Change Detection on Multi Temporal Images using NSCT image fusion and Morphological Operator

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ABSTRACT -

The main objective of the paper is to develop a novel multi focus image fusion scheme in non sub sampled contour let transform (NSCT) domain and a new morphological filter is applied and to detect the focused regions of the source images; meanwhile, each of the source images is decomposed using NSCT. The simulated results will be proven that rationing generates better difference image for change detection using supervised classifier segmentation approach and efficiency of this algorithm will be exhibited by sensitivity and correlation evaluation and cluster efficiency analysis.

Index Terms **: - MS Image; NSCT; Spatial Fuzzy Cluster; Morphological Edge Operator; Cluster Efficiency.**

I.Introduction

Change detection is a process that compares and analyses two satellite image acquired over same geographical area at two different time instances. Change detection has now become an vitally important topic digital image processing. Its applications requires knowledge about the rapid abrupt changes and/or evolution of slow phenomena. This paper deals with damage assessment based on natural disasters application such as changes caused by tsunamis [2], fires [3], etc. Segmentation is a preprocessing step, which performs higher level operations such as recognition, scene understanding, indexing etc. There are various image segmentation techniques and algorithms have been proposed previously [9][12][20]. The studies by[3][4][7][21] evaluate and reported that the existing techniques are specific to the segmentation of the satellite images.

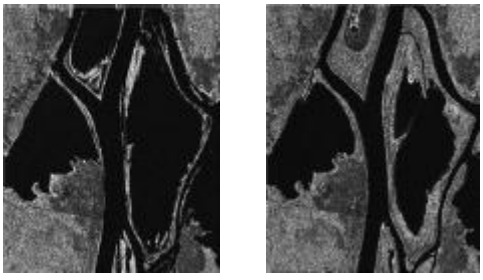
Supervised learning technique requires some initial training data to learn the class parameters [5-6]. But it is not suitable for many practical applications where training data is not known. An unsupervised learning technique lear ns the class parameters by exploiting the structure of the (unlabeled) data [6]. This paper presents a statistical modeling based segmentation technique where Hopfield type neural network is used to update the parameters of the clusters formed by the pixels of the satellite image. In order to assess the effectiveness of the proposed techniques, we consider a satellite images and compared the results provided by the proposed technique with the results obtained from the satellite images. This paper is organized as follows: Section II describes the proposed method, and conclusion has been drawn in section III.

II. PROPOSED METHOD OF IMAGE CHANGE DETECTION

To validate the effectiveness of the proposed unsupervised change detection based on NSCT image fusion and morphological operator, the real SAR data set is chosen. The proposed method NSCT image fusion and morphological operation on the multi temporal images produce better results when compared with unsupervised classification obtained using Hopfield.

EXPERIMENTAL DATA SET:

The first data set is a section (pixels) of two SAR
images with 10mresolution acquired by Radarsat SAR sensor in May and August 1997, as shown in Fig. 1(a) and (b), respectively.These images were provided by the Defense Research and Development Canada, Ottawa. Roughly, there are two regions in these images, i.e., water and land. The ground truth mapshown inFig. 1(c) is generated by integrating prior information with photo
interpretation based on the input images in Fig. (a) and (b).



(a) (b)

(c)

Fig 1 : Ottawa data set. (a) Image acquired in July 1997. (b) Image acquired in August 1997. (c) Ground truth.

The second data set is a section (pixels) of two SAR images with 10m resolution acquired by Radarsat SAR sensor in april 2001 and march 2015 by the geographical survey department Chennai ,the area covered is MRC nagar in adayar region. Fig 2(a) shows the region obtained in april 2001 (b) shows the image obtained in march 2015 and (c) is the ground truth image of the respected area.

(a) (b)

(c)

Fig 1 : MRC Adayar,Chennai ,Tamil Nadu data set. (a) Image acquired in April 2001. (b) Image acquired inmarch2015. (c) Ground truth.

NSCT based Image Fusion

Image fusion can be defined as the method of combining two or more different images to form a new image usingcertain algorithms. Contour-let transform [16] is a true two-dimensional transform that can capture the intrinsic geometrical structure, which is key in visual information.

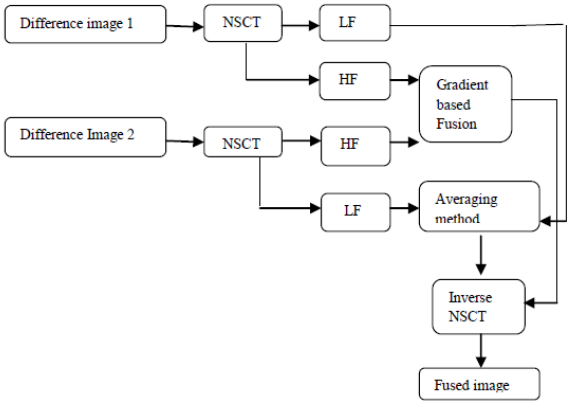
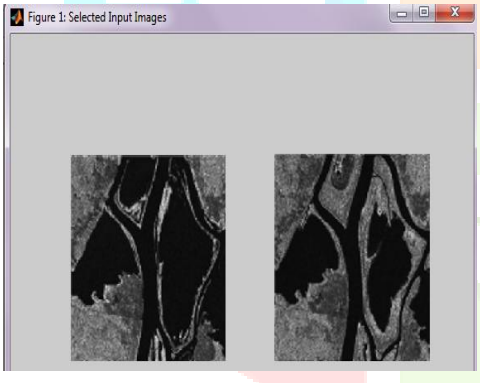
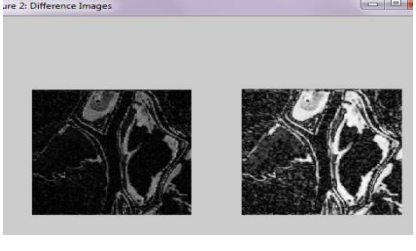


Figure 3: Block diagram on NSCT image fusion where LF denotes low frequency and HF denotes high frequency .

When compared with wavelet, contour let provides different and flexible number of directions at each scale. It has been successfully employed in image enhancement, de-noising and fusion. Unfortunately, due to down samplers and up samplers presented in both the laplacian pyramid and the directional filter banks (DFB), the foremost contour let transform is not shift-invariant, which causes pseudo-Gibbs phenomena around singularity. NSCT is a kind of multi-scale and multi-direction computation framework [25] of the discrete images. It involves two stages such as non-sub sampled pyramid(NSP) and non sub sampled directional filter bank(NSDFB) to extract the texture, contours and detailed coefficients. NSP decomposes the image into low and high frequency sub bands at each decomposition level. It produces n+1 sub images if decomposition level is n. NSDFB extracts the detailed coefficients from direction decomposition of high frequency sub bands obtained from NSP. It generates m power of 2 direction of sub images, when the number of stages be m.



(a)



(b)

(c)

Scene change detection

Change detection approach for synthetic aperture radar images is based on an image fusion and a spatial fuzzy clustering algorithm [26]. The image fusion technique is introduced to generate a difference image by using complementary information from a mean-ratio image and a log-ratio image. NSCT based fusion involves an average operator and maximum gradient coefficient selection are chosen to fuse low-frequency and a high-frequency band, which restrain
the background information and enhance the information of the changed regions in the fused difference image.

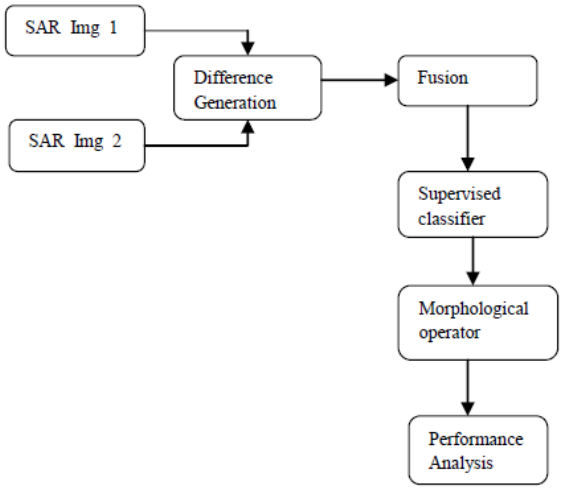


Figure 4: Block diagram on scene change detection.

(a) **(b)**

Fig 5. (a) ground truth of Ottawa data set ,(b) image obtained using morphological operator.

CONCLUSION

This paper presented the change detection approach for remote sensing satellite images based on an image fusion and an artificial neural network. The NSCT decomposition was effectively used to extract the smoothing and contour wedges from images. It improves pixel level fusion with better efficiency. The images were detected from the fused images with significantly lesser time using back propagation neural network. The simulated results shows that the generated fused image has less error and acquired better segmented changed region based on the fuzzy cluster analysis and morphological operator. The better performance of the proposed method over the existing conventional methods can be recognized from the highest results of the sensitivity, peak signal to noise ratio, and cluster accuracy.

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