International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 13 • Issue 2 pp. 1-6 June - Dec 2021 www.csjournals.com

Change Detection of Forest Areas Using Object-Based Image Analysis

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Abstract: In environmental studies the use of remote sensing is becoming frequent. In the 1970s and 1980s satellite images were mostly used in simple interpretations or as a map background. In the past three decades satellite imagery has been used successfully for weather, geographical and geological applications. Deforestation is one of the major contributors to global warming and climate change. An elevation in the greenhouse gases that halo our planet is because of the global warming. The effect of global warming is further exacerbated by deforestation because the removal of densely forested areas decreases the number of the CO2 consuming vegetation. Indirectly, Deforestation disturbs the delicate balance of CO2, consumed by trees and produced by different sources. Change detection from remotely sensed images is a process that utilizes a pair of images acquired over the same geographical area at different times to identify the changes that may have occurred between the considered acquisition dates. Because of insensitiveness to atmosphere (particularly rain and clouds), the SAR system is more suitable for this purpose than other remote sensing devices, employed in change detection for land use and land cover. Hence, in the past decades, it has been successfully used in many applications such as agricultural surveys, environmental monitoring, damage assessment, urban studies, and forest monitoring.
Keywords: Deforestation, SAR system, RS image, SIFT.

1. INTRODUCTION

To detect a change in forest cover (deforestation or forest degradation) with existing data, images are needed for two or more time periods. By overlaying the images and determining the differences between them, the change between the two dates can be determined. This multi- temporal data set can then be classified to show loss of forest, degradation of forest and other changes.[1][2][3]
Wall-to-wall and sampling methods are the two major approaches used to assess deforestation over large scales. In wall-to- wall methods, images covering an entire country or region are analyzed. Sampling approaches use systematic sampling where a regularly spaced grid to identify plot locations across an entire region or random sampling stratified by topography, soil type, broad forest type, or degree of disturbance (hot spots) Wall-to-wall mapping has primarily been used for sub-national or national-level assessments while sampling approaches have primarily been used for continental or global scale assessments.[4]
Remotely sensed image change detection techniques can be categorized into two main research streams: supervised and unsupervised techniques. However, unsupervised methods have been widely studied since they do not need any prior knowledge of images. Automatic change detection systems are proposed based on the statistical modeling. It models the ratio image as a mixture of two generalized Gaussian distributions associated withchanged and unchanged classes and employs an automatic threshold selection method to obtain the change map changed and unchanged classes and employs an automatic threshold selection method to obtain the change map.

However, owing to the effect of speckle noise in RS images, the pixels in changed areas may share

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a wide range of values with the unchanged pixels. As a result, the selection of the best threshold values is a challenging task. Moreover, the accuracy will decrease when the assumed statistical model does not match the practicalsituation.[5][6]

2. SYSTEM DESIGN

The block diagram in Fig 1 gives the general description of system.
The detailed procedure is summarized in 5 steps as follows:

- **Log ratio image generation**: we are taking two multitemporal images of same geographical area at two different time interval for comparison
- **Extraction of SIFT key points:** SIFT key points are extracted in the log- ratio image to force the further detection regions within some smaller ranges.

- **Segmentation:**Here, we make segmentation around the extracted key points in the two original multi-temporal RS images, where the edges of the detection regions are much clearer
- **Comparison**: Two segmented images are compared for actual change detection.
- **Change Detection:** Then finally change detection map of particular geographical area in certain period of time is generated.

2.1 Hardware Requirements:

System: Pentium IV 2.4 GHz and above.
Hard Disk: 40 GB Min.
Ram : 256 Mb Min.

2.2 Software Requirements:

Operating system : Windows XP Professional and above.
Coding Language : MATLAB 7 and above.
Toolbox :Imageprocessing toolbox of Matlab.

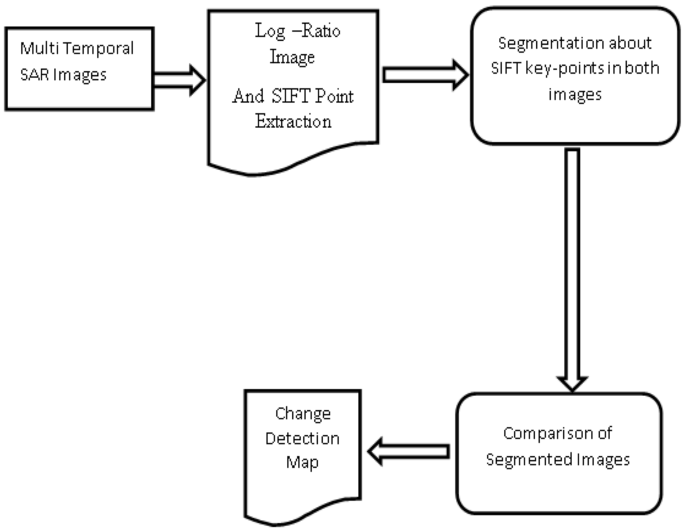

Fig. 1

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3. WORKING

Here we have used two techniques to track the amount of vegetation in the image. The two approaches are RGB and HSV. The RGB colour model is an additive colourmodel in which red, green, and blue light is added together in various ways to reproduce a broad array of colours. HSV stands for hue, saturation, and value, and is also often called HSB (B for brightness). The Algorithm through RGB is a standard algorithm used in detecting colours. HSV has been used by us to detect colourwith various different shades and thus helping us to detect more different shades of the green colour. Thus it provides a wide range of detection.

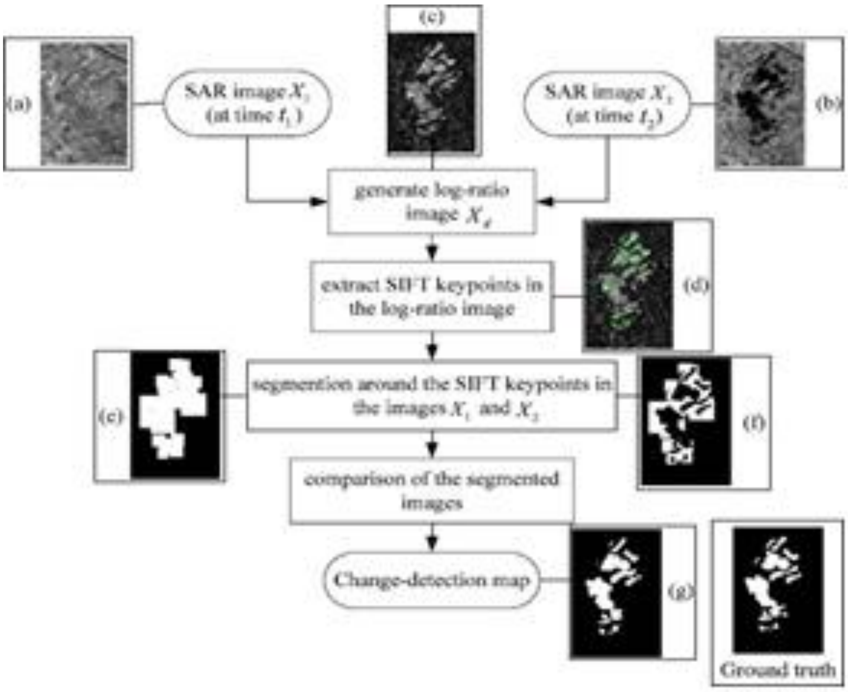

Fig 2.

Proposed technique exploits not only the SIFT that is **scale invariant feature transforms**key points extracted from the difference image to improve the detection robustness to the speckle noise, but also the region information around the SIFT key points in the original RS images to obtain accurate changed regions.The detailed procedure is summarized as follows. In this the log-ratio image is first generated from the two multi-temporal images. Then, since the SIFT feature can detect blob like structures in an image and be insensitive to noise, the noise-robust SIFT key points are extracted in the log- ratio image to force the further detection regions within some smaller ranges. The change map is directly obtained from the difference image, and the edges ofthechanged regions may be blurred consequently. Here, we make segmentation around the extracted key points in the two original multi-temporal RS images, where the edges of the detection regions are much clearer than those in the difference.

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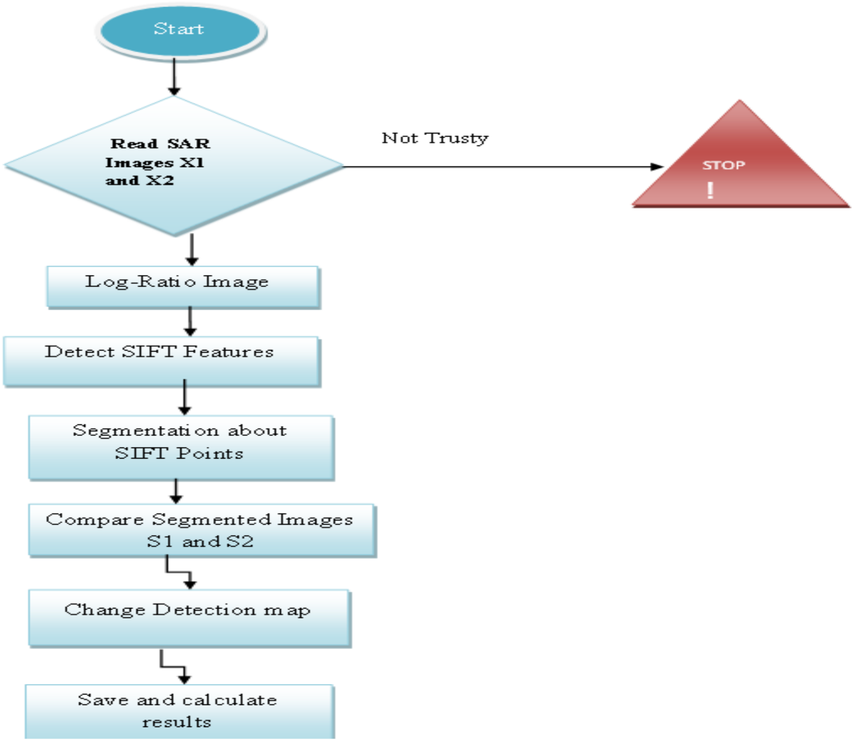
Flow chart for proposed algorithm is as follows:



Our proposed algorithm given in fig.2 and fig. 3 of flow chart showing step by step methodology consists followingsteps:

1) Generation of log-ration image from the two multi-temporalimages
2) Extract SIFT key points in log-ration image
3) Segmentation about SIFT key-points in bothimages
4) Comparison of segmentedimaged
5) Generation of change detectionmap.

Result:

The unsupervised method of classification does not require the user to specify any information about the features contained in the images. We are comparing the two multitemporal images from the same Landsat of the same geographical area here to extract the change detection map. Here 986 SIFT points are extracted which are further used for getting change detection map. Stepwise results for one dataset are as follows:

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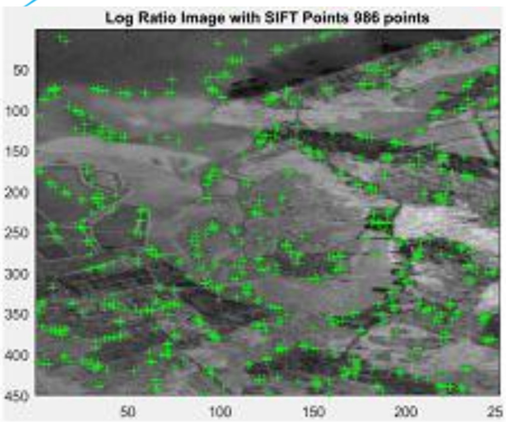

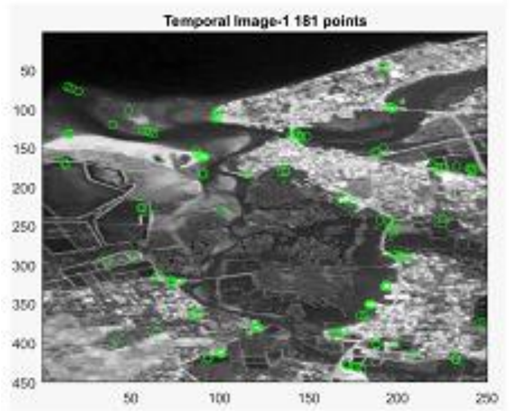

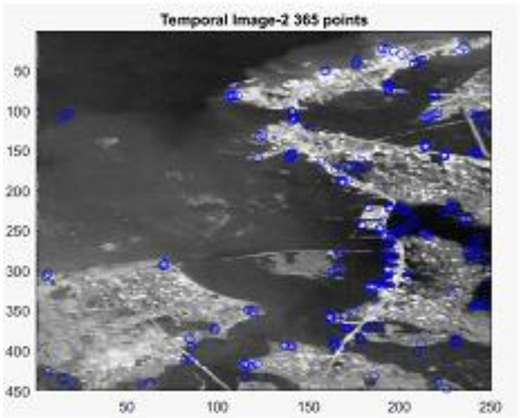

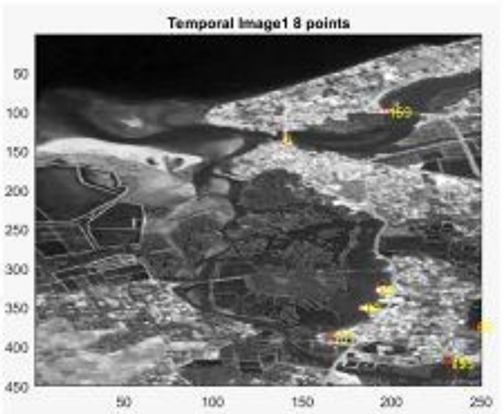

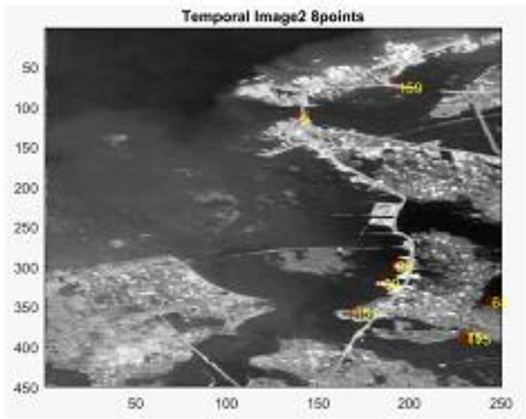

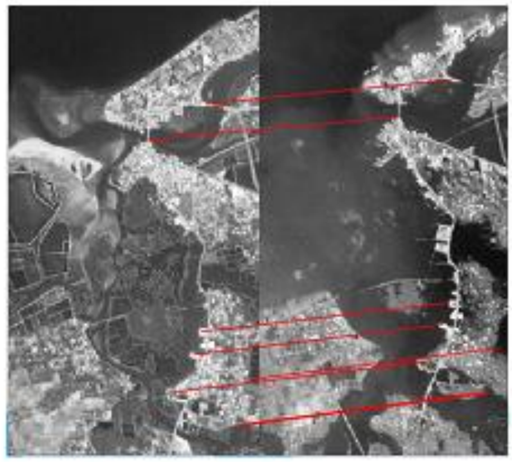

Fig. Change Map Lines

Fig. Change detection map

CONCLUSION

Proposed technique will exploit not only the scale invariant feature transforms (SIFT) key points extracted from the difference image to improve the detection robustness to the speckle noise but also the region information around the SIFT key points in the original RS images to obtain accurate changedregions.

Our system will deliver essential information to people in forestconservation of each country through satellite image comparisons. The software will be a fully compact tool kit to forest conservation departments of each country. It will facilitates its uses to track deforestation through satellite image processing and also the software will be equipped with tools to analyze data and provide critical information needed to combat deforestation. Our software will also be capable of delivering future deforestation probabilities based on previous deforestation patterns.

ACKNOWLEDGMENT

We are greatly indebted to my guide Prof.A.S.Mali for his unstained support and valuable suggestions. We are grateful to them not only for the guidance but also for their unending patience and keeping our spirits high thought. We express my sincere thanks to our beloved Head of the Department Prof. C.P.Shinde and Principal Dr.S.V.Anekar for being source of inspiration.

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