture by a digital computer [7]. In a broader context, it implies digital processing of any two-dimensional data. A digital image is an array of actual numbers represented by a finite number of bits. The principle advantage of Digital Image Processing methods is its versatility, repeatability and the preservation of original data precision.

III.IMAGE PROCESSING TECHNIQUE

Classification of Image Processing techniques are given below

1. Image representation
2. Image preprocessing
3. Image enhancement
4. Image analysis
5. Image compression

3.1. Image Representation

An image defined as in the "real world" is considered to be a function of two real variables, such example, $f(x,y)$ with f as the amplitude of the image at the *real* coordinate position (x,y). An image processing operation typically defines a new image g in terms of an existing image f. The effect of digitization is given figure.

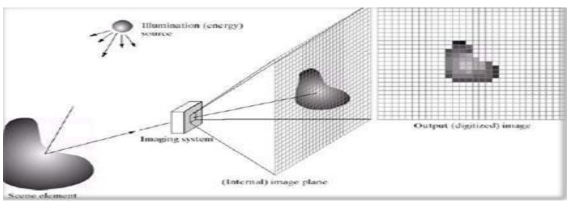

Figure 2: A digital Image Representation.

3.2 Image Preprocessing

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Preprocessing indicates that the same tissue type may have a different scale of signal intensities for different images. Preprocessing functions involve those operations that are normally required prior to the main data analysis and extraction of information and are generally grouped as radiometric or geometric corrections. Radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or atmospheric noise, removal of non-brain vowels and converting the data so they accurately represent the reflected or emitted radiation to find out a transformation between two images precisely. The pre-processed images will have some noise which should be removed for the further processing of the image. Image noise is most apparent in image regions with low signal level such as shadow regions or under exposed images. There are so many types of noise like salt and pepper noise, film grains .All these noise are removed by using algorithms. Among the several filters, median filter is used.

3.4 Image enhancement

Image enhancement techniques can be divided into two wide categories:

1. Spatial domain methods, which function directly on pixels
2. Frequency domain methods, which function on the Fourier transform of an image.

3.4.1 Spatial Domain Methods

The value of a pixel with coordinates (x,y) in the enhanced image $\hat{F}$ is the result of performing some operation on the pixels in the neighbourhood of (x,y) in the input image, F. Neighbourhoods can be any shape, but usually they are rectangular. There are two method for spatial domain category

3.4.1.1. Grey scale manipulation

The simplest form of operation is when the operator T acts on a 1*1 pixel neighbourhood in the input image, that is F(x,y) only depends on the value of F at (x,y) .This is a grey scale transformation or mapping. The simple form of case is thresholding where the intensity profile is replaced by a step function, active at a chosen threshold value. In this case any pixel with a grey level below the threshold in the input image gets mapped to 0 in the output image. Other pixels are mapped to 255.

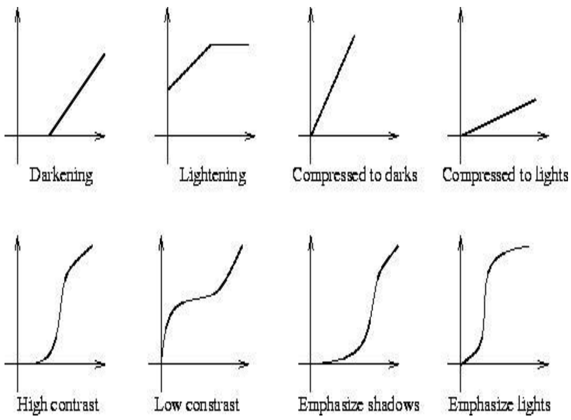

Figure 3.Gray scale transformations

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3.4.1.2 Histogram Equalization

Histogram equalization is a common technique for enhancing the appearance of images. Suppose we have an image which is predominantly dark. Then its histogram would be skewed towards the lower end of the grey scale and all the image detail is compressed into the dark end of the histogram. If we could `stretch out' the grey levels at the dark end to produce a more uniformly distributed histogram then the image would become much clearer.

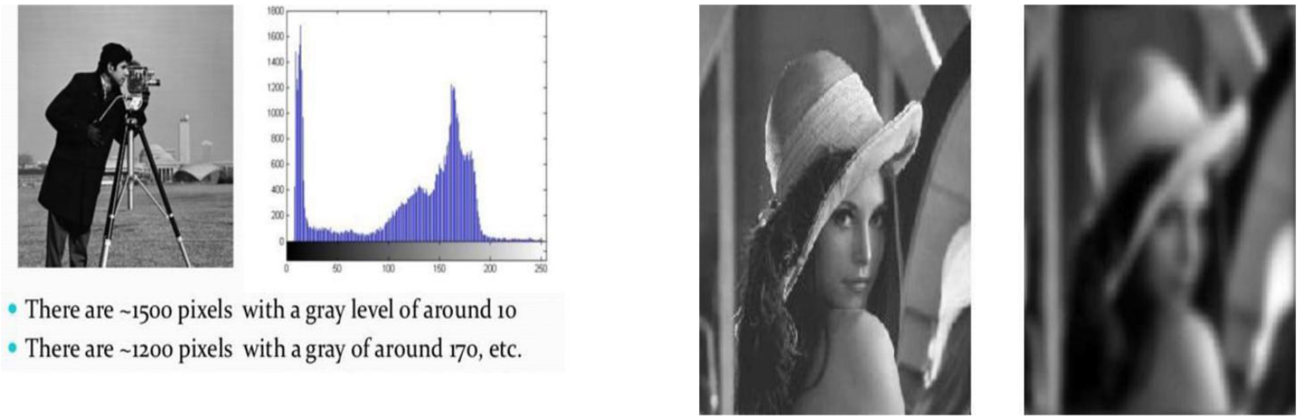

Figure 4: The original image of camera man and its histogram, and the equalized versions. Both images are quantized to 64 grey levels.

3.4.2 Frequency domain methods

Image enhancement in the frequency domain is straightforward. We simply compute the Fourier transform of the image to be enhanced, multiply the result by a filter and take the inverse transform to produce the enhanced image.

The idea of blurring an image by reducing its high frequency components or sharpening an image by increasing the magnitude of its high frequency components is intuitively easy to understand. However, computationally, it is often more efficient to implement these operations as convolutions by small spatial filters in the spatial domain. Understanding frequency domain concepts is important, and leads to enhancement techniques that might not have been thought of by restricting attention to the spatial domain.

3.4.2.1 Filtering

Low pass filtering involves the elimination of the high frequency components in the image. It results in blurring of the image .An ideal low pass filter would retain all the low frequency components, and eliminate all the high frequency components. However, ideal filters suffer from two problems:

1 *blurring* and

2 *ringing*.

These problems are caused by the shape of the associated spatial domain filter, which has a large number of undulation. Smoother transitions in the frequency domain filter, such as the Butterworth filter, achieve much better results.

Figure 5: Transfer function from original image to blurring image.

3.4.Image Analysis

Image analysis methods extract information from an image by using automatic or semiautomatic techniques termed as scene analysis, image description, image understanding, pattern recognition, computer/machine vision .Image analysis differs from other types of image processing methods, such as enhancement or restoration in that the final result of image analysis procedures is a numerical output rather than a picture.

3.5 Image Compression

The objective of image compression is to reduce the size of digital images to save storage space and transmission time. Lossless compression is preferred for artificial images like technical drawings, icons and also be preferred for high value content, such as medical imagery or image scans made for archival purposes. Lossy methods are especially suitable for natural images such as photos in applications where minor loss of fidelity is acceptable to achieve a substantial reduction in bit rate. The lossy compression that produces unnoticeable differences can be called visually lossless. Run-length encoding, Huffman encoding and Lempel Ziv encoding are the methods for lossless image compression. Transform coding such as DCT ,Wavelet transform are applied followed by quantization and symbol coding can be cited as a method for lossy image compression. A general compression model is shown in figure 7.

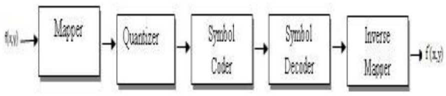

Figure 7: General Compression Model

IV. CONCLUSION

Digital image processing of satellite data can be primarily grouped into some categories such as Image Rectification, Enhancement and Information withdrawal

Image rectification is the pre-processing of satellite data for geometric and radiometric connections. Enhancement is applied to image data in order to effectively display data for subsequent visual interpretation. Information withdrawal is based on digital classification and is used for generating digital thematic map. This paper presents various techniques of image processing. These are still a challenging task for the researchers and academicians. Comparing the performance of image processing technique is difficult unless identical data sets and performance measures are used. Studied in different papers related to some image processing techniques are used for better technique for different types of data inputs. There are different types of symbol coding techniques that can be used for image processing. After study of all techniques it is found that lossless image compression techniques are most effective over the lossy compression techniques

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