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FUSION OF LAND COVER SATELLITE IMAGES USING ADAPATIVE KERNAL FUZZY C-MEANS SEGMENTATION

[a]J.Hemagowri, [b]E.Surenthar*

[a]Assistant Professor, Department of Computer Science, Karpagam Academy of Higher Education
[b]PG Student, Department of Computer Science, Karpagam Academy of Higher Education

A B S T R A C T

In our proposed work, Multispectral (MS) and Synthetic Aperture Radar (SAR) are the two Remote Sensing images taken as input, and made a pre-processing analysis on this images using various filtering Techniques like Gaussian, Median, LOG, Average, Gabor filters.MS image is taken for Land cover segmentation using the Algorithms Adaptive fuzzy c-means (AFCM), Kernel fuzzy c-means (KFCM), and Genetic Algorithm (GA) are combined to detect the boundary regions of Trees, Buildings, Agriculture Area and Wetland Area. SAR image is taken for classification using Neural Network (NN) classifier to Train the Feature like Maximum Value, Minimum Value, Mean, Entropy, Kurtosis, Standard Deviation, and Variance to classify the pixel based regions. Finally, Fusion is made on these two regions and the output of an image gives more informative than the input image.

Keywords: Remote Sensing images, classification, SAR Image, Clustering

1. Introduction

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps:

- Importing the image with optical scanner or by digital photography.
- Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
- Output is the last stage in which result can be altered image or report that is based on image analysis.

The two types of methods used for Image Processing are Analog and Digital Image Processing. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing. Digital

Processing techniques help in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platform contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital technique are Pre- processing, enhancement and display, information extraction.

Before going to processing an image, it is converted into a digital form. Digitization includes sampling of image and quantization of sampled values. After converting the image into bit information, processing is performed. This processing technique may be, Image enhancement, Image restoration, and Image compression.

Image enhancement:

It refers to accentuation, or sharpening, of image features such as boundaries, or contrast to make a graphic display more useful for display & analysis. This process does not increase the inherent information content in data. It includes gray level & contrast manipulation, noise reduction, edge crispening and sharpening, filtering, interpolation and magnification, pseudo coloring, and so on.

Image restoration:

It is concerned with filtering the observed image to minimize the effect of degradations. Effectiveness of image restoration depends on the extent and accuracy of the knowledge of degradation process as well as on filter design. Image restoration differs from image enhancement in that the latter is concerned with more extraction or accentuation of image features.

Image compression:

It is concerned with minimizing the number of bits required to represent an image. Application of compression are in broadcast TV, remote sensing via satellite, military communication via aircraft, radar, teleconferencing, facsimile transmission, for educational & business documents, medical images that arise in computer tomography, magnetic resonance imaging and digital radiology, motion, pictures, satellite images, weather maps, geological surveys and so on.

- Text compression – CCITT GROUP3 & GROUP4
- Still image compression – JPEG
- Video image compression - MPEG

2. Methodology

1. Preprocessing Stage – In this module, noise can be removed for the satellite image based on Filtering Techniques.

2. Segmentation Stage – In this module, images are split into clusters based on mentioned algorithms such as Adaptive fuzzy c-means (AFCM), Kernel fuzzy c-means (KFCM), and Genetic Algorithm (GA)

3. Classification Stage – In this module classify the boundary regions of Trees, Buildings, Agriculture Area and Wetland Area based on Neural Network (NN) classifier

The spatial arrangement information such as color or intensities in an image or selected region of an image is provided by Image texture. Textures can be found or artificially created in an image. Image textures are normally used in Segmentation or classification of images. Structural Approach and Statistical Approach are the two methods to analyze an image in computer. The use of image texture can be used as a description for regions into segments. There are two main types of segmentation based on image texture, region based and boundary based. Though image texture is not a perfect measure for segmentation it is used along with other measure, such as color, that helps solve segmenting in image. Attempts to group or cluster pixels based on texture properties together. The image texture can be used as a description for regions into segments.

Texture Feature	Formula
Energy	$\sum_i \sum_j P_d^2(i,j)$

Contrast $\sum_i \sum_j (i-j)^2 P_d(i,j)$

Homogeneity $\sum_i \sum_j \frac{P_d(i,j)}{1+|i-j|}$

Correlation $\frac{\sum_i \sum_j (i-\mu_x)(j-\mu_y) P_d(i,j)}{\sigma_x \sigma_y}$

It specifies sensitivity thresholds for the canny method. Thresh is a two-element vector in which the first element is the low threshold, and the second element is the high threshold. If you specify a scalar for thresh, this scalar value is used for the high threshold. Use the Threshold source parameter to specify how to enter your threshold values. If you select Specify via dialog, the Threshold [low high] parameter appears in the dialog box. Enter the threshold values. If a pixel's magnitude in the gradient image, which is formed by convolving the input image with the derivative of the Gaussian filter, exceeds the high threshold, then the pixel corresponds to a strong edge. Any pixel connected to a strong edge and having a magnitude greater than the low threshold corresponds to a weak edge. If, for the Threshold source parameter, you choose Input port, use input port to specify a two-element vector of threshold values. These values must have the same data type as the input data. The Edge Detection block computes the automatic threshold values using an approximation of the number of weak and non edge image pixels. Enter this approximation for the approximate percentage of weak edge and non edge pixels (used to automatically calculate threshold values) parameter. Use the Standard deviation of Gaussian filter parameter to define the Gaussian filter whose derivative is convolved with the input image.

3. Conclusion

In this proposed research work, various remote sensing images like SAR, MODIS, and ASTER Datasets are tested to find diverse regions in the image are which alienated in order to analyze the information present in it. The pixels are separated from each other to identify uniqueness in them where every pixel in the image is classified or labeled into several groups with respect to color. Each region has been labeled with different color so that it is easy to differentiate each region with some object using Region Merging and Splitting algorithm and Enhanced Region Growing algorithm. Sobel and Canny edge detection operators have been used for detecting edges for gray scale image. Finally, the segmented color image is sprint through Canny Edge detection Technique to acquire Color edge detected image. Eminent image quality measures like includes Mean Square Error (MSE), Peak Signal-to-Noise Ratio (PSNR), Normalized Absolute Error (NAE), Normalized Cross-Correlation (NCC), Maximum Difference(MD), has been assessed for different kind of Remote sensing images and it illustrates its efficiency and accuracy is faster for various remote sensing Images.

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