Remotely Sensed Knowledge Based Change Detection in Several Land Cover Optimization

Priya Nagwekar[1], U.V.Gaikwad[2]
[1]Dept of Computer Engineering
[2]Professor, Dept of Computer Engineering
[1, 2] Terna Engineering College, Navi Mumbai, Maharashtra, India

Abstract- *This paper proposes remotely sensed knowledge based change detection in several land covers by using kernel minimum noise fraction method. Change detection can be defined as the process of identifying differences in the state of an object or phenomenon by observing it at different times. This process is usually applied to Earth surface changes at two or more times. In particular, the focus of this work is on the land cover change detection problem.*

Keywords- Remotely sensed, Change detection, KMNF

I. INTRODUCTION

The earth's surface is perpetually transmuting as a result of natural phenomena or different human activities like industrialization, forest cutting, wildfires, lightning strikes, storms, pests, agroforestry, agricultural expansion, gregarious, economic, technological, historical factors and urban magnification.

Change detection can be defined as the process of identifying differences in the state of an object or phenomenon by observing it at different times. This procedure is customarily connected to Earth surface changes at least two times.

Kernel minimum noise fraction method is presented for the change detection. Other two methods like Principal component analysis and Image regression are also considered to analyze the result.

II. METHODOLOGY

A. Data set

Set 1: Two data sets are considered

Figure 1a: Hisponiola_lake_2002
Figure 1 b: Hispaniola_lake_2016

Set 2:

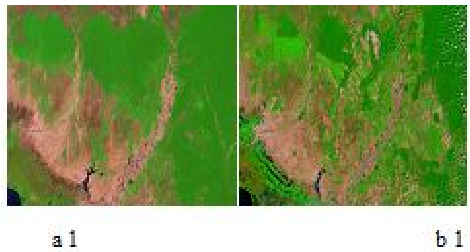


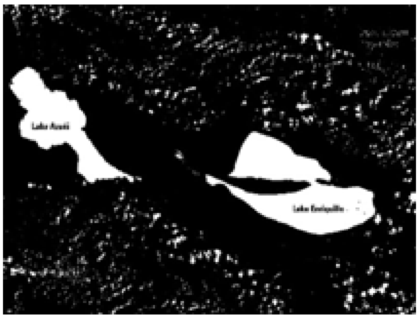
Figure 2a: Combodia
Figure 2 b: Combodia

III. ALGORITHMS

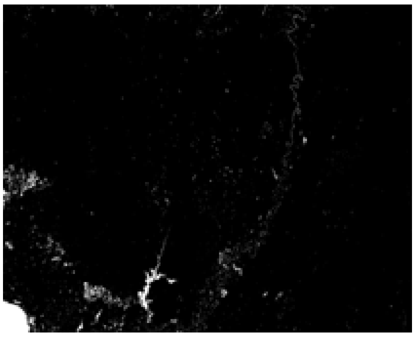
1. Principle component analysis

The principal components [1] are based on the eigenvectors of the variance – covariance matrix of the merged data set (the six bands). These eigenvectors were linearly transformed to provide the eigenstructure which specify the type of information content and the weight of which band variance loaded and involved in each principal component. Thus, the unchanged areas which have high correlation between the two examined images, i.e., areas of common variance in the two dates could be explained by the first PCs as they sought to account for the maximum possible variance of the multi-date data. In contrast, changed areas which can be interpreted as the features that are not present in either of the sets and occupy only a minor proportion of the two dates would be presented in the latter order of the principal components. This whole procedure was implemented using MATLAB software and the output of only PC 2 component was considered which gave the information about the changes occurred in the images.

The change detected image is shown in figure result1_PCA and result2_PCA.The white Pixels indicate changed pixels and black indicate no change pixel.



Result1_PCA 1

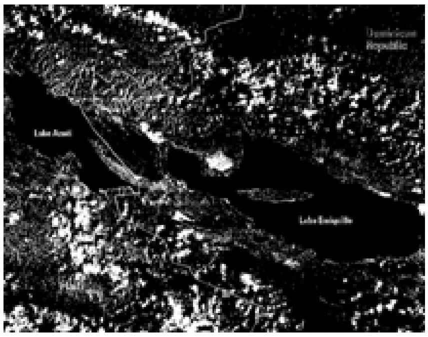


Result2_PCA 1

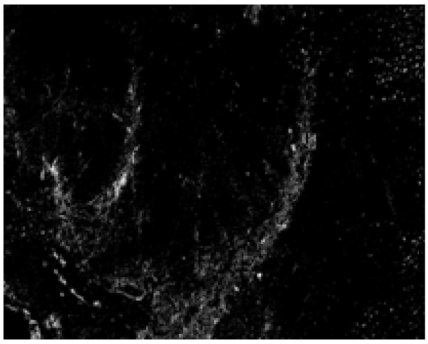
2. Image Regression

The regression intersection method [2] of minimizing the effect of the atmosphere is attractive to many analysts as it provides absolute results from the image data without the use of ancillary data. The method generally involves calculation of regression lines for a number of surface materials of contrasting spectral properties. The regression line method (RLM) determines a 'best fit' line for multispectral plots of pixels within homogenous cover types. Ideally, the intersection of lines must represent a point of zero ground reflectance since this is the only point at which radiometric values of two spectrally different materials can be safe. If no atmospheric scattering has taken place, the intersection of the line would be expected to pass through the origin. The slope of the plot is proportional to the ratio of the reflective material. However, the lines will, in reality, intersect the x and y axis producing two offset values. These brightness values represent the amount of bias caused by atmospheric scattering Crippen (1987)[3] recommends the collection of a series of training areas resulting in many regression lines intersecting in two dimensional spaces at the same point using training sets to represent homogeneous land cover types. The relative values generated by regression method tend to be more reliable. In this method, the image I2 from time (t2) is assumed to be a linear function of image I1from time (t1). The image I2 is taken as the ‘‘reference’’ image and I1 as a ‘‘subject’’ image. The subject image is then adjusted to match the radiometric conditions of the reference image. A regression analysis, such as least-squares regression, can help identify gains and offsets by radio metrically normalizing the subject image to match the reference image (Lunetta, 1999). Change is detected by subtracting regressed image from the first-date image using MATLAB software.

The change detected image is shown in figure result2_IR1 and result2_IR2.The white Pixels indicate changed pixels and black indicate no change pixel.



Result2_IR 1



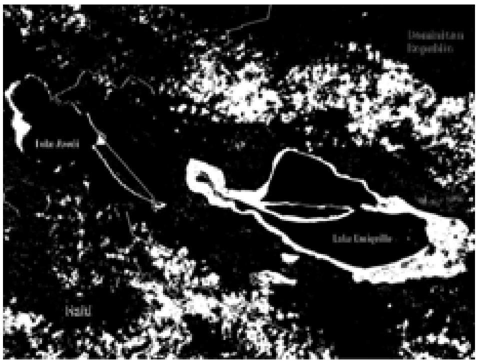
Result2_IR 2

3. Kernel minimum noise fraction:

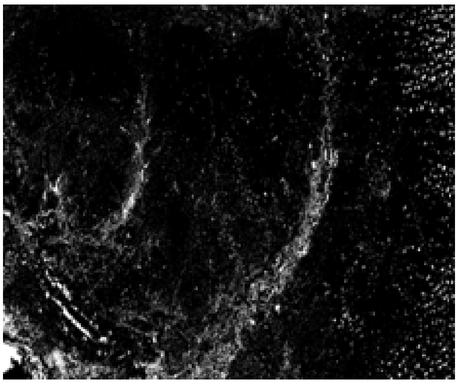
The kernel minimum noise fraction (KMNF) [4-9] method is a nonlinear dimensionality reduction method for hyperspectral images. KMNF can transform the original data into higher dimensional feature space by using nonlinear transformation project. The key issue of KMNF is the noise estimation. The original KMNF performs noises estimation based on spatial neighborhood information. However, the spatial resolution of hyper spectral images always is not very high, and the images usually have seriously mixed pixels.

Therefore, the spatial information is not enough to precisely estimate noise for KMNF. Differently, we adopt spectral correlation information which is more stable to estimate noise for KMNF.

The change detected image is shown in figure result1_KMNF1 and result2_KMNF1.The white Pixels indicate changed pixels and black indicate no change pixel.



Result 1 KMNF 1



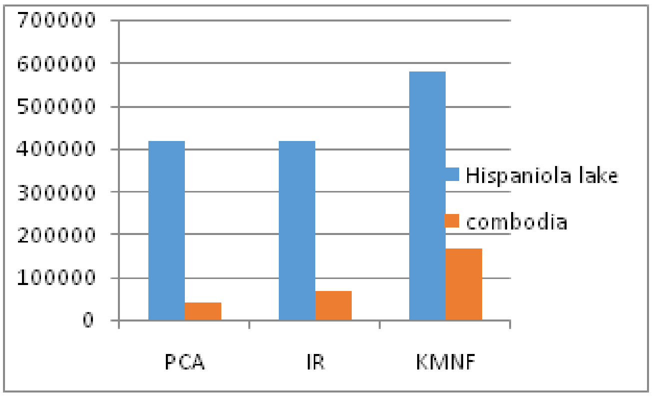
Result2_KMNF 1

III. RESULTS

Results can be summarized in tabular form:
No. of changed pixels are

Data set	PCA	IR	KMNF
Hispaniola lake	418737	415582	577902
Cambodia	38800	68435	165176

Graph of result:



IV. CONCLUSION

In this paper change detection is done for the forest regions using different satellite images. Images from two different periods are collected and analyzed. Performance evaluation for these methods is based on no of changed pixels for each method. Kernel minimum noise fraction gives the best numeric results for both the image data set used. It is followed with Image regression and Principle Component Analysis. The main advantage of this method is that requires only smaller number of pixels. As change detection is more useful in many areas this method can also be implemented for change detection in water, ice etc.

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