EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRES

LITERATURE SURVEY

[1]

In fire detection, the color of the image from a camera is highly important. Sometimes, it does not possible to watch the entire forest images according to the size as it may be some difficulties in detecting the fire.So that, using Convolutional Neural Network(CNN) technology would be easier to avoid the blindness and accurate level of fire identification. It uses the support vector mechanism for the image classification.In this technique, the image is segmented based on the color of the flame and transferred to the CNN network. This would be found out more attributes and decide there is a fire occurs or not. Fire can be detected by analyzing the color of the flame in a picture. Finding the fire by using the number of pixels plotted in a picture according to the fire color and can be measure the intensity of the fire. So that, it should be easier to detect fire and stamp out the fire. The system should be trained and tested using a large amount of data. Algorithms are used for the segmentation of images and in finding the fire. This method should be more effective and reliable in identifying the fire. The accuracy should be much better than the other methods.(Yuanbin Wang, 2019)

[2]

In this paper, Environment can be destroyed by the forest fire, and it could be making a huge amount of loss. Recently, the amazon forest has had a fire and it remained for over 15 days. This resulted a huge loss and it affected negatively to the diversity and global conditions. The wireless sensor networks help in detecting the forest fire.Itcan give a warning as soon as if there any unusual event occurs. Sometimes, these networks can be making false alarms according to the wrong detection. In such cases, machine learning mechanism can be used to prevent such cases. Earlier, satellite-based systems are used to detecting fire. But it may not be possible to finding the distraction as it took pictures of surface of the earth in every two days. As a result, it may not be considered as an effective method. Also, the

weather conditions may be affected in the quality of the pictures. Another method for the fire detection was using watch towers. It was handled manually by watching the whole forest area in a tower and finding if there any fire occurs. Another one is using optical sensors and digital camera. It would not be much effective as the vision can be distracted by the high trees or hills.

[3]

In this paper, a novel method for fire detection is proposed based on ensemble learning. The dataset is created using 10581 images from various public sources like BowFire , FD-Dataset , ForestryImages , VisFire . The dataset is preprocessed and fed into not just one but two individual object detectors, YOLOv5 and EfficientDet integrated in parallel mode to achieve better accuracy than a single object detector. Although it uses integrated object detectors, this does not take the whole image into consideration. Therefore, another classifier is introduced to solve this problem. EfficientNet takes the image as whole and evaluates the image to enable total advantage of the information. The results will be decided by a decision strategy algorithm which takes the opinion of the three individual object detectors into account which in turn improves the performance of the model and decrease the rate of False positives. This paper claims that they have achieved a superior trade-off average accuracy, average recall, false positive and latency.

[4]

This paper proposes that forest fires can be detected by vision-based fire detection systems which can be mounted to an unmanned aerial vehicle (UAVs) for strategically scanning acreage of fire prone areas. This paper also strongly recommends Convolutional neural networks for identifying smoke and fire through videoframes which is taken as images. They have collected the dataset from different internet sources. They have resized the images to canonical size of 240x320. In this paper, the basic idea is to find the fire patches in an image. The authors propose two methods for the algorithm to build the model. First was to apply fire patch classifier from scratch. Second was to teach a full image classifier and apply fine-tuned patch classifier if the image contains fire. Then they compare SVM-pool5 (Support vector machines) with CNN-pool5, the accuracies recorded

are 95.6% and 97.3% respectively with a detection rate of 84.8%, making CNN-pool5 network more accurate than SVM-pool5 classifier.

[5]

In this paper, the author uses CNN-convolutional neural networks to detect fire with the help of live video footage through anti-fire surveillance systems. The paper proposes YOLOv2 convolutional neural network is one of the best solutions for detecting fire and smoke both indoor and outdoor environment. You only look once (YOLO) is a deep learning model for object detection, YOLOv2 is the next version which has been upgraded to rectify the setbacks of YOLO namely the inaccuracy to locate and mark the region of interest in the images and the lower recall rate compared to other region-oriented algorithms. Thus, increasing the efficiency of the architecture. They started with an input image of size 128x128x3. They used convolutional layers to map the features on the input image. The features extracted are then given as input to YOLOv2 object detection subnetwork. YOLOv2 Transform layer is implemented to improve network stability for object localization.

[6]

This research paper, the authors propose a cost-effective fire detection using CNN from surveillance videos. This papers critically analyses the statistics of deaths due to fire. So, their focus is to propose a system that is home friendly and commercial. This paper gives us an insight of how to carefully select the data properly, how to analyse the computational complexity and detection accuracy. They use a model called GoogleNet for extracting the features from the images. For reducing the complexity of larger patches, they reduce dimensionality. The model is tested with two different datasets for validation purposes and results are compared. They achieved an accuracy of 93.5% on the first dataset and an 86% on the next dataset.

[7]

Deep learning and wireless sensor network can be helpful in forest fire detection. The research put forward a system using these approaches can detect the forest fire in the early stages. Using the deep learning model, the system detects the fire according to the collection of data from different sensor networks placed widely in the forest. Here, the system consists of the Internet of Things used as a main concept, moving or fixed sensors and a suitable deep learning model. More accurately, there are several sensor nodes places within each 1 km distance and these nodes are transfer data to the internet servers through the gateways. Then this collected information is displayed in a dashboard with online network. Each nodemeasures the values of humidity, carbon monoxide, temperature, carbon dioxide, and atmospheric pressure. These factors have a major role in the forest fire. In this method, firstly, it calculates the weather information from the weather detector located in forest and then find out the Fire weather index (FWI) using the sensor nodes with the help of deep learning algorithms and the metrics. If the FWI have value changes, the Unmanned Aerial Vehicle (UAV) helps to detect these sensor values more accurately to find the existence of fire. Also, the control tower act as a fire distinguisher to distinguish the fire (Wiame Benzekri1, 2020).

[8]

Fire can be detected by using the amount of smoke. The smoke sensors are used to measure the amount of smoke from the fire, and it could be compared with a threshold value and if it is beyond that value, it is considered as a fire scenario.Using image processing, fire can be detected as soon as possible. Fixing the CCTV camera everywhere and the images from these cameras can be processed to monitor the fire. If any changes occur, it is easy to detect and extinguish the fire quickly. This system has a water extinguisher for extinguish the fire when the alarm turns on. The CCTV camera is used for recording the video of a particular spot and it is connected to a mini- computer called Raspberry-pi. So that it could get the constant video recording of a particular area. The captured video pictures are processed frame by frame and once the fire detected, the alarm would be turn on. Also, the alarm would be turned off when the fire extinguished completely.The Virtual Network Computing is used for the execution of the program, where the details of video are transferred from the raspberry-pi to the

viewing computer.This system includes detection, alert, fire extinguish, software and network modules.

[9]

A research study proposes a system which is a combination of using neural networks, computer vision rules, and other expert rules helps in detecting the forest fire. Different approaches are applied to build this system; visual infrared image matching, using the previous hazards memory, image processing, location, size, and geographical data. Here, infrared cameras, visual cameras, meteorological sensors are using for the collection of input data. The image processing tool is combined with the visual and infrared processing. Infrared processing is a combination of detection, oscillation, and alarm processing processes. The growing-region algorithm is used to separate the false alarms. The visual processing finds out the exact location of the visual image from the infrared analysing process. By using different algorithms, it can be detected and easily reject the false alarms. The meteorological information used to detect the humidity, temperature and other factors which affect the forest fire. So that, it is easy to estimate the possibility of fire. Using this proposed system, it can be detecting the forest fire in early stage and avoid the false detection (Begoña C. Arrue, 2000).

[10]

This paper put forward an approach in real-time forest fire detection using wireless sensor network paradigm. This method can detect and forecast the fire more accurately than the other methods used in forest fire detection. Firstly, the sensor networks acquire the details about the humidity, smoke, temperature, and wind speed as these factors affect the forest fire. The sensor nodes are placed widely in the forest, and it is arranged into clusters. The sensor nodes use GPS to track their location as they can sends these location details along with the data such as measurements of temperature to the cluster head. Then, using a neural network method, the cluster header computes the weather index and then these information sends to the manager node. The wind speed is calculated by the wind sensor nodes, which are manually placed in the forest. The users get information from the manager node when an abnormal event occurs like high temperature and smoke.

As well as manager node gives information about the levels of forest fire risk rate according to the weather index from different clusters. So that, users can easily find out the exact location of fire in the forest if it occurs. Also, they could protect the forest from the fire hazard due to the early detection (Liyang Yu, 2005).