Literature Survey

Emerging Methods For Early Detection Of Forest Fires

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Abstract: In the turn of this century forest fires have become a frequent and most dangerous natural disaster as a result of climate change. We have witnessed the countless acres of forest and hundreds of wildlife were destroyed as a result of forest fire, The 2020 Australian forest fire which resulted over 338,000 km^2 area were burnt. The fire also killed countless wildlife in that habitat. So using forest surveillance video cameras and still cameras can be used to monitor the forest areas and they can be alert the forest department if there is any symptoms of forest fire or any other suspicious activities. This method can be used to prevent forest fires.

Keywords: Forest fire detection; fire detection; computer vision; back propagation algorithm; artificial intelligence; convoluted neural network; video processing; image processing; image segmentation; YOLOv5.

I. INTRODUCTION

Forest fires are the one of the random natural disaster that is too hard to identify even with the existing state of the art technology. According to the prognoses, forest fire, including fire clearing in tropical rain forests, will halve the world forest stand by the year 2030[1]. The fact that more than 20% of complete world CO_2 emissions comes from forest fires indicates that it is a phenomenon which has to be dealt with great attention. Also due to the global warming the rate of occurrence of forest fire has increased.

It has the characteristics of suddenness and randomness which cannot be monitored by patrol officers or small scale sized sensor network system.

Some of the earlier methods used to detect forest fire are:

A. Fire Lookout Tower

They are usually small building usually located at the top of the mountain or summit that provides a protection for person who is in charge of detecting wild fires in his/her proximity.

B. Satellite Monitoring

These are usually done by UAV (Unmanned Aerial Vehicles) and Earth Observing Satellites which usually covers large area while the resolution of the satellite imagery is low. It also ineffective as real-time detection is quiet impossible in satellite monitoring because of the sheer volume of the area it covers, while these satellite system are expensive. The satellite sensing can also be extremely misleading if there is clouds in the satellite's view. While these are extremely helpful in damage assessment [2].

C. Use of IOT systems

These are wireless node networks which use temperature sensors to measure the temperature of the particular area. These can

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be easily manipulated by the area it placed or simply when it is a sunny-hot day and they can give false alert. The smoke sensors also played a huge role in the detection of forest fires and they also work similarly to the temperature sensors.

D. Use of Infrared Cameras

The infrared cameras usually captures the temperature distribution in the area and detects the hot spots. The thermal imaging cameras (IR Cameras) are calibrated in such a way that in real-time they could sense the temperature information in each pixel, automatically detecting any outbreak of fire.

II. VIDEO & IMAGE PROCESSING

Compared to these conventional methods discussed above the digital image processing technique, pattern-recognition technology and reinforcement learning can greatly improve the sensing of forest fire and they are much more effective as they improve forecast and reaction time is much less compared to other techniques [3].

In early days this image processing technique has seemed impossible because of the expensive camera modules but today, we have got inexpensive CMOS sensors and even the state-of-the art cameras have become cheaper.

The various parameters involved in the flame detection in the process are:

A. Color identification: based on flame's colors. From center of the frame to side of the frame, colors change from white to red.
B. Form: flames have the peaks.
C. Circular degree: Degree of characterization of circular shape of the complexity of the objects[4]

III. IMAGE PROCESSING

There are various parameters involved in the flame detection and various image processing technique are involved in the process:

A. Image Segmentation:

Image segmentation algorithm helps to break down or make the image into small subgroups. In a 24fps video there are 24 still images per second. Threshold are important parameters for image segmentation, which can be selected through the process of successive iteration [5].

B. Median Filter:

Median filter is a nonlinear noise removal treatment methods can remove noise at the same time retain a good image of the details of information. The principle of median filtering are put digital images in sequence or point value, with the point o-domain points in the value of value instead

C. Flame Recognition:

The purpose to partition an image is divided into some small regions. The most direct way to resolve this problem is to put an image into the region to meet a certain criterion.
There is a way to partition the region known as region growing or region generating. The flame can be recognized by changing the actual image into a greyscale image with the help of filters we are able to identify the flame in the picture.

IV. COMPUTER VISION

Computer Vision Algorithm are a mathematical model for digital image processing. It gives computer a vision to see, in which the computer can interpret what is happening and can obtain knowledge from images instead of data [6]. Open source software like OpenCV helps to implement Computer Vision in models which were created in Tensorflow much easily.

V. CONVOLUTED NEURAL NETWORKS

The rise of the Artificial Neural Network (ANN). These are biologically inspired computational models are able to far exceed the performance of previous forms of artificial intelligence in common machine learning tasks [7]. CNN is a type of artificial neural network that requires a convolutional layer but can have other types of layers, such as nonlinear, pooling, and fully connected layers, to create a deep convolutional neural network. Depending on the application, CNN can be beneficial. However, it brings additional parameters for training. In the CNN, convolutional filters are trained using the back-propagation algorithm [8].

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