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Evaluation of Deforestation using Watershed Algorithm

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***Abstract*— Deforestation is a serious issue that most nations face today. Deforestation is primarily due to urbanization. Most nations that are presently under the scanner for deforestation had immense forest stretch. The need for settlements and development has triggered such a scenario. The proposed method segment the forest region with city and classify how much deforestation occurs. In this paper image segmentation is performed by combining color space and watershed transform. If only watershed algorithm be used for segmentation of image, then we will have over clusters in segmentation. The developed algorithm was applied for segmentation of color images too. In this regard, first, the image was transformed from RGB to La*b*, then the algorithm was applied to segment each channel separately and then the best result for each channel was selected. Finally, color matching was performed for better presentation. Results of proposed algorithm in compare with segmented image by the algorithm in RGB space is more accurate and furthermore proposed algorithm can be ensue an automatic method for evaluating deforestation.**

Keywords- Deforestation, L*a*b*, Watershed segmentation;

I. INTRODUCTION

TamilNadu State located in the south-eastern region of India has an area of 130,058 km21 with a population of approximately 62,405,679 people. Its population density is 480 people\km23, making it one of the most densely populated states. Its western region is mountainous due to the Western Ghats mountain range, whereas in the eastern region, plains stretch towards the Bay of Bengal. The climate in the western mountainous belt averages an annual temperature ranging from 20^o to 24^oC, while the plains area in the eastern region is semitropical and hot throughout the year with temperatures of around 30^oC. The average annual rainfall is 925 mm. The rainy season is from October to December. It is affected by the north-eastern monsoons. The ratio of forest area in Tamil Nadu State was about 17% in 1992, which was slightly under 23% of the entire country of India. In the said state, deforestation had continuously progressed due to increases in demand for wood as fuel both in urban districts and rural areas. As a result, valuable animal fauna had been lost. Approximately 89% of the forests are owned by the national government. However, deforestation had been going on continuously due to development deriving from a rising population and urbanization. At the time of appraisal 7000 sq. kms of forest area in TamilNadu state was degraded. The reason for the deforestation is that a large number of residents depend on forest products for their livelihoods.

At the same time, deforestation marks the local community lands mainly due to urbanization and the encroachment. Traditional management methods for community resources such as trees and fruit trees have not been sustained and local residents have been unable to garner adequate profits from community forests.

Based on the above, it was concluded that it would be necessary to formulate and implement a project aimed at preventing denudation of these forests, regenerating deforested areas, promoting biodiversity conservation, and raising the productivity of these forests.

II. LITERATURE REVIEW

Image segmentation is an important process and its results are used in many image processing applications. Image segmentation is the process of dividing an image into homogeneous regions. This is equivalent to finding the boundaries between the regions. Segmentation is the first step form any higher level image processing and computer vision operations, including shape recognition, medical imaging locating objects in satellite images, face detection and road sign recognition.

Color images contain far more information than monochrome images. Each pixel in a color image has information about brightness, hue and saturation. The re are many models to represent the colors , including RGB (red, green, blue), CMY(cyan, magenta, yellow), HSV (hue , saturation, intensity), YIQ, HSI and many others . Several color spaces have been used for image segmentation and no general advantage of one color space has yet been found.

Many of the color image segmentation algorithms are derived from methods of grey scale image segmentation. However, color creates a more complete representation of an image and exploiting this fact can result in a more re liable segmentation. Specialized techniques suited to the nature of color information have been devised.

A brute force method of dealing with image segmentation would be to enumerate all possible partitions of the image and evaluate each one. This creates an extremely large search space, and so this method is not feasible [1]. The Clustering is an unsupervised, computationally efficient and simplest technique, which can be applied to multidimensional data and the results are meaningful only if the homogenous non-textured color regions define the image data, in general. The pixel-based segmentation technique, consisting of Fuzzy C-Means and K-Means considers only the spectral pattern to segment the image. These techniques are not sufficient to segment high-resolution satellite images due to the variability of spectral and structural information in such images. The SOM and hybrid genetic algorithm approach shows good results when applied to different types of satellite images. However the problem with this approach is the slow speed. Despite the many methods for image segmentation, there is no general algorithm that works well for all images. Because of the wide variety of images, a general algorithm needs to be adaptable. Only then can a segmentation algorithm cope with a wide variety of images. Many adaptive methods have been used for image segmentation, including genetic algorithms, neural networks, self-adaptive regularizations, ant colony optimization, fuzzy clustering and simulated annealing [3].

III. DESCRIPTION OF PROPOSED SYSTEM

A. *Watershed Algorithm*

The watershed is the powerful tool for image segmentation. Watershed segmentation is a morphological based method of image segmentation. The gradient magnitude of an image is considered as a topographic surface for the watershed transformation. Watershed lines can be found by different ways. The complete division of the image through watershed transformation relies mostly on a good estimation of image gradients. The result of the watershed transform is degraded by the background noise and produces the over-segmentation. Also, under segmentation is produced by low-contrast edges generate small magnitude gradients, causing distinct regions to be erroneously merged [2].

The main problem of watershed algorithm is over segmentation, because all of edge and noise would appear in the image gradient, which make the de-noising process necessary. In the image analysis, noise removal, without blurring the edge, is difficult. Typically, noise is characterized by high spatial frequencies in an image. Wavelet transform usually can suppress the high-frequency component which is a desirable effect, but also reduces the edge sharpness. Therefore using Wavelet transform for noise removal is not suitable. But wavelet transform provides good localization in both spatial and spectral domains, and low-pass filtering is inherent to this transform. In this paper we use wavelet transform for noise removal and blurring the image for over segmentation.

B. *L*a*b color conversion*

A Lab color space is a color-opponent space with dimension L for lightness and a and b for the color-opponent dimensions, based on nonlinearly compressed CIE XYZ color space coordinates[9]. The CIELAB color space is an approximately uniform color scale. In a uniform color scale, the differences between points plotted in the color space correspond to visual differences between the colors plotted. The CIELAB color space is organized in a cube form. The L*axis runs from top to bottom. The maximum for L* is 100, which represents a perfect reflecting diffuser. The minimum for L* is zero, which represents black. The a* and b* axes have no specific numerical limits. Positive a* is red. Negative a* is green. Positive b* is yellow. Negative b* is blue. Below is a diagram representing the CIELAB color space.

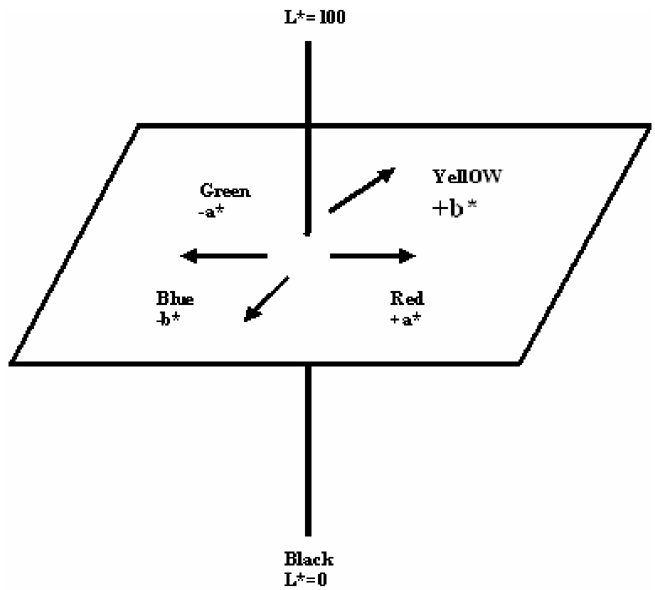

Figure 1. CIELAB color space

The vertical L* axis represents "lightness", ranging from 0-100. The horizontal axes are represented by a* and b*. These are at right angles to each other and cross each other in the center, which is neutral i.e. grey, black or white. The a* axis is green at one extremity (represented by –a) and red at the other (+a). The b* axis has blue at one end (-b), and yellow (+b) at the other. The centre of each axis is 0.In practical the value of a* and b* are numbered from -128 to +127. The below formulae helps for finding lab color values;

If X/X_n, Y/Y_n and Z/Z_n are all greater than 0.008856, then

$L^*=116(\sqrt{Y/Yn}) - 16$

$a^*=500(\sqrt[3]{X/X_n} - \sqrt{Y/Y_n})$

$b^*=200(\sqrt{Y/Y_n} - \sqrt{Z/Z_n})$

If any of X/X_n, Y/Y_n, or Z/Z_n is equal to or less than 0.008856, then

$L^*=903.3(Y/Y_n)$

$a^*=500[f(X/X_n)-f(Y/Y_n)]$

$b^*=200[f(Y/Y_n)-f(Z/Z_n)]$

Where,

X, Y and Z are the CIE Tristimulus values.

IV. EXPERIMENTIAL RESULTS AND DISCUSSION

The result of the proposed technique was given below. The Figure 1) is the original image which is to be analyzed. The original image is taken from the GeoEye-1 satellite. The original image is filtered to remove the unwanted noise from from the Figure 1. The Figure 2 is the Filtered image from the original image. The Filtered image is segmented and converted into the LAB color conversion which is shown in Figure 3 & 4. Then, the result of the proposed is given in the Figure 5. The Figure 6 shows the scatter plot of the segmented pixels in lab space.

Figure 1. Germalam village in sathyamangalam near Erode (India)

Figure 2. Filtered image

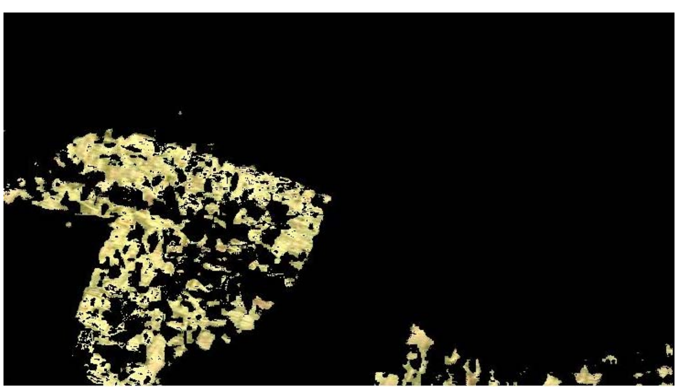

Figure 3. Segmented Image

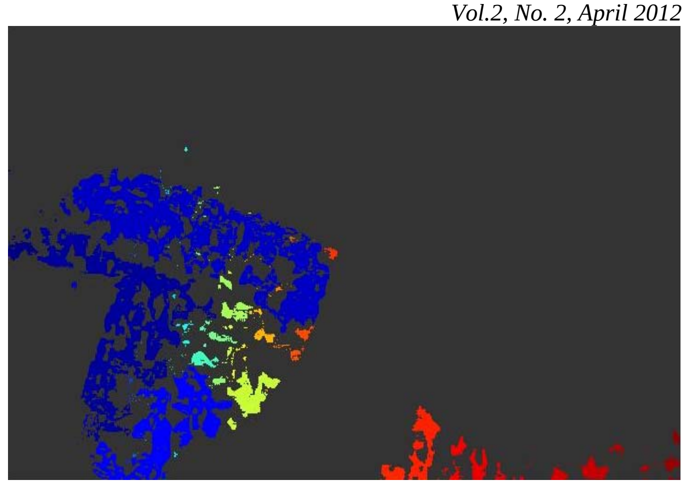

Figure 4. Color Converted Image

Figure 5. Segmented L*a*b* Image

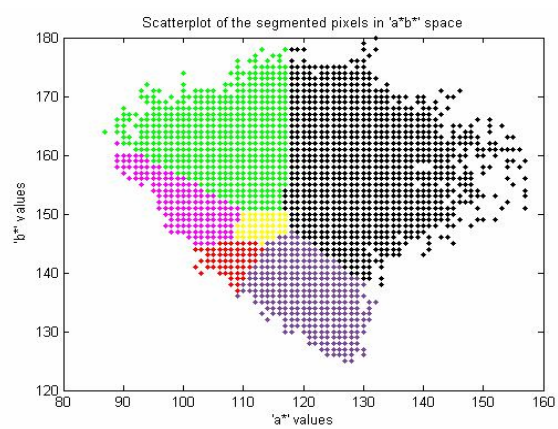

Figure 6. Scatterplot of the segmented pixels in l*a*b space

V. CONCLUSION

In this paper, the evaluation of the deforestation using watershed algorithm is proposed. The identification of the deforestation area and analyze the result with the accuracy of 90% using the satellite image. With the above result we can take necessary steps to prevent deforestation and various impact of deforestation such as global warming, soil erosion, pollution etc. This segmentation algorithm is less complex and free from over segmentation. The paper mainly involves in the area of segmentation and its accuracy. In future the work will be expanding by comparison of the deforestation area with the decade satellite images.

REFERENCE:

[1] Keri Woods,Genetic Algorithms: Color Image Segmentation Literature Review.

[2] Malik Sikandar, Hayat Khiyal, Aihab Khan, and Amna Bibi "Modified Watershed Algorithm for Segmentation of 2D Images." Volume 6, 2009.

[3] Manimala Singha et al, "Color Image Segmentation for Satallite Images"-International Journal on Computer Science and Engineering(IJCSE).

[4] Laure nt, Na jman and Michel Couprie, "Applying Watershed Algorithms to the Segmentation of Clustered Nuclei" Lab oratoire A2SI, Group e ESIE E Cit´e De scarte s, BP 99.

[5] Lydia P Olander, Holly K Gibbs, Marc Steininger, Jennifer J Swenson and Brian C Murray,"Reference scenarios for deforestation and forest degradation in support of REDD: a review of data and methods".

[6] Nassir Salman, "Image Segmentation Based on Watershed and Edge Detection Techniques"

[7] Krishnan Nallaperumal, K.Krishnaveni, Justin Varghese, S. Saudia, S.Annam and P. Kumar "A novel Multi-scale Morphological Watershed Segmentation Algorithm" International Journal of Imaging science and engineering(IJISE).

[8] Nadia Smaoui Zghal and Dorra Sellami Masmoudi "Improving Watershed Algorithm with a Histogram Driven Methodology and Implementation of the System on a Virtex 5 Platform" International Journal of Computer Applications (0975 – 8887) Volume 9– No.12, November 2010.

[9] http://www.hunterlab.com/appnotes/an08_96a.pdf.

[10] B. Arrue, A. Ollero, and J. Matinez de Dios. An Intelligent System for False Alarm Reduction in Infrared Forest-Fire Detection. IEEE Intelligent Systems, 15(3):64–73, 2000.

[11] D. Stojanova, P. Panov, A. Kobler, S. Dzeroski, and K. Taskova. Learning to Predict Forest Fires with Different Data Mining Techniques. In D. Mladenic and M. Grobelnik, editors, 9th International multiconference Information Society (IS 2006), Ljubljana, Slovenia, 2006.

[12] Ollero, J.R. Martinez-De Dios and B.C. Arrúe, *"Integrated systems for early forest-fire detection"*, III International Conference on Forest Fire Research 14th Conference on Fire and Forest Meteorology VOL II, pp.

[13] K. Mehrotra, C. K. Mohan, and S. Ranka, Elements of Artificial Neural Networks, the MIT Press, 1997.

[14] A. Fernandes, A. Utkin, A. Lavrov, and R. Vilar, "Development of Neural Network Committee Machines for Forest Fire Detection Using Lidar," Pattern Recognition, vol. 37, no. 10, pp. 2039-2047, 2004.

[15] Z. Li, S. Nadon, J. Cihlar, "Satellite detection of Canadian boreal forest fires: development and application of the algorithm," International Journal of Remote Sensing, vol. 21, no. 16, pp. 3057-3069, 2000.

[16] Michael Kleine, Ghazala Shahabuddin, Promode, "Case Studies On Measuring And Assessing Forest Degradation" Addressing Forest Degradation In The Context Of Joint Forest Management In Udaipur India, December 2009.

[17] Sebastián Martinuzzil, William A. Gould, Olga M. Ramos Gonzalez, Alma Martinez, Robles4, Paulina Calle Maldonado4, Néstor Pérez-Buitrago4 & José J. Fumero Caban4, "Mapping tropical dry forest habitats integrating Landsat NDVI, Ikonos imagery, and topographic information in the Caribbean Island of Mona", Rev. Biol. Trop. (Int. J. Trop. Biol. ISSN-0034-7744) Vol. 56 (2): 625-639, June 2008.

[18] Feeley, K.J., T.W. Gillespie & J.W. Trborgh. 2005. "The utility of spectral indices from Landsat ETM+ for Measuring the Structure and Composition of Tropical Dry Forests", Biotropica 37: 508-519.

[19] Haar A.: Zur Theory deorthogonal Funktionensysteme. Mathematics Annalen, 69, 331–37, 1910