SEGMENTATION OF DRY FOREST REGION USING WATERSHED ALGORITHM

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***Abstract*— Forest fire is a serious issue that most nations face today. Fire is one of the major causes of surface change and happens in the mass of vegetation zones across the world. Forest fires are key ecological threats that lead to deterioration of economy and environment. Early detection of forest fires is the primary way of minimizing their damages. The proposed method segments the green forest region and classifies the dry forest region. 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 L*a*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 forest fire.**

Keywords-component; Forest fire, dry forest region, L*a*b*, Watershed segmentation.

I. INTRODUCTION

India, with a forest cover of 20.55% of geographical area, contains a variety of climate zones, from the tropical south, north-western hot deserts to Himalayan cold deserts. Forest fires are a major cause of degradation of Indian forests. According to a Forest Survey of India report, about 50 per cent of forest areas in the country are prone to fire. It is estimated that the proportion of forest areas prone to forest fires annually ranges from 33% in some states to over 90% in others. While statistical data and geospatial information on forest fire are very weak or even not available. The degree of forest fire risk analysis and frequency of fire incidents are very important factors for taking preventive measures and post fire degradation assessment. Various regions of the country have different normal and peak fire seasons, which normally vary from January to June. In the plains of northern and central India, most of the forest fires occur between February and June. In the hills of northern India fire season starts later and most of the fires are reported between April and June. In the southern part of the country, fire season extends from January to May.

In the Himalayan region, fires are common in May and June. The forests of Western Himalayas are more frequent vulnerable to forest fire as compared to those in Eastern Himalayas. In 1995 forest fire had destroyed more than 3.75 million hectares of forest wealth in Uttaranchal alone.

Tamilnadu includes a Recorded Forest Area of 22.6 lakh ha. Covering 17.4% of geographic area of the State. However area under forest cover according to FSI is only 17.07 lakh ha covering 13.13% of the Geographic Area. Tropical dry Deciduous Forest covers an area of 12.23lakh ha constituting 54.30%, Tropical Thorn Forest covers an area of 5 lakh ha constituting 22.10%, Tropical Moist Deciduous Forest covers an area of 2.60 lakh ha constituting a percentage of 11.10%.

The Biodiversity rich forest types are the Tropical Wet Evergreen Forest covering an area of 0.60 lakh ha constituting 2.67%, Tropical Semi Evergreen Forest covering an area of 0.23 lakh ha constituting 1.01%, Subtropical Broad leaved Hill Forest covers an area of 1.14 lakh ha constituting 5.04%,

Table 1. Status of Forest Cover in India

Class	Area (km²)	Percent of Geographic Area
Forest Cover	6,75,538	20.55
Non-forest	2,611,725	79.45
Geographic Area	3,287,263	100.00

the Tropical Dry Evergreen Forest which is a unique type of Tamil Nadu covers an area of 0.26 lakh ha constituting 1.16%, the mangrove forest covers an area of approximately 0.23 lakh ha constituting 1.01%.

II. LITERATURE REVIEW

The past or early detection of forest fires [1] is an essential element for controlling such phenomenon. The application of remote sensing is at present a significant method for forest fires monitoring [2], particularly in vast and remote areas. A scheme of multi-sensorial integrated systems for early [3] detection of forest fire. A graph based forest fire detection algorithm based on spatial outlier [4] detection methods. Yasar Guneri Sahin [5] has proposed a mobile biological sensor system for prior detection of forest fires which utilizes animals as mobile biological sensors. the location of fire with enough resolution is also very significant [6]. Infrared detection is the basis of some existing detection systems such as the Bosque system from **FABABAZAN** and **BSDS** system from **FISIA-TELETRON** [7]. The Bosque system is capable of detecting a one square meter at ten kilometers or a ten square meter fire at twenty kilometers [8]. The neural network has been applied to a lot of application [9] in the past two decades, including satellite-based forest fire detection [10]. Satellite based monitoring is a popular method to detect forest fire now [11]. But the long scan period and low resolution of satellites [12] restrict the effectiveness of the satellite-based forest fire Detection.

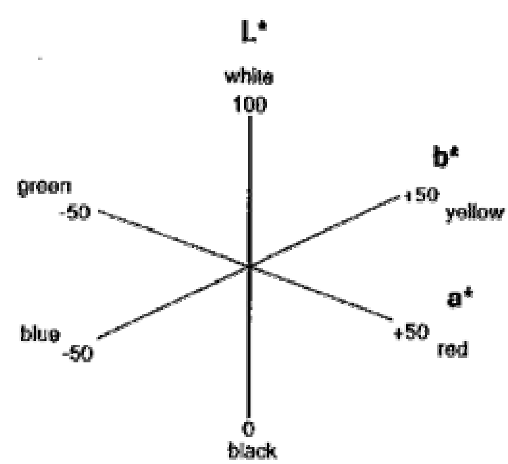
III. DATA SET

In the paper we use GeoEye-1's unsurpassed panchromatic image resolution of .41 meters of an object the size of home plate on a baseball field. Once a panchromatic image is collected by **GeoEye-1**, it must be **resampled** to .500-meter resolution according to our current operating license. After a multispectral image is collected at 500 feet resolution by GeoEye-1, it may be sharpened using information from the **panchromatic mode**. So that the final image is full-color with .50-meter resolution. The **Salem, Namakkal, Erode** district are the **western part** of **tamilnadu**.The **Salem** district forest cover is **21.66%** and the **Namakkal** district consist of **16.14%** of forest cover and the **Erode** district consist of **27.17%** of forest cover. **Kalrayan** hill forest is situated in Salem district and extending northeast from the Salem District and Covering an area of 600 sq. km Along with kalrayan hill the Pachaimalai, Javadi, and Shevaroy hills are also situated. **Deciduous forests** can be found between above **800 meters**. Erode district with an extent of 2, 28,749 ha under forest is the highest among districts in their contribution to the forest area of the state. Namakkal forest cover is only 16.14 % – 551 square kilometers. The forest cover should be 33.33%, the cover in Namakkal is much less than the 21.6% cover in India and 17.6% in Tamil Nadu. The Lesser forest cover in this district is primarily due to the dry climate. **Kolli Hills** is a small mountain range located in central Tamil Nadu in Namakkal district of India. The mountains are about 1000 to 1300 m in height and cover an area of approximately 280 km². Sathyamangalam Forest is situated on the southern side of the Western Ghats, which extends towards the east from the Nilgiri Mountains. It is located at a distance of 7 km from the ghats in Sathyamangalam Taluk of Erode district. Sathyamangalam Wildlife Sanctuary (SWS) is a protected area in South India, declared in 2008, and enlarged in 2011, which covers forest area of 1,411.6 km^2 (545.0 sq mi).

IV. 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. 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. 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* 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. 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

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

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

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

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.

V. 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 Figure 2) is the Filtered image from the original image. From the Filtered image the high density green area alone is segmented in the Figure 3).

Figure 1. Western part of Tamilnadu

Figure 2. Filtered Image

Figure 3. Segmented high density green area

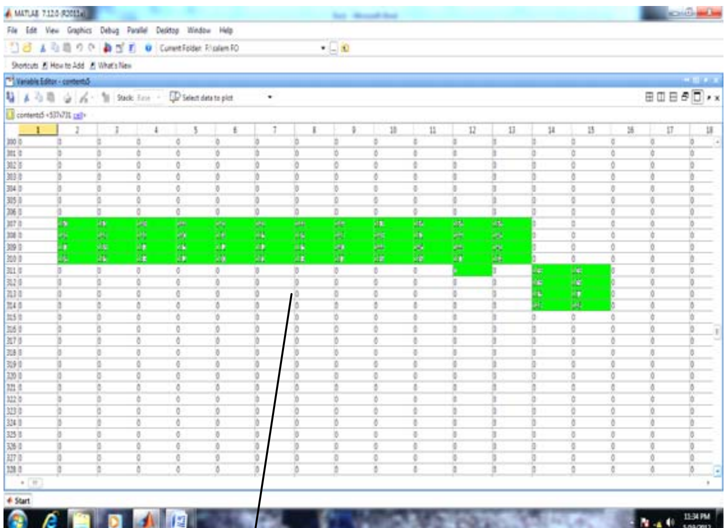


Figure 4. La*b* color image of figure 3

High density Forest area Figure 5. Pixel values for Figure 4

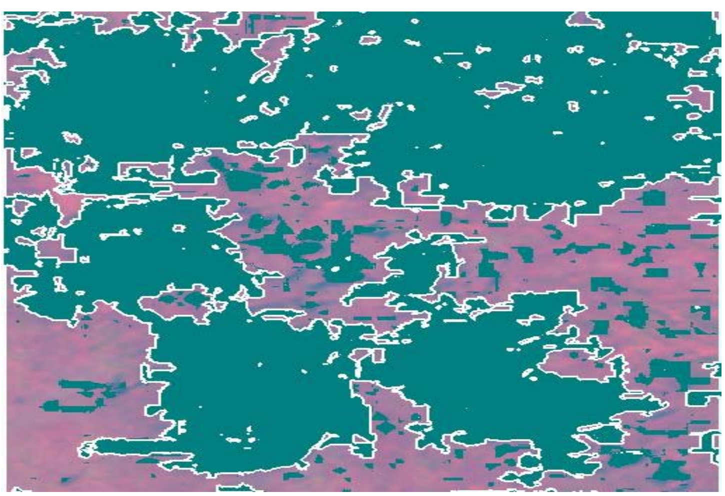
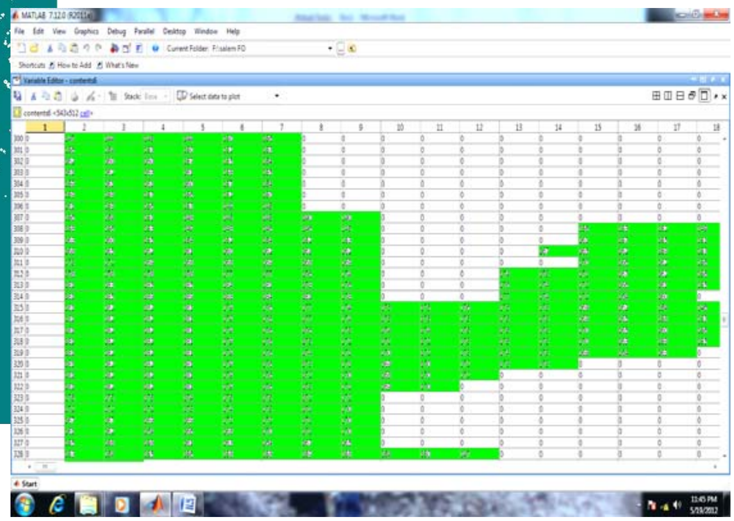


Figure 6. Segmentation of dry area from figure1



Dry Area Figure 7. Pixel values of Figure 6

In the Figure 4) the La*b color is applied for the segmented green area. The pixel value for the segmented green area is mapped in the Figure 5.In the figure 6) the dry area are segmented from Figure 1.the pixel values for the Figure 6) is mapped in the Figure 7.In the Figure 5) the high density green values are started from (307,2)i.e. the highlighted area in the Figure 5.but in the Figure 7) the dry area values are started from(300,2)i.e. the highlighted area in the Figure 7.

VI. CONCLUSION

In this paper, the evaluation of the dry forest region using watershed algorithm is proposed. The identification of the dry forest area is analyzed by comparing the two figures (i.e. Figure 5 & Figure 7) and analyzes the result with the accuracy of 90% using the satellite image. With the above result we can take necessary steps to identify the dry forest area and develop them. 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 with the 3year decade data's.

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