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A Survey on various Techniques Feature and Knowledge Extraction of SAR Image

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Abstract— **As the digital world is growing with various kind of data which is processed on different servers, so proper balancing of work is required. As data include text file, image, video, etc. Out of those image plays an important role in different field such as remote sensing, social media, etc. Here information extraction from the image for different studies required proper pre-processing steps. This paper give a brief survey of SAR image processing and knowledge extraction techniques. Here various feature are explained in brief with their requirements.**

Index Terms— **Digital Image Processing, Haze, Information Extraction, Load Balancing.**

I. INTRODUCTION

Detecting regions of changes in region at totally different times is of widespread interest thanks to large number of applications in various disciplines. It plays in necessary role in several domains like on land use/land cover dynamic [1], remote sensing, diagnosing, with the event of remote sensing technology, modification detection in remote sensing images becomes additional and additional necessary. Synthetic Aperture radar (SAR) imaging representational process} has found necessary applications thanks to its clear blessings over optical satellite imagery one in all them having the ability to work in varied climate [2]. However, there are issues related to the nature of the radar imaging method due to the comparison of the wavelength to surface roughness. The presence of speckle noise degrades SAR pictures considerably and should hide necessary details on the images, resulting in the loss of crucial info. Within the literature, typically unsupervised modification detection in SAR images is predicated on a three-step procedure

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i. Preprocessing.
ii. Manufacturing difference image between the multitemporal images.
iii.Analysis of the difference image.

Radar

Radar is a ranging radiolocation instrument measuring device. An object-detection system that uses radio waves to determine the vary, angle, or rate of objects. It may be used to find aircraft, ships, spacecraft, guided missiles, automobiles, weather formations, and piece of land. A radar system consists of a transmitter manufacturing electromagnetic waves in the radio or microwaves domain, an emitting antenna, a receiving antenna (separate or constant because the previous one) to capture any returns from objects within the path of the emitted signal, a receiver and processor to determine properties of the objects.

Synthetic Aperture radar

Environmental observance, earth-resource mapping, and military systems need broad-area imaging at high resolutions. Often, this imagery should be acquired at night or during inclement weather. Synthetic Aperture radar (SAR) provides such a capability. Synthetic Aperture {radar microwave and instrument measuring device} (SAR) systems profit of the long-range propagation characteristics of radar signals and also the advanced information processing capability of recent digital electronics to produce high resolution imagery. synthetic Aperture (SAR) enhances photographic and different optical imaging capabilities as a result of it's not restricted by the time of day or region conditions and because of the distinctive responses of piece of land and cultural targets to radar frequencies. Synthetic Aperture radar (SAR) technology has provided piece of land structural info to geologists for mineral exploration, oil spill boundaries on water to environmentalists, sea state and ice hazard maps to

navigators, and intelligence and targeting info to military operations. There are several different applications for this technology. a number of these, particularly civilian, haven't however been adequately explored because lower price electronics are simply beginning to build synthetic Aperture (SAR) technology economical for smaller scale uses SAR could be a coherent and microwave imaging radar to get high spatial resolution two-dimensional (2-D) reflectivity images of the Earth's surface in nearly all climate and severally of the day-night cycle.

II. Related Work

Duk-jin Kim et al. [2]. "Detection of Durable and Permanent Changes in Urban Areas Using Multitemporal Polari metric UAVSAR Data". Change detection using synthetic aperture radar (SAR) data is useful in emergency situations and unfavorable weather conditions. A comparison of results with historical Google Earth images showed a good level of agreement. Fitting of the hyperbolic tangent function to the multitemporal polar metric parameters significantly reduces the false detection rate and indicates whether a building was constructed or destroyed, as well as when the detected changes occurred.

Maoguo Gong et al. [3]."Change Detection in Synthetic Aperture Radar Images based on Image Fusion and Fuzzy Clustering". use an unsupervised distribution-free change detection approach for synthetic aperture radar (SAR) images based on an image fusion strategy and a novel fuzzy clustering algorithm. It incorporates the information about spatial context in a novel fuzzy way for the purpose of enhancing the changed information and of reducing the effect of speckle noise. Experiments on real SAR images show that the image fusion strategy integrates the advantages of the log-ratio operator and the mean-ratio operator and gains a better performance. The change detection results obtained by the improved fuzzy clustering algorithm exhibited lower error than its preexistences.

Arnaubec et al. [5] evaluated the precision of vegetation height estimations when an RVoG model was applied to P-band data at different or many polarizations. It was found that a loss in vegetation height precision could be calculated, independent of estimation method, when derived from an adaptation of the Cramer-Rao bound. It is possible that a similar theoretical derivation could be done for X-band data.

M. Airouche et al. [4]. "Image Segmentation Using Active Contour Model and Level Set Method Applied to Detect Oil Spills". In this paper we explore image segmentation using active contours model to detect oil spills. A partial differential equation based level set method, which represents the spill surface as an implicit propagation interface, is used. The proposed method has been illustrated by experiments to detect oil spills in real images. Its advantages over the traditional image segmentation approaches have also been demonstrated.

D. Baswaraj et al. [1]. "Active Contours and Image Segmentation: The Current State of the Art". Image segmentation is a fundamental task in image analysis responsible for partitioning an image into multiple sub-regions based on a desired feature. Here in this paper we attempt to brief the taxonomy and current state of the art in Image segmentation and usage of Active Contours.

Problem Identification

A huge volume of data must be processed for knowledge which requires load balancing:

• Many types of satellite sensors are available, but their spectral bands are not always identical in center wavelength and band width;
• Noise due to differences in light conditions, atmospheric conditions, sensor calibration and ground moisture at the two acquisition dates considered causes apparent changes.

• Each image has own geometrical distortion and problems of alignment of multitemporal images
(registration noise).

Concerning this last issue, two images should be registered so that pixels with the same coordinates in the images may be associated with the same area on the ground. This is a very critical step in very high resolution satellite and airborne

imagery, especially when the angle of acquisition varies greatly, rendering change detection results unreliable.

III. Existing Techniques

Pre-Processing technique

As researcher are continuously working in removing haze, fog, mist from the image for further analysis, so various techniques are developed so far. Few of those are explained below:

Dark channel prior: In [2] Dark channel technique is developed in order to calculate the atmospheric light in the image. So it is emerged as a common technique in non sky part of the image because few color channels has very less intensity in the few pixels. Here in dark color channel low intensity is present because of the below three components:

i). Surface Colourful objects such as grass, trees, etc.

ii). Shadow of tree, building, pillers, etc.

iii). Any high intensity object surface such as black stone, trunk, etc.

Figure 1: Haze removal results. Top: input haze images. Middle: restored haze-free images. Bottom: depth maps.

Median Filter: Median filtering is done by, first sorting all the pixel values from the surrounding neighborhood into numerical order and then replacing the pixel being considered with the middle pixel value. The median of the pixel values in the window is calculated, and the center pixel of the window is replaced with the calculated median value [16].

Lee Filter: It is based on multiplicative speckle model and uses local statistics to preserve details. Lee filter works on the variance basis, i.e. if variance of the area is low then it performs smoothing operation but not for high variance. That means it can preserve details in low as well as in high contrast hence it has adaptive nature [17].

Frost Filter: It uses a negative exponential distribution for the speckle noise and local image statistics for filtering process. In order to minimize the mean square error of the signal Estimate this filter performs a weighted average of the cell values in the filter window, with the weights for each cell [18].

Image Segmentation Techniques

There are some normally used technique for image segmentation equivalent to edge detection, Threshold, Histogram, Region primarily based and clustering. Therefore we tend to use segmentation to separate these two elements.

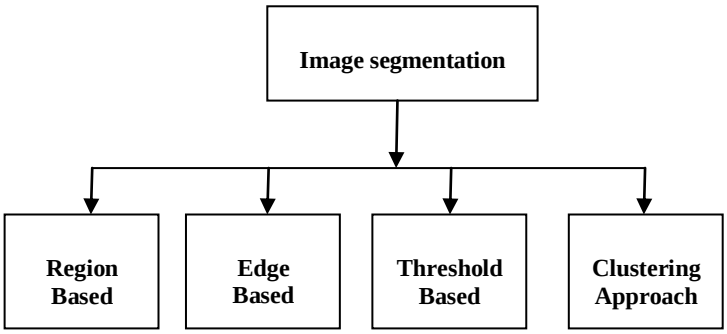

Figure 2: Segmentation Techniques. [5]

Region Based Segmentation In region based segmentation technique the similar subset or pixels of an image based upon some criteria are grouped together to form image region. Image regions are constellation of connected pixels with similar belongings[11].

Edge Based Segmentation In this method the images are partitioned by identifying the edges or pixels of rapid transition in intensity. Edge Based approach is done by first detecting the edges or pixels between the different region that have change in intensity and linked those pixels to form closed boundaries [12]. The edges identified by this segmentation technique are often disconnect and to segment the pixel there should have closed connect boundaries. Boundaries are connected by using various morphological operations .These techniques are less immune to noise and if more than two edges have to be determined then it doesn't work well.

Thresholding based Segmentation Thresholding technique is used to convert a multilevel or a grey scale image into a binary image with the help of histogram of the image [9]. Thresholding refers to an amount or a level. Histogram is the graphical representation of an image having diverse intensities values. To apply Thresholding a preset threshold value T is used to compare the intensities of the pixels at the peaks, if the pixel are dark it growing darker or white it become whiter.

Clustering Method refers to the pixels having similar properties grouped together known as clusters. Grouping is based on maximizing the similarities, if inter class similarities are increased then the quantity of clusters are automatically increased to get the optimum results. There are two types of clustering methods, first is called k means. K means method can be done through the particular value of k and the fuzzy techniques by using the different level segmentation of the images [10].

Spectral change Detection Technique

In spectral change detection, pictures of two dates are transformed into a new single-band or multi-band image, that contains the spectral changes. The resultant image should be more processed to assign the changes to specific land cover varieties. Since these ways are supported pixel-wise or scene-wise operations, they're sensitive to image registration and co-registration accuracy. Discrimination of modification and no-change pixels is of the best importance in sure-fire performance of those ways. a typical methodology for discrimination is use of applied mathematics threshold .In this methodology a careful call is needed to put threshold boundaries to separate the realm of modification from no-change.

IV. IMAGE FEATURES

As Image is collection or sequence of pixel and each pixel is treat as single value which is a kind of cell in a matrices. In order to identify an object in that image some features need to be maintained as different object have different feature to identify them which are explain as follows:

Color feature: Image is a matrix of light intensity values, these intensity values represent different kind of color. so to identify an object colure is an important feature, one important property of this feature is low computation cost .

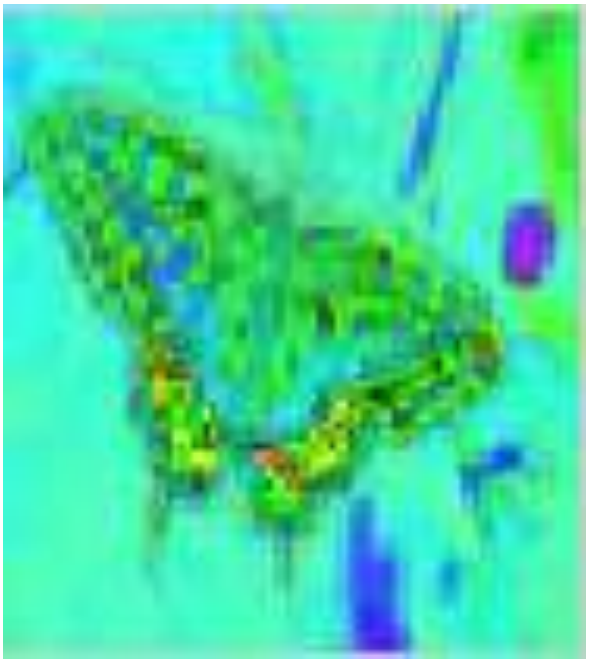

Fig. 3 Represent the HSV (Hue Saturation value) format of an image.

Different Image files available in different color formats like images have different colure format ranging from RGB which stand for red, green, and blue. This is a three dimensional representation of a single image in which two dimensional matrix represent single color and collection of those matrix tends to third dimension. In order to make intensity calculation for each pixel gray format is use, which is a two dimension values range from 0 to 255. In case of binary format which is a black and white color matrix whose

values are only 0 or 1. With the help of this color feature face has been detected efficiently in [8].

Edge Feature : As image is a collection of intensity values, and with the sudden change in the values of an image one important feature arises as the Edge as shown in figure 4. This feature is use for different type of image object detection such as building on a scene, roads, etc [7]. There are many algorithm has been developed to effectively point out all the images of the image or frames which are Sobel, perwitt, canny, etc. out of these algorithms canny edge detection is one of the best algorithm to find all possible boundaries of an images.

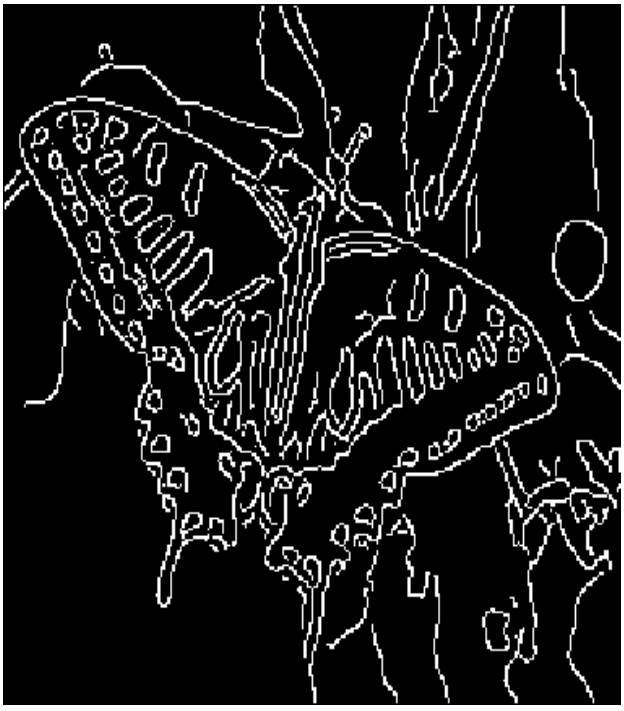

Fig. 4 Represent Edge feature of an image.

Texture Feature : Texture is a degree of intensity difference of a surface which enumerates properties such as regularity and smoothness [6]. Compared to color space model, texture requires a processing step. The texture features on the basis of color are less sensitive to illumination changes as same as to edge features.

Corner Feature: In order to stabilize the video frames in case of moving camera it require the difference between the two frames which are point out by the corner feature in the image or frame. So by finding the corner position of the two frames one can detect resize the window in original view. This feature is also use to find the angles as well as the distance between the object of the two different frames. As they represent point in the image so it is use to track the target object.

Fig 5 Represent the corner feature of an image with green point.

V. Conclusions

With the high demand of image in various fields researchers get attracted for analysis. This paper cover various approaches of Remote sensing image processing and knowledge extraction methods. As unfavorable weather condition make high data lose, so recovering those is done by extracting features from the image. It is obtained that dark channel removal is important technique that recover image efficiently, in worst weather condition. It is also obtained that color and edge feature plays an important role for object detection in image or video frame.

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