Analysis of Wild Fire Behaviour in Wild conservation Area using Image Data mining

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Abstract— **Forest fire is a major environmental issue creating ecological damage. Fire detection is a key element for controlling such incident. As per the forest survey of India 19.27% or 63.3 million hectare of the Indian land has been classified as forest area, of which 38 million ha alone are hoarded with resources in great quantity (top density above 40%).There are many fire detection algorithms available, each one of it has its own approach of predicting fire. The proposed work processes the satellite images based on its intensity levels to find out the fire affected region (hot spots). In order to detect hot spots agglomerative hierarchical clustering algorithm is used and the direction of the fire spread regions are plotted based on the clusters obtained by the algorithm for the given input image. The implementation is based on RGB values of pixels of an image. The algorithm's efficiency is relatively high when it is applied on forest fire images.**

Keywords— Forest fire, Agglomerative Hierarchical clustering, satellite image, Dendogram

I. INTRODUCTION

Image data mining is the process of searching and discovering valuable information and knowledge in large volumes of data. The fire prediction algorithm uses the satellite image to predict spreading of fire in a forest. The extracted feature of the image will identify the fire. Due to the development of digital camera technology and advanced content based image, there is a major trend to replace conventional fire detection system with computer vision based system. [1]

One and possibly the most important method for protecting forests from wildfires is to identify them in their early hours. The initial possible detection enables a rapid response to minimize the spread. Therefore, early detection, containment at the early stages and extinguishment of a fire before it spreads are crucial for wildfire management [3][4].

The impact of forest fire damage involves not only the amount of timber burnt but also environmental damage to forested landscapes. In this regard, constant research has been conducted in the area of fire surveillance but most of the works are based on real time implementation of fire detection algorithms, analysis of satellite images and so on.

978-1-4799-6085-9/15/$31.00©2015 IEEE

This proposed method aims at detecting the forest fire and then predicts the direction of fire by using the agglomerative hierarchical clustering algorithm.

II. LITERATURE SURVEY

Many different forest fire detection and fire management system have been developed and successfully applied. The forest fire assessment helps in identifying degradation of forest using the Geographical Information System (GIS), satellite remote sensing frame works by collecting the information about the forest fire. GIS software frame work is used for forest fire risk zone mapping using topography and vegetation related parameters. The analysis of these parameters of the risk zone from satellite images is done using Artificial Neural Networks [3] for training the data set. Based on this training many simulation models are used to predict smoke emission and estimating the risk zone. [4][5].

Satellite images provide almost real-time data for forecaster to predict natural hazards, atmospheric interfering such as clouds and smoke and fog grounds distortions in the images retrieved. Image analysis will help in generating predictive models for detection of forest fire in cost effective manner [6][7].

One group of researchers has studied forest fire prevention through an analysis of cause [6]. In addition, other studies have dealt with private management systems for particular forest areas.

Forest fire detection systems use image processing base systems. At this point, the first category (image processing based systems) is based on satellite images and another is based on fixed camera shoots. These camera images are used to locate the fire affected areas [7][8][9].

There are systems currently available with sensor networks in the market which can sense the occurrence of fire. These systems will either detect the fire by capturing the image or by sensing the smoke. These real time systems work efficiently and send necessary signals to the alarm system [12].

From survey it is clear that, there are some frame works available for detecting the fire and its effects on wild conservation area. To avoid the further loss caused by fire, it is required to study about the fire behaviour .The proposed framework does the analysis on fire and it's flow direction.

Satellite images are used for the analysis. The input image is converted to gray scale image for the fire recognition. If fire

is identified in the input image, pixel values are extracted to analyse fire movement with a dendogram.

III. HIERARCHICAL CLUSTERING FOR IMAGE DATA MINING

Hierarchical clustering is a model for analyzing the clusters, which requires to build a hierarchy for the clusters. There are two strategies for hierarchical clustering one is Agglomerative, this is a "bottom up" approach. The observation starts in its own cluster, and pairs of clusters are merged as one moves up the hierarchy. Second one is Divisive, this is a "top down" approach, all observations start in one cluster, and splits are performed recursively as one moves down the hierarchy. The merges and splits are determined in a greedy approach. The results of hierarchical clustering are usually represented using dendogram.

The proposed work does the Image analysis by extracting the pixel values of forest fire image. The extracted pixel values are stored in the file for segmentation. Once the segmentation process is done the cluster of the similar pixel value is calculated using Euclidean distance by identifying the reachable density of the pixel value.

Steps in Hierarchical clustering:

i. Consider two disjoint clustering having levels $L(0) = 0$ and sequence number n =0.
ii. Obtain most similar pair of clusters in the clusters, example (r), (s), according to $d[(r),(s)] = \min d[(i),(j)]$ where the minimum is over all pairs of clusters in the present cluster.
iii. Increase sequence number by 1i.,e $n = n + 1$. Merge clusters (r) and (s) into a single cluster to form the next clustering n. Set the level of this clustering to $L(n) = d[(r),(s)]$
iv. Update the proximity matrix, M, by deleting the rows and columns which corresponds to clusters (r) and (s) and adding a row and column corresponding to the newly formed cluster. The proximity between the new cluster, denoted (r,s) and old cluster (k) is defined as $d[(k), (r,s)] =$ **min** $d[(k),(r)], d[(k),(s)]$.
v. If all objects are in one cluster, stop. Otherwise repeat the step 2.

IV. DESIGN AND IMPLEMENTATION

The Image Mining Technique is used for predicting the spreading of fire in forest by analyzing a collection of pixel values. The first method is to predict the fire from the image; here the main concentration is towards the prediction of fire by comparing the fire RGB values from the image.

The proposed model uses the satellite image as input. The sample satellite image used for the experimental purpose is from the website www.futuretimeline.net with resolution of 750*563. The image is processed using the **Hierarchical clustering** algorithm.

Steps involved in the proposed method:

i. Enter input image
ii. Select the flame RGB's value dataset from the available sets
iii. Find out the fire from the input image
iv. Convert the image into binary image
v. Plot the Dendogram using the clustering algorithm
vi. Plot the scatter graph for obtained dendogram clusters

Analyze the direction of fire from the maximum sets of cluster's using the accuracy ratio.

In the proposed work, pixel level is domain independent statistical features (referred to as pixel statistics) are extracted to predict hot spots in wild conservation area.

The forest fire image is given as input, to extract RGB values. The RGB values are stored inside the file and the range of color is specified in order to obtain the matrix. The range of pixel values are specified for red color are between 200-255 and is considered as 1 ,for green 120 to 200 and it is considered with 2 and for blue 48 to 100,considered with 3. Once matrix is defined the distance is calculated using Euclidean distance by identifying the reachable density of the pixel value. The average link with minimum distance clusters are merged together in the dendogram.

The obtained distance to form single link steps are as follows:

i. The minimum distance between each pixel is calculated and stored in the variable .
ii. Average value distance is calculated in order to provide the single link .
iii. The obtained single link cluster shows the hotspot region in the image.

In order to predict the fire spread direction a scatter graph is drawn. The fire clusters with x-axis and y-axis of the image pixel values will help in identification of fire direction.

V. RESULTS

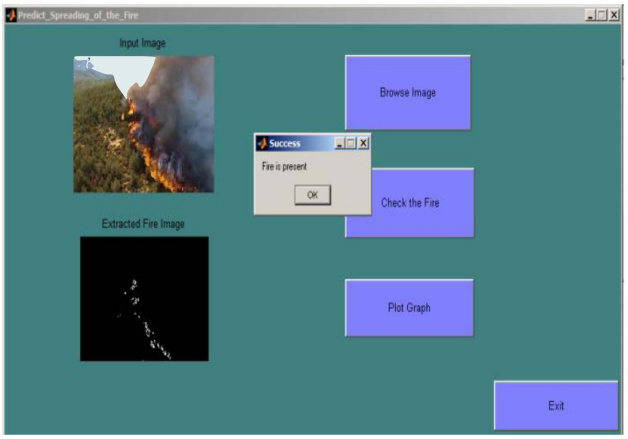

Fig- 1: Detection of Fire

Fig 1 depicts that if the fire is present in the selected image then a message is displayed stating “Fire is present”. The selected image will be used to extract the pixel values in order to predict fire present or not using the scatter graph. This graph helps in analyzing where the fire presents in the image. The pixel level, from the image processing technique (Thresholding technique) is used to extract the spatial hot spot.

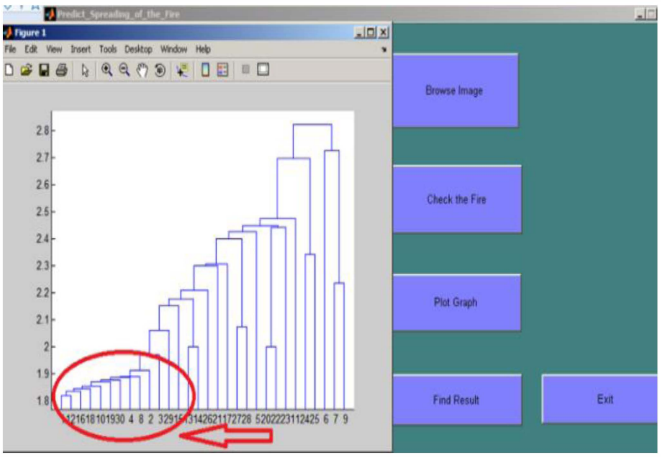

Fig- 2: Dendogram

Fig 2 Depicts the Dendogram based on pixel value clusters. Merging of Clusters is based on the similarity of values for the hot spot detection in the input image. Once the single link clusters are made, automatically fire affected area can be found. Area of fire is calculated by density of pixel clusters. In order to predict the fire propagation a scatter graph is used based on fire hotspots.

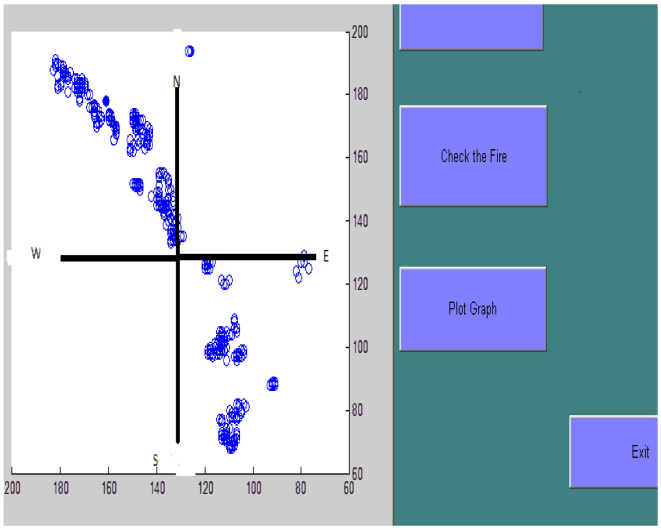

Fig- 3: Scatter Graph With directions

Fig-3 Shows the Scatter Graph of fire affected region. The fire clusters are displayed with scatter graph which is having direction of North(N), East(E),West(W),South(S).Based on hotspots obtained and wind direction, analysis can be made to predict the fire spreading direction.

VI. CONCLUSION

Forest fire causes severe damage to environment and wild lives. In the last two decades, significant efforts are made tobuild automatic detection model that could assist Fire Management Systems (FMS). The proposed model can be used to detect the fire flames and fire behavior from the image of forest fire and wind direction. It also aims at detecting the afforest flames using satellite image and then, predict the direction’s of spreading of fire. The proposed model is executed with the satellite image. In future it can be enhanced using thermal images for forest fire detection and control system development.

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