



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 4, April 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

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Image Processing Based Early Forest Fire Detection Based Deep Learning

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ABSTRACT: Forest fire detection using the image processing technique is proposed. Forest fire major threat around the world, causing many negative impacts on human beings and forest ecosystem. Even though rapid climate changes arising from high environmental pollution. Forest fire detection using the images processing technique use find out. A rule based color model for fire pixel classification is used. Algorithm uses RGB and ycbcr color space. The advantage of ycbcr color space is that it can separate luminance from chrominance more effectively compare to RGB color space. Luminance in images is actually a light intensity or the amount of light ranges from black to white. The method is tested on a select images Which captured by the camera that contains fire. Deep Learning framework called fire net, that is trained on landsat imagery for the more effective representation.

KEYWORDS – Forest fire detection, Image processing, Image segmentation, deep learning

I. INTRODUCTION

Forest fires are unexpected fires that happen in nature and cause heavy damage to human resources and balance of nature. Forest fires destroy forests, wipe out accommodation, and can lead to high rates of human death near populous regions. Human carelessness, lightning and full exposure to extreme heat are main causes of forest fires. Fires are known to be part of the forest ecosystem in some cases and are important for the life cycle of forest habitats. Forest fire is causing considerable damage to the forest, which can affect economic loss. Nowadays, all related sensors are used by the fire detection system. The sensor's quality, precision, and position distribution determine the system's performance. In the case of outdoor applications, abundance of sensors is required for high accuracy of fire detection systems. Every sensor also requires a large battery capacity in a large open space to keep it operating. If and only if it is close to fire, sensors detect fire, but this will damage the sensor instead.

II. OBJECTIVE

This project helps with the Classification of Forest fire detection. This project is based on two methods. There are Image processing and Deep learning.

III. LITERATURE SURVEY

A CNN-based fire detection system appropriate for power-constrained devices was proposed by Vinicius et al. (de 2020). To decrease the computational cost of a deep detection network while attempting to maintain its original performance, this method involves training the network and then eliminating its less crucial convolutional filters. Dampage (2022) presented a system and technique for using a wireless sensor network to identify forest fires in their



earliest stages. In addition, for more precise fire detection, a machine learning regression model is proposed. In their work, Dogan et. al.(2022) suggested deep learning models using ResNet and InceptionNet to detect fire from images. These models have been used for extracting the features and these features have been classified using SVM. The authors demonstrated that ResNet gave better performance.

IV. METHODOLOGY

The hardware which is the Raspberry Pi Zero W (Wireless). The Pi connects with the compatible camera which is Raspberry Pi Camera Module V2. The camera will capture the image based on the angle facing it and the camera comes with an 8-megapixel lens. The image will be saved in the microSD on the board and can access it in the SD card, either to transfer or remove the images. For the software, divided by two which are RGB image and Wavelet Analyzer. The raw image will be enhanced to RGB color model and then into Y chrominance and luminance. The fire region is segmented by using RGB and YCbCr color model method and the Rule (I) and (II) are implemented in this process. Rule (I) and (II), apply for segmentation of the fire region which involves the intensity of RGB and YCbCr color model. Next, the Rule (III) and (IV) are also implemented to fulfill the requirement of fire detection. Rule (III) and (IV), used for segmentation of fire center which involves mathematical concepts such as mean and standard deviation to calculate segmented regions of the YCbCr color model. The fire detection process will decide whether fire is detected or not. If not, it will go back to insert the raw image. Next, the usage of Wavelet

Analyzer. By using Wavelet Packet 2-D for the image processing, the image will analyze and compress the image and give out statistics for graphs and histogram. The system operates with a connection board as . To build this system, the connection board simulation is needed. It is designed with Fritzing software to show the connection between Pi and camera, a Pi Camera Module V2 and Raspberry Pi Zero W and are needed. The camera connected with flexible flat cable (FFC) to the camera port in the Pi and the Raspberry Pi NoIR CameraBoard V2. This camera is a high-quality, custom designed 8-megapixel Sony IMX219 image sensor for Raspberry Pi with a fixed focus lens. Because of its infrared illumination, it can also capture in a panel and uses the specially designed CSI interface for camera interfacing.

V. FUTURE SCOPE

Early detection and prediction will lower the count of forest fires in the entire world and save our planet Earth. In the future, we can develop this model to minimize the energy consumption of all sensors and complete networks considering the node distribution among clusters using distributed sensing.

VI. CONCLUSION

In this research work a rule based color model for forest fire pixel classification is proposed. The proposed color model makes use of RGB color space and YCbCr color space. From this a set of seven rules were defined for the pixels to be classified as fire pixels. The performance of the proposed algorithm is tested on two sets of images; one containing fire and the other with no- fire images. The proposed model achieves 99% flame detection rate and 14% false alarm rate. The arithmetic operations of this model are linear with the image size. Also, the algorithm is cheap in computational complexity. This makes it suitable to use in real time forest fire monitoring systems

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Impact Factor: 8.423



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