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Video Fire Detection based on Attention Mechanism

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ABSTRACT

When compared to traditional fire identification systems that rely on sensors, vision-based fire detection systems have recently gained favor. The demand for video perception in private, modern, business areas, and wooded areas has increased the adoption of vision-based fire detection systems. Recently, a number of fire-related incidents have happened as a result of insufficient surveillance or the inability to cover certain risky locations, such as limited areas in forests or industry buildings. To avoid such mishaps, the system proposes a novel way based on convolutional neural networks (CNN).To solve these problems, a more advanced fire detection scheme proposing the use of CNN technology. instead of feature description has attracted more and more attention. In this article, we propose an efficient neural network architecture for forest fire detection and recognition based on CNN.

Keywords: Deep Learning, CNN, Attention Mechanism, Fire Detection

I. INTRODUCTION

In the 350-image training dataset, identify how many photos have fire and how many do not. The Back-propagation technique was used to train the Convolution Neural Network (CNN). 220 random photos will be used to train the CNN model, and 100 further images will be utilized to evaluate the model. the trained CNN model to extract the fire from the testing image/video after we've verified its correctness. The labels to display the fire detection result. Researchers have presented both classical and learnt representation-based fire detection approaches for detecting fire. According to the literature, traditional fire detection systems use either colour or motion properties. Color features, for example, were used for fire detection by experimenting with a variety of colour models, including HSI, Ycbcr, YCbCr, RGB, and YUC. The high percentage of false alarms associated with these approaches is a key drawback. There have been several attempts to solve this challenge, including merging colour information with motion and analyzing the shape and other characteristics of fire. A comprehensive literature review is usually beneficial. The system believes that an effective CNN-based system for fire detection in films taken in uncertain surveillance circumstances should be suggested. This method

employs light-weight deep neural networks with no dense fully connected layers, resulting in a low computational cost. Experiments are carried out using benchmark fire datasets, and the findings show that our technique outperforms the state-of-the-art. We feel that our system is a good choice for fire detection in an unpredictable IoT environment for mobile and embedded vision applications during surveillance because of its accuracy, false alarms, size, and operating time. By allowing intelligence via mobile edge computing and data transfer across a 5G network, the tactile Internet may combine several technologies. Several convolutional neural networks (CNN)-based algorithms based on edge intelligence have recently been used for fire detection in a specific environment with respectable accuracy and run time. These systems, however, fail to detect fire in an unpredictable IoT environment with smoke, fog, and snow. Furthermore, for resource-constrained systems, attaining acceptable accuracy while reducing operating time and model size is difficult. When detecting fires, the CNN design is often altered so that the final fully linked layer has two classes: fire and non-fire.

The input data is transferred to the proposed CNN for training, which entails altering and learning the weights of a large number of neurons to categories them as fire or non-fire. The adoption of a region-based convolutional neural network in this study represents a considerable improvement. CNN is a classification technique that uses machine learning to categories pictures. It does not determine the position and orientation of the item. Working efficiently need extensive training. For object detection, R-CNN (Region based CNN) is used. CNN may not perform properly if there are several objects in the visual area owing to interference. In R-CNN, the image is divided into about 1000 region recommendations, and then CNN is applied to each area. The right region is added into the artificial neural network when the size of the regions is decided. The system utilizes real-time databases to save time and money when paired with Mobile Net. The Mobile Net (v2) model outperforms other models. Alex Net, Google Net, and Squeeze Net are just a few examples. As a result, in an unpredictable surveillance environment, a model with a similar architecture to Mobile Net is utilized and changed according to fire detection. To achieve this, the number of neurons in the last layer of this design is restricted to two instead of 1000, allowing categorization into fire and non-fire. It is more feasible than other CNN algorithms for memory and bandwidth-constrained hardware architectures

II. LITERATURE SURVEY

The risk management for forest fire has been focused in this research [1], and it involves several methods such as fire prevention and firefighter preparedness. Enhancement of spatial data, such as the creation of themed layers creation of a digital landscape model, matrix analysis All of the recorded risk objects, regardless of substrate or soil type, will be destroyed. Assist in the fight against forest fires.

Yen Feng, Luo Ning Zhao, and Wu Benxiang describe fire detection based on flame colour utilizing RGB, HSV, and YCVCR colour models in paper [2.] To detect the location of numerous classes at once, algorithms such as YOLO and YOLOv2 are utilized. The fire and smoke are detected in the acquired photographs, and the accuracy value is determined using the fire and smoke score.

In previous work [4], the researchers present various frameworks for predicting and detecting the fire zone area using various technologies. The fire detection algorithm uses a support vector machine, with the input being a video image, from which the moving region is extracted and resampling for the same size is performed, after

which flame features such as texture and colour moment are extracted and data is normalized to obtain the eigen values, and finally SVM recognition is performed, which produces the result.

III. PROPOSED METHODOLOGY

CONVOLUTIONAL NEURAL NETWORK (CNN) Convolutional neural networks (CNNs) are a type of artificial neural network that is used in image identification and processing. They are specifically designed to analyze pixel input. A neural network is a hardware and/or software system modelled after the way neurons in the human brain operate.

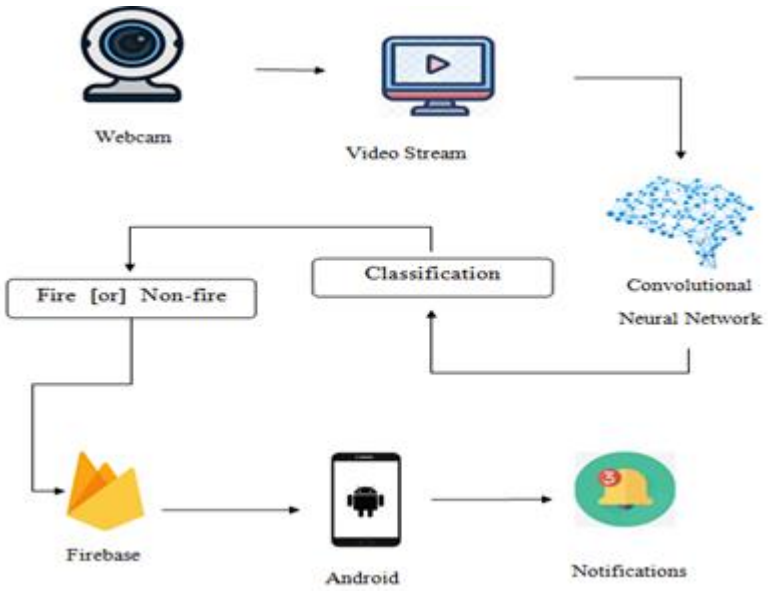

Figure. 3.1 Architecture for fire detection using video survilance

In first video will be streeming by using the web camera by using CNN (Convolutional neural network) Algorithm the system will classify the fire . If fire occur the system will send the fire alert messege to the fire base . Fire base is nothing but it is a type of cloud database. Then the firebase will send the alert notification to the mobile phone this is the working process of the system.

IV. EXPERIMENTS AND RESULTS

This system will recognize fire in a video frame based on a portion of the pictures. Each video frame, we detect and track the fire picture. The angle of the eye is used to compensate for the CNN's recognition limitations.

4.1. DATA SET COLLECTION

There are many types of data sets like raw data set, image data set, audio data set etc… The dataset consists of images chips extracted from Kaggle. We have collected two types of images.

Figure 4.1.1 Fire images

Figure 4.1.2 Non fire images

4.2. DATA REPROCESSING

In data preprocessing, the image data is converted to NumPy array, and it is normalized to avoid over fitting. Also, the images are reshaped to fit into our model.

4.3. ALGORITHM MPLEMENTATION

Implementing the CNN (Convolutional neural network) Algorithm. Then train the both fire and non-fire images separately, multiple time for getting an accurate detection. The goal behind CNN is to predict the firing by comparing the datasets images

4.4. FIRE DETECTION

Fire detection can be done using the video streaming with webcam. In the video, if fire occurs then the system will send the alert message to the firebase. Through firebase will get a alert notification to the android mobile phone

Fig 4.3.1 Input video for training model

Fig 4.3.2 Fire Detection

Fig 4.3.3 Sending Message to firebase

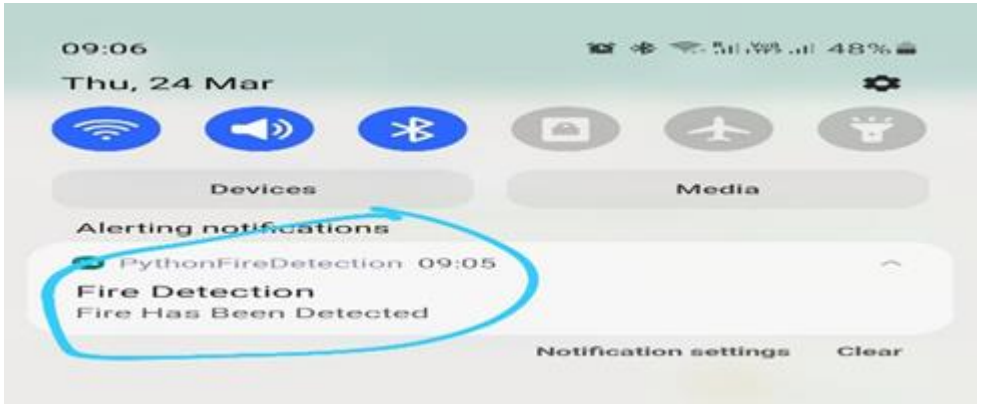

Fig 4.3.4 Fire Detection Notification

V. CONCLUSION

Object detection and identification research is gaining popularity. This work employs a deep learning technique to recognize fire from an input video. As part of this work, the CNN model was tested on a range of movies and photos, and the results show that our model can anticipate nearly every fire in a video frame. It also features a colorful border that identifies the frame and indicates the boundary. To train our model, we used a clean picture dataset, and the videos/images being evaluated are also free of environmental influences. According to the study, the most prevalent components that influence fire detection accuracy are changing weather conditions, which affect visual features and haze, and so on. When it comes to selecting a good fire detection technology, these criteria give rise to a plethora of options. The goal of future study should be to establish a comprehensive fire collection that includes both actual and synthetic images for a wide range of climatic conditions. Overall, we can conclude that video-based fire detection is a hot research issue with significant operational promise in the near future due to the vast amount of data available for free on the internet.

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