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Research Article

CHANGE DETECTION OF FOREST AREAS USING OBJECT-BASED IMAGE ANALYSIS

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A B S T R A C T

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.

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]

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 analysed. 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.

Remotely sensed image change detection techniques can be categorized into two main research streams: supervised and unsupervised techniques.

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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 modelling. It models the ratio image as a mixture of two generalized Gaussian distributions associated with 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 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 practical situation.[2]

Existing methodology

Deforestation is typically assessed by quantifying the amount of area deforested, measured at the present time. From an environmental point of view, quantifying the damage and its possible consequences is a more important task, while conservation efforts are more focused on forested land protection and development of land-use alternatives to avoid continued deforestation. Many Researches are on-going to track the deforestation pattern and amount for analysis. Some of the related works are:

1. Earlier visual interpretation of satellite images were carried out to make various thematic maps. However, many effective methods and techniques for automatic classification enable the researchers to generate thematic maps automatically. Land cover classification is a challenging problem because terabytes of data are acquired every day. Processing such a large amount of data has attracted the research attention as it is difficult and time consuming. It also dependents on the knowledge of the individual domain expert. Various Change detection techniques have been reviewed in Coppin and Bauer (1996); Singh (1989). These papers discusses various pre-processing requirements of the images acquired by remote devices, factors which causes changes in the land cover and the different change detection techniques. [1]
2. The classification of satellite imagery has many applications in real world. Land covers such as high mountains, large seas, dense forests, big deserts, deep valleys etc.; all can be imaged using satellites. The image classification can provide more information about characteristics, changes, increase or decrease in these areas. A further analysis of the information has been helpful to study their bearing on mankind. Effective classification techniques for satellite images may even prove to be helpful to detect the forest fires. A time series analysis of the imagery may help develop forewarning system for flood, spread of diseases in crops etc. Most of these applications require ground data for supervised classification but in many cases it may be difficult to collect ground data. Therefore, for such applications unsupervised learning techniques may prove to be useful. [2]
3. Land covers are not disjoint due to which there is inherent fuzziness in the land cover classes. Based on the resolution of the image a single pixel of satellite image may cover a large area including features of many classes. Land cover areas have high spatial auto-correlation which means neighbouring pixels more likely get grouped into the same category. Spatial auto-correlation has also been addressed by using Majority analysis. [3]
4. Three unsupervised learning techniques: Ward clustering, k-means, and expectation-maximization, were used for classification of sub-sequences of the time series data. In Mukherjee et al. (2009) the effect of canal on land use and land cover in an area of Punjab, India has been discussed. [4]
5. P. Lombardo and C. J. Oliver explained about maximum like hood approach to the detection of changes between multi temporal SAR images. [5] [6]
6. Remotely sensed image change detection techniques can be categorized into two main researchstreams: 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 modelling. It models the ratio image as a mixture of two generalized Gaussian distributions associated with 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 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 practical situation. [7] [8]

System operation

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 colour model 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 colour with various different shades and thus helping us to detect more different shades of the green colour. Thus it provides a wide range of detection.

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 of the changed 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

Flow chart

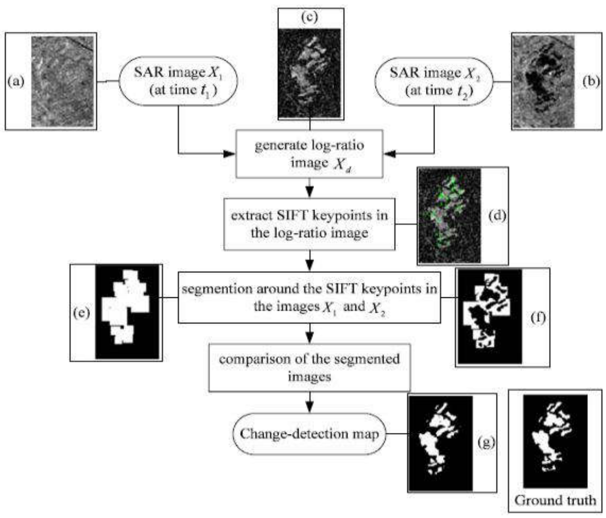

Fig 1

Our proposed algorithm given in fig.1 of flow chart showing step by step methodology consists following steps:

1. Generation of log-ration image from the two multi-temporal images

2. Extract SIFT key points in log-ration image
3. Segmentation about SIFT key-points in both images
4. Comparison of segmented imaged
5. Generation of 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 keypoints in the original RS images to obtain accurate changed regions.

Our system will deliver essential information to people in forest conservation 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 analyse 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.

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