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Predicting the Forest Fire Using Image Processing

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Abstract: Predicting the forest fire is an important problem from many points of view. It destroys ecology and decreases the overall life quality. It is important from economical point of view as wood is a valuable resource. In this paper, we examine the problem of early fire detection using images of different parts of the forest areas. Our approach is based on image pre-processsing and segmentation of images are produced using the segmentation methods. A new approach is used to extract the features using histogram of gradient (HOG) by extract the features such as gradient, angle, magnitude and the support vector machine (SVM) are used to recognize patterns for classification is shown.
Keywords—Fire, Pre-processing, Segmentation, Histogram Of Gradient (HOG), Support Vector Machine(SVM).

I. INTRODUCTION

Forest fire is a important issue now a days. It destroys the valuable resources of the forest like woods, etc and they can create great environmental problems for Nature. When a wildfire burns out of control, the size of the losses can be almost immeasurable. More than that forest is one of the reason for rain.

The causes for the forest fire are weather temperature, wind direction, moisture level, humans carelessness like burning by grazers, shifting cultivation, fires to ward off wild animals or by visitors to forests by way of smoking etc.

The cost of such disaster leads to losses of millions of trees, in addition to losses of structures, animals and human life. Forest fires also leads to global warming, soil erosion, ozone layer depletion and the loss of livelihood of those dependent on forest products. The only way of protecting forest from wildfires is their early prediction.

A number of early forest fire detection methods have been proposed using various remote sensing systems based on infrared thermal camera imaging, airborne or ground-based Lidar , Satellite-based Synthetic Aperture Radar (SAR) imaging techniques, radio – acoustic based sounding system, and fire detection based. Currently many institutions are trying to develop reliable and efficient methods to forecast the fire disasters, which may induce heavy property loss as well as serious social impact. The traditional method to detect fire is employing some people as inspectors, but human resource is expensive and such approach has very low efficiency. Fire sensors have already been used as another method to detect the particles generated by smoke or fire, temperature, relative humidity, etc. But they must be placed in the proximity of fire or their detecting range is usually exceeded, and the approach fails to supply the additional information about the process of burning, such as fire location, size, growing rate, and so on. Fortunately, computer vision based fire detection brings us a new kind of method which can overcome the key deficiencies of the aforementioned methods.

II. LITERATURE SURVEY

A Fast Image Based Fire Flame Detection Method Using Color Analysis by Wen-Bing Horng1* and Jian-Wen Peng,2008
Discussion:

Fires usually cause serious disasters. Thus, fire detection has been an important issue to protect human life and property. In this paper, we propose a fast and practical real-time image-based fire flame detection method based on color analysis. We first build a fire flame color feature model based on the HSI color space by analyzing 70 training flame images. Then, based on the above fire flame color features model, regions with fire-like colors are roughly separated from each frame of the test videos. Besides segmenting fire flame regions, background objects with similar fire colors or caused by color shift resulted from the reflection of fire flames are also extracted from the image during the above color separation process. To remove these spurious fire-like regions, the image difference method and the invented color masking technique are applied. Finally, the fire flame burning degree is estimated so that users could be informed with a proper fire warning alarm.

"P. Morerio, L. Marcenaro, C. Regazzoni,and G. Gera, "Early fire and smoke detection based on colour features and motion analysis", IEEE International Conference on Image Processing, ICIP2012, September 30th, Orlando, FL, USA, 2012, pp 459-47"

Fire detection systems are among the most important components in surveillance systems used to monitor buildings and the environment. As part of an early warning mechanism, it is preferable that the system has the capacity to report the earliest stage

of a fire. Currently, almost all fire detection systems use built-in sensors that depend primarily on the reliability and the positional distribution of the sensors. It is essential that these sensors are distributed densely for a highprecision fire detection system. In a sensor-based fire detection system for an outdoor environment, coverage of large areas is impractical due to the necessity of a regular distribution of sensors in close proximity.

"D. G. Asatryan, G. S. Sazhumyan, and H. S. Shahverdyan, "Technique for coherent segmentation of image and applications", Transactions of IIAP of NAS RA, Mathematical Problems of Computer Science, vol. 28, pp. 88-93, 2007"

Due to the rapid developments in digital camera technology and developments in content based video processing, more and more vision based fire detection systems are introduced. Vision based systems generally make use of three characteristic features of fire: colour, motion and geometry. The colour information is used as a pre-processing step in the detection of possible fire or smoke.

"Chen, T., Wu, P., Chiou, Y.,"An early fire-detection method based on image processing", Proc. IEEE Internat . Conf. on Image Processing, ICIP'04, pp. 1707-1710, 2004"

Fire detection system sensors are used to detect occurrence of fire and to make decision based on it. However, most of the available sensors used such as smoke detector, flame detector, heat detector etc., take time to response [1]. It has to be carefully placed in various locations. Also, these sensors are not suitable for open spaces. Due to rapid developments in digital camera technology and video processing techniques, conventional fire detection methods are going to be replaced by computer vision based systems. Current vision based techniques mainly follow the color clues, motion in fire pixels and edge detection of flame. Fire detection scheme can be made more robust by identifying the gray cycle pixels nearby to the flame and measuring flame area dispersion.

"Töreyin, B.U., Dedeoglu, Y., Çetin, A.E.," CONTOUR BASED SMOKE DETECTION IN VIDEO USINGWAVELETS", European Signal Processing Conference, EUSIPCO-06, Sept. 2006"

In this paper, we present an automatic real-time smoke detection method in video. Conventional point smoke and fire detectors typically detect the presence of certain particles generated by smoke and fire by ionization or photometry. An important weakness of point detectors is that in large rooms, it may take a long time for smoke particles to reach a detector and they cannot be operated open spaces.

III. EXISTING METHOD

In the scientific literature there are a lot of methods and approaches for the fire and/or smoke determination which are based on image segmentation procedures. We refer to some surveys on this topic, but some articles contain ideas and procedures which are close to the present investigation, therefore we will briefly consider them. Method for the detection of fire and smoke proposed in is based on the usage of color spaces RGB and YCbCr. For the fire area pixel consistent pattern **Y>CRr>Cb** is discovered. For the smoke detection the feasibility of the system of these three inequalities |R-G|< Th. |R-B|< Th are checked, where is located between 15 and 25. However the application of this method in our investigation directly is impossible, when the brightness of the monitoring area is non homogeneous. *Th* In YUV color model for the representation of video data is used. They used time derivative of luminance component Y to declare the candidate fire pixels, then depending on chrominance components U and V classified the candidate pixels into fire and non-fire sections. They report that their algorithm detects less than one false alarm per week. However, this method makes a lot of computations and not good for on the fly decision making. This article proposes an approach, based on RGB image full segmentation and simplification. As mentioned above, areas of three types are analyzed: containing fire, containing smoke and areas without smoke and/or fire .

IV. PROPOSED METHOD

Forest fires represent a constant threat to ecological systems, infrastructure and human lives. Past has witnessed multiple instances of forest and wild land fires. Traditional fire protection methods use mechanical devices or humans to monitor the surroundings. The most frequently used fire detection techniques are usually based on particle sampling, temperature sampling, and air transparency testing. An alarm is not raised unless the particles reach the sensors and activate them. So we are going to capture the images through satellite and will give the captured image as a input to the software, this system will give the output as whether the fire is present or not. If fire is present then it will display the status of the fire like mild stage, severe stage or no fire stage.

Initially the process which is going to takes place is preprocessing .In pre-processing, there are three steps, such as grayscale conversion, resize the image to fixed size, and filter the image. Grayscale conversion is used to reduce the brightness effect and it also reduce the memory requirement. Then the image is converted into fixed size to simplify the calculations and filtering an image process will takes place to remove the noise in the image.

Figure 4.4: JPEG Image

Figure 4.5: Grayscale Image

After completion of pre-processing the segmentation process will takes place. In edge segmentation we are using cannel method to find out the edges accurately. Then our system uses Threshold method to separate the background and foreground image. After separation of background and foreground the software used HOG algorithm to extract the features like gradient, magnitude and angle. These features are useful to find out the fire and non fire images. Our system uses SVM classifier to classify the images.

V. NUMBER OF MODULES

A. Pre-Processing

An image commonly involves removing low frequency background noise, normalizing the intensity of the individual particles images, removing reflections, and masking portions of images. In our approach we have converted RGB color image into grayscale image to reduce the size of the memory requirement and then we have resize the image so that the complexity of pixel calculation will be reduced. Then we have filtered the images to reduce the noise.

B. Segmentation

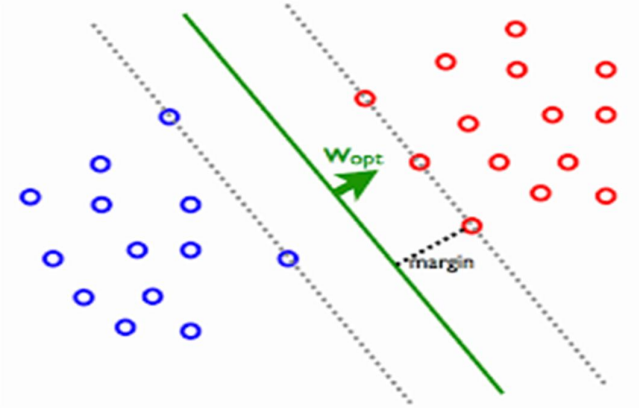
In computer vision, image segmentation is the process of partitioning a digital image into multiple segments Segmentation is the process of dividing an image into multiple parts. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. This is typically used to identify objects or other relevant information in digital images. There are many different ways to perform image segmentation, including: edge segmentation, thresholding methods. Thresholding is used to separate the background and foreground by using local threshold and global threshold.

C. Histogram Of Gradient (HOG)

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. The Histogram of Oriented Gradients (HOG) is a feature descriptor used in computer vision and image processing for the purpose of object detection. The technique counts occurrences of gradient orientation in localized portions of an image. This method is similar to that of edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy.

D. Support Vector Machine (SVM)

SVM are supervised learning models with associated learning algorithms that analyze dataUsed for classification and regression analysis. Given a set of training examples, each marked for belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.



The SVM is a machine learning algorithm, we will train the SVM with the set of images. SVM is a pattern reorganization classifier and it classifies the images based on features of an image. The hyper plane zone is nothing but a decision zone where it decides the test image falling under which category. The features which are extracted from the HOG place in hyper plane, then it will decide the image category.

VI. RESULTS AND TABULATION

The result produced by our approach shows better approxiamation than the existing system. In this the image given is converted into gray scale , resized and the noise is reduced and then the edges of the image is found with there threshold Value and features by HOG which is then used to categories the image into mild, severe and no fire using support vector machine is done.

S.NO	CLASSES	FIRE CATEGORIES
1.	1	Mild
2.	2	Severe
3.	3	No fire

VII. CONCLUSION

We propose a method for the detection of fire through the usage of photographed data of forest area followed by computer processing of the data. A method for reading information, pre-processing of an image color components, the segmentation and data classification using SVM is proposed. The method is working very fast and can be used for online calculations and decision making. The efficiency of the proposed procedures is shown: 95 % detection ration and 5 % false detection is shown. The proposed method can be used in the monitoring systems of the area to detect fire.

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