

Emerging Methods for Early Detection of Forest Fires

Problem Statement

Forest fires lead to destruction of forest wealth and not only that it also destroys the flora and fauna which causes harm to biodiversity. Forest is great resources and to preserve them is a major challenge. As, they are irreparable damage to the ecosystem, so forest fire and prevention is utmost important and best way to tackle this problem. But the forest fire early detection and prevention is another major challenge faced all over the world.

Several methods for controlling and monitoring of fires have been proposed. In earlier days, manned observation towers were used but this technique was inefficient and failed. After that satellite and camera imaging technologies were tried but this also proved inefficient and ineffective. For example, cameras were installed at different sites in forest but these provide only line of sight pictures. For a very large areas alert system is required as it is really tedious task to monitor all the images.

Existing System:

The existing system for detecting fire are smoke alarms and heat alarms. The main disadvantage of the smoke sensor alarm and heat sensor alarms are that just one module is not enough to monitor all the potential fire prone places. The only way to prevent a fire is to be cautious all the time. Even if they are installed in every nook and corner, it just is not sufficient for an efficient output consistently. As the number of smoke sensor requirement increase the cost will also increase to its multiple. The proposed system can produce consistent and highly accurate alerts within seconds of accident of the fire. It reduces cost because only one software is enough to power the entire network of surveillance. Research is active on this field by data scientists and machine learning researchers. The real challenge is to minimize the error in detection of fire and sending alerts at the right time.

Literature Survey

[1]. 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.

[2] This paper the authors propose a system that mimics the human fire detection system. It uses Faster R-CNN which is a region-based algorithm to detect suspicious Point of interest. After marking the region of interest, the features extracted from the bounding boxes are passed to LSTM Long Short-Term Memory to classify if there is fire or not in short interval of time. Faster R-CNN exploits the features of CNN and introduce a region proposal network which is used to map the features in the input image. It extracts features through the ROI pooling operation and then classifies according to the class scores of the object position.

[3] 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.

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