Forest Fire Detection Using Image Processing

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***Abstract*—This project aims to automatically detect forest fires around the world by using infrared(IR) images sourced from satellites and other sources using different Image Processing Techniques.**

***Index Terms*—Image Processing, Fire Detection, Forest Fires, Thresholding.**

I. Introduction

A forest fire is a phenomenon which can be defined as an uncontrolled fire in an area of combustible vegetation. They can result in a great number of environmental disasters, causing vast economical and ecological losses. In order to prevent this, forest fire monitoring and detection have become a significant solution, which attract an increasing interest around the world.

Conventional forest fire detection techniques make use of watchtowers and human observers to search and observe fires. It consumes tremendous labour, threatens observers' safety and costs a great deal of time. Owing to the development of modern technologies, more advanced forest fire detection approaches include integrating remote sensing techniques with various platforms (such as satellites, ground-based equipments, and aircrafts), which are designed to overcome drawbacks of traditional methods.In our project, we propose a method to detect fires from a picture taken by UAVs, drones, etc. by using image thresholding.Thresholding is a method used to partition images on the basis of some input parameters.

II. Literature Survey

In this project, multiple papers were referred to formulate our algorithm. Chief among those is [1], a paper which deals with fire detection using IR images for UAV-based devices. In this paper, an algorithm which makes use of brightness and motion clues along with histogram-based segmentation and optical flow approach for fire pixels detection is used for detecting fire in IR video sequences.In paper [2], a method for the detection and localization of flames with the use of infrared images, was proposed. In paper [3], an algorithm to detect different types of burning objects, by analyzing their burning temperature, is proposed.

III. Problem Statement

Forest Fire Detection of Infrared Images using Image Processing solved using Thresholding.

A. Objectives

- To detect forest fires with reasonable accuracy.
- To detect the approximate area of fire.
- To detect the heat emitted from the fire.

IV. Methodology

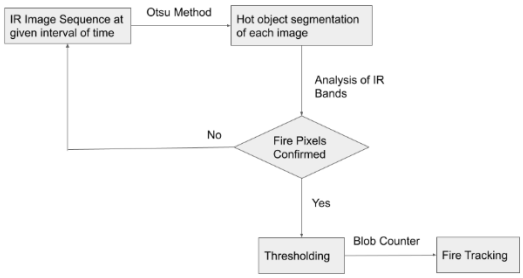

Fig. 1. Flow Diagram

As shown above, the input is an infrared image which may or may not have fire pixels in it. We then perform the hot object segmentation, which divides the image parts on the basis of heat emitted, on the input image. Upon analysis of the identified IR bands, we can detect the fire pixels, if it exists. If no fire pixels are found, the next input image is called for and the process starts again. Else, binary thresholding is performed on the fire pixels to identify those fires whose heat is above a particular heat and area value to remove human settlements,etc. from consideration. Finally, a blob counter is used and an output image is returned with the identified fire spots.

V. Results and Design Analysis

A. Input of Dataset

All the images to be processed for fire detection are stored in a folder named "images". These images are iterated through and imported to the program and are processed simultaneously.

B. Contour/Edge Detection

- Edge detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges.
- The result of applying an edge detector to an image may lead to a set of connected curves that indicate the boundaries of objects.
- The four stages of edge detection are:- 1) Smoothing: suppress as much noise as possible, without destroying the true edges. 2) Enhancement: apply a filter to enhance the quality of the edges in the image (sharpening). 3) Detection: determine which edge pixels should be discarded as noise and which should be retained (usually, thresholding provides the criterion used for detection). 4) Localization: determine the exact location of an edge (sub-pixel resolution might be required for some applications, that is, estimate the location of an edge to better than the spacing between pixels). Edge thinning and linking are usually required in this step.

C. Pixel Intensity detection

The pixels are converted into grayscale values by taking average of all the three RGB values and the intensity is compared.

D. Detection of Fire

To reveal the brightest regions in the blurred image we need to apply thresholding: This operation takes any pixel value p greater than equal to 200 and sets it to 255 (white). Pixel values lesser than 200 are set to 0 (black).

We perform connected component analysis on the resulting image to identify blobs of bright regions and label them with a number. All these blobs are iterated through and any blob with less number of pixels are discarded.

These blobs are highlighted with a red circle and overlapped on the original image.

TIMELINE

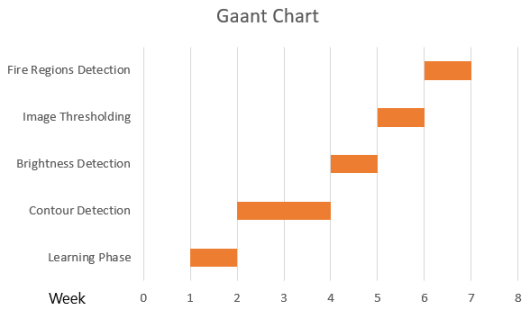

Fig. 2. Gantt Chart

CONCLUSION

The program is successfully able to detect the forest fire. An image of a forest is taken as input and the output image will highlight the areas of fire according to the heat intensity. The required fire regions will be encircled and each region will be mapped to its count.

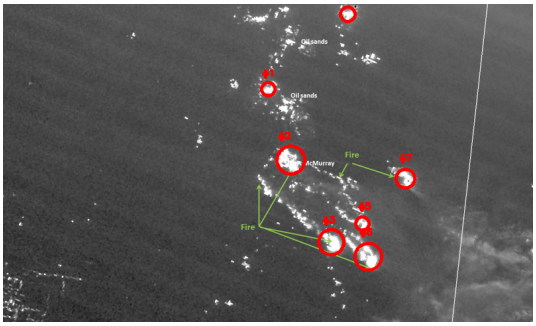

Fig. 3. Sample Grey Scale Output Image

Fig. 4. Sample Coloured Output Image

The program also works for regular coloured images in addition to grey scale Infrared Images.
The program was tested on a set of over 100 different sized images and by analysis, the overall efficiency is coming out be around 88% - 90% .

REFERENCES

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