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Multitemporal Image Analysis Using NSCT Fusion and Supervised Classifier for Land Change Detection

Pooja Sawant[1], Dr. S. D. Shirbahadurkar[2]

Student, Electronics & Telecommunication Department, Dr. D. Y. Patil School of Engineering, Ambi, Pune, India[1]

Principal, Electronics & Telecommunication Department, Dr. D. Y. Patil College of Engineering, Ambi, Pune, India [2]

Abstract: The project presents change detection approach for artificial aperture radiolocation (SAR) pictures based mostly on a picture fusion and supervised classifier system. The image fusion technique will be introduced to come up with a distinction image by victimisation complementary info from a mean-ratio image and a log-ratio image. NSCT (Non- sub sampled contour let transform) fusion rules based on a mean operator and minimum native space gradient square measure chosen to fuse the contour let coefficients for a low-frequency band and a high-frequency band, respectively to restrain the background details and increase the info of modified regions within the amalgamate distinction image. For the remote sensing images, differencing (subtraction operator) and rationing (ratio operator) square measure well-known techniques for manufacturing a distinction image. In differencing, changes are calculate by subtracting the intensity values pel by pel between the thought-about couple of temporal pictures. In rationing, changes are gained by applying a pixel-by-pixel quantitative relation operator to the thought-about couple of temporal pictures. In the case of SAR images, the ratio operator is generally used rather than the subtraction operator since the image differencing technique isn't tailored to the statistics of SAR pictures. An artificial neural network kind multilayer perception or back propagation with feed forward network are going to be projected for classifying modified and unchanged regions within the amalgamate distinction image. This classifier comes under supervised segmentation that is worked based mostly on coaching liquid body substance classification. The results are going to be proven that allocation generates higher distinction image for amendment detection victimisation supervised classifier segmentation approach and potency of this algorithmic program can be exhibited by sensitivity and correlation analysis.

Keywords: SAR (Synthetic Aperture Radar), NSCT (Non-sub sampled contour let transform), VHSR (Very High Spatial resolution).

I. INTRODUCTION

Buildings are of primary interest for urban planners and governmental agencies, as they form an important geospatial data layer for different applications. Their detection in very high spatial resolution (VHSR) images has recently been the subject of extensive research, and efforts have been made to automate or semi-automate the process. The complex appearance of buildings in VHSR images, together with the fact that the properties of these images may vary considerably with the sensor, makes the automatic detection of buildings a difficult task.

Moreover, the automatic recognition of semantic information is problematic, and the performance of existing methods tends to fail, as different urban types are treated therefore, these methods still need to be improved. A common trend in the methods for building detection is the use of spatial and contextual information, in addition to the spectral information used by per-pixel image analysis that was found to be insufficient to treat the increased intra class heterogeneity of VHSR images. A considerable number of methods first divide the image into spectrally homogeneous regions (segments) and then classify the segments. Thus, different shapes and contextual attributes may be computed for these segments and used to improve the results of the classification. A difficulty arises in the areas of building boundaries because of the low local contrast of VHSR images and mixed pixels. To overcome this, Hough transform and graph theory were used to refine the contours of the segments to better conform to real object boundaries, prior to classification. Xu and Li compared the contribution of three invariant moments, namely Hu's moments, Zernike moments, and wavelet moments, combined with spectral information, to the improvement of object-based classification.

It was found that the three moments significantly improved the overall classification accuracy; however, the segmentation level used was crucial for the improvement. Other methods develop specific algorithms to directly delineate building contours and reconstruct building areas afterward. Sirmaçek and Unsalan used the scale invariant feature transform (SIFT) algorithm to locate key points possibly situated on buildings, and a graph cut method to match them to previously defined building templates. In a later work, the same authors designed a specific set of Gabor filters to extract local features and their descriptors (location, orientation, and possible distance to the building

center) in order to find edges of differently oriented buildings. The snake model, also called the active contour model, was used by Mayungaet al. to detect building boundaries. To overcome one of the limitations of the snake model, related to initializing the initial contours for the algorithm.

II. LITERATURE REVIEW

1. **A COMPARISON OF FOUR ALGORITHMS FOR CHANGE DETECTION IN AN URBAN ENVIRONMENT, REMOTE SENS. ENVIRON., VOL. 63, NO. 2, PP. 95–100, FEB. 1998**

Author:-M. K. Ridd and J. Liu,
Description:-Four digital change detection algorithms are applied to 1986 and 1990 Landsat Thematic Mapper (TM) images of a portion of the Salt Lake Valley area to determine the land-cover/land-use changes between the two dates. Image differencing and image regression are used with the six reflective TM bands to create 12 change images. A tassled cap transformation is also used to create three change images (change in brightness, greenness, and wetness). A new method a Chi square transformation is proposed and used with the six reflective bands to create a single band change image. A thresholding strategy is applied to the change images to separate the pixels of change from those of no change. Five hundred eighty-five samples are selected through a combination of stratified random sampling and systematic sampling procedure. Ground truth information on the sample sites is obtained from the interpretation of color aerial photo slides of the two dates. Three indices are used to assess the accuracies of the sixteen change images for land-cover/land-use change detection. The regression of TM Band 3 is found to be most accurate for detecting change vs. no change in all three indices, while the difference image of TM4 is found to be least accurate. The kind of change in land-cover/land-use is also examined. The results are compared and summarized. Changes involving construction sites and farmlands are found to be accurately detected by several change images.Gadget timed out while loading.

2.Multi-temporal SAR Image Change Detection Technique Based on Wavelet Transform,

Author:-HUANG Shiqi, LlUDaizhi, Hu Mingxing

Description:A novel change detection method for multi-temporal SAR images using nonsubsampledcontourlet transform (NSCT) has been proposed. Firstly, we obtain the log-ratio map by comparing two co-registered SAR images with a ratio operator in a logarithmic scale. Secondly, the log-ratio map is decomposed into multiscale and multidirectional sub-images by NSCT, and the speckle noise in each sub-image is suppressed by scale correlation method. Finally, the changes in every sub-image are detected through a constant false alarm rate (CFAR) detector and the result map is derived according to an adaptive fusion strategy. Experimental results on simulated data and real airborne SAR imagery data both confirm the effectiveness of the proposed method.

3. Earthquake damage assessment of buildings using VHR optical and SAR imagery," IEEE Trans. Geosci. Remote Sens., vol. 48, no. 5, pp. 2403–2420, May 2010.

Author:-D. Brunner, G. Lemoine, and L. Bruzzone,
Description:Rapid damage assessment after natural disasters (e.g., earthquakes) and violent conflicts (e.g., war-related destruction) is crucial for initiating effective emergency response actions. Remote-sensing satellites equipped with very high spatial resolution (VHR) multispectral and synthetic aperture radar (SAR) imaging sensors can provide vital information due to their ability to map the affected areas with high geometric precision and in an uncensored manner. In this paper, we present a novel method that detects buildings destroyed in an earthquake using pre-event VHR optical and post-event detected VHR SAR imagery. The method operates at the level of individual buildings and assumes that they have a rectangular footprint and are isolated. First, the 3-D parameters of a building are estimated from the pre-event optical imagery. Second, the building information and the acquisition parameters of the VHR SAR scene are used to predict the expected signature of the building in the post-event SAR scene assuming that it is not affected by the event. Third, the similarity between the predicted image and the actual SAR image is analyzed. If the similarity is high, the building is likely to be still intact, whereas a low similarity indicates that the building is destroyed. A similarity threshold is used to classify the buildings. We demonstrate the feasibility and the effectiveness of the method for a subset of the town of Yingxiu, China, which was heavily damaged in the Sichuan earthquake of May 12, 2008. For the experiment, we use QuickBird and WorldView-1 optical imagery, and TerraSAR-X and COSMO-SkyMed SAR data.

4. Change detection techniques for ERS-1 SAR data," IEEE Trans. Geosci Remote Sens., vol. 31, no. 4, pp. 896–906, Jul. 1993

Author:-E. Rignot and J. van Zyl,
Description:-Several techniques for detecting temporal changes in satellite synthetic-aperture radar (SAR) imagery are compared, using both theoretical predictions and spaceborne SAR data collected by the first European Remote Sensing Satellite, ERS-1. In a first set of techniques, changes are detected based on differences in the magnitude of the signal intensity between two dates. Ratioing of the multidate radar intensities is shown to be better adapted to the statistical characteristics of SAR data than subtracting, and works best when the number of looks is large. In a second set of techniques, changes are detected based on estimates of the temporal decorrelation of speckle. This method works best with one-look complex amplitude data, but can also be used with intensity data provided that the number of looks is small. The two techniques are compared using actual SAR data collected by ERS-1. The results illustrate the viability as well as the complementary character of these techniques for detecting changes in the structural and dielectric properties of remotely sensed surfaces.

5. Assessment of very high spatial resolution satellite image segmentations," Photogramm. Eng. Remote Sens., vol. 71, no. 11, pp. 1285–1294, Nov. 2005.

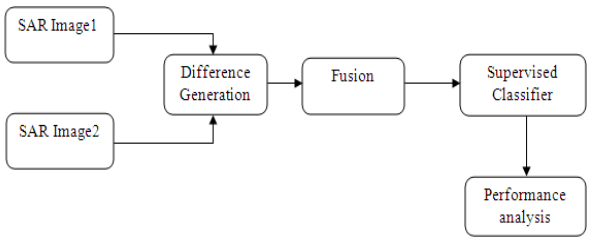
Author:-A. Carleer, O. Debeir, and E. Wolff
Description:-Since 1999, very high spatial resolution satellite data represent the surface of the Earth with more detail. However, information extraction by per pixel multispectral classification techniques proves to be very complex owing to the internal variability increase in land-cover units and to the weakness of spectral resolution. Image segmentation before classification was proposed as an alternative approach, but a large variety of segmentation algorithms were developed during the last 20 years, and a comparison of their implementation on very high spatial resolution images is necessary. In this study, four algorithms from the two main groups of segmentation algorithms (boundarybased and region-based) were evaluated and compared. In order to compare the algorithms, an evaluation of each algorithm was carried out with empirical discrepancy evaluation methods. This evaluation is carried out with a visual segmentation of Ikonos panchromatic images. The results show that the choice of parameters is very important and has a great influence on the segmentation results. The selected boundary-based algorithms are sensitive to the noise or texture. Better results are obtained with region based algorithms, but a problem with the transition zones between the contrasted objects can be present.

III.SURVEY OF PROPOSED SYSTEM

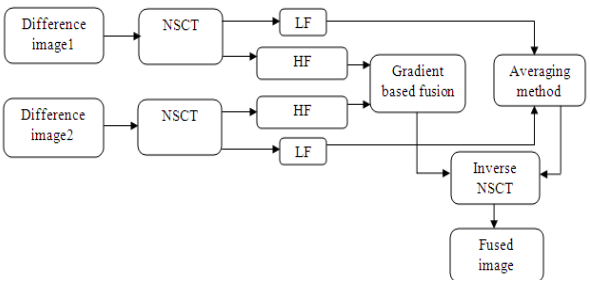
The methodology consists of applying the POHMT to multispectral images to detect potential building locations. The size of the structuring element (SE) was defined through the morphological top-hat by reconstruction transform. To remove irrelevant locations, vegetation areas were masked using the normalized difference vegetation index (NDVI), and the detected locationsMulti temporal synthetic aperture radar image analysis for land cover change detection based on NSCT based image fusion approach and Artificial neural network with feed forward back propagation model

Block Diagram

1. Change detection



2. Fusion Design model



METHDOLOGY

- Difference image detection with log-ratio and mean-ratio operator
- Fusion using NSCT
- Back propagation with feed forward network classifier
- Parameters Evaluation(Cluster efficiency, Sensitivity and Correlation)

IV. CONCLUSION

We presented a novel method for the detection of buildings in VHSR images. It consisted of finding potential building locations using a vector-based POHMT, removing irrelevant locations using a vegetation mask, and verifying building locations using shadow information. The method used spectral, contextual, and geometrical (concerning the size of buildings) information.
The main originality of our method was the proposed vector based strategy to apply POHMT on multispectral images, which compared the spectral properties of the object to those of its neighbourhood, whereas preserving the correlations between spectral bands in VHSR images. Also, in our opinion, an original technique to define the size of SE was proposed, which may be used by other morphological operators. The experimental results were promising and we think that the method has the potential to deal with more complex urban structures.

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