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Video Surveillance Fire Detection System Using CNN Algorithm

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Abstract: —In this Paper, To create a classification model that utilizes Deep Learning to detect fires in images/video frames, allowing for early detection and saving manual work. This model can be used to detect fire in surveillance videos. This method can also be used to reduce the number of accidents caused by fires in industries, hospitals, and other locations. Furthermore, by taking into consideration the specific characteristics of the situation at hand as well as the variety of fire data, this suggested system demonstrates how a balance between fire detection accuracy and efficiency may be achieved.

Keywords: Fire detection, CNN, Deep learning, Image Processing etc.

I. INTRODUCTION

Rate of forest fires reports have increased yearly due to human causes and dry climate. To avoid terrible disaster of fire, many detection techniques have been widely studied to apply in practice. Most of traditional method are based on sensors due to its low-cost and simple installation . These systems are not applicable for using outdoor where energy of flame affected by fire materials and the burning process affected by environment that have potential cause of false alarms. Visual-based approach of image or video processing was shown to be more reliable method to detect the fire since the closed circuit television (CCTV) surveillance systems are now available at many public places, can help capture the fire scenes. In order to detect fire from scenes of color-videos, various schemes have been studied, mainly focus on the combination of static and dynamic characteristics of fire such as color information, texture and motion orientation, etc.

Examine the convolution to address the above issue A depth function based on a neural network (CNN) for early fire detection in a surveillance network. Our most important original contribution The summary is as follows.

1) Avoid the time-consuming effort of traditional ones Handmade features for fire detection and detailed investigation Learning the architecture for early fire detection in both CCTV surveillancenetworks Indoor and outdoor environments.

2) The fire Detection framework improves the accuracy of fire detection Reduces false positives compared to state-of-the-art Method. Therefore, this algorithm can play an important role Early fire detection to minimize damage

II. PROBLEM DEFINATION

To develop a classification model that uses Deep Learning to recognize fires in images/video frames, allowing for early detection and reducing manual work. In surveillance videos, this model can be used to detect fires. This approach is also useful for reducing the number of accidents that occur as a result of fires in industries, hospitals, and other places. Safety is a crucial consideration in the design of residential and commercial buildings in order to safeguard against loss of life and damage to property. Aim to built a system which detect the fire

III. Proposed System

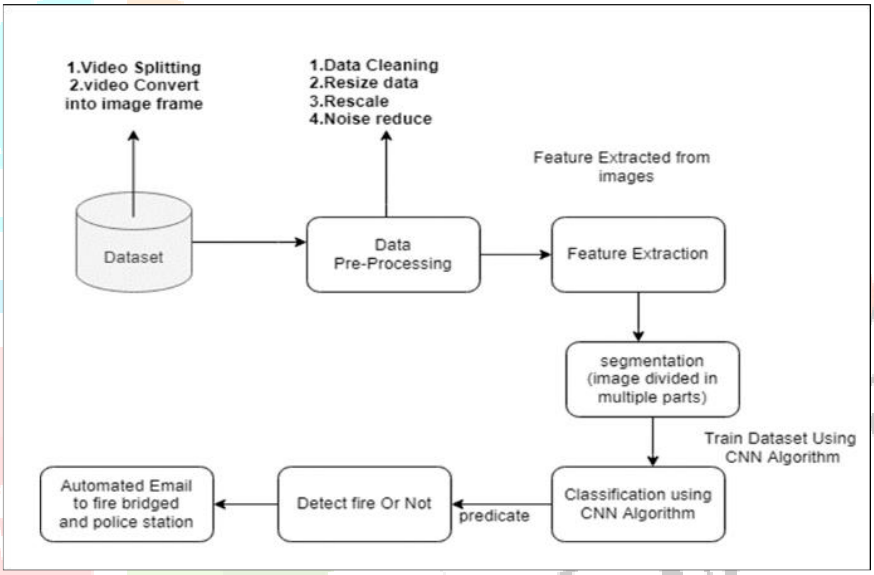

Fig 1: System Architecture

Figure 1.1 shows, The proposed system input as video then Pre-processing refers to all the transformations on the raw data before it is fed to the machine learning or deep learning algorithm. For instance, training a convolutional neural network on raw images will probably lead to bad classification performance CNN is a neural network that extracts input image features and another neural network classifies the image features. The input image is used by the feature extraction network. The extracted feature signals are utilized by the neural network for classification.

• CNN (Regions with CNN feature) is one representative work for the region based methods. It performs the semantic segmentation based on the object detection results.

• To be specific, CNN first utilizes selective search to extract a large quantity of object proposals and then computes CNN features for each of them. The convolutional neural network (CNN) is a class of deep learning neural networks. CNNs represent a huge breakthrough in image recognition. They're most commonly used to analyze visual imagery and are frequently working behind the scenes in video classification.

• Preprocessing- Preprocessing refers to the transformations applied to our data before feeding it to the algorithm. Data Preprocessing is a technique that is used to convert the raw data into a clean data set.

• Feature Extraction- Aims to reduce the number of features in a dataset by creating new features from the existing ones (and then discarding the original features). These new reduced set of features should then be able to summarize most of the information contained in the original set of features.

• Data Segmentation- is the process of taking the data you hold and dividing it up and grouping similar data together based on the chosen parameters so that you can use it more efficiently within

marketing and operations. Examples of Data Segmentation could be: Gender. Customers vs. Prospects.

• Classification using CNN-Convolutional Neural Network is a Deep Learning algorithm specially designed for working with Images and videos. It takes images as inputs, extracts and learns the features of the image, and classifies them based on the learned features.

• Detect the fire or Not.

IV. Mathematical Model

Let S be the Whole system S= I, P,O

I - input

P - procedure

O - output

Input(I)

I= Input as Fire image/video Dataset

Where ,

Step 1. Dataset contain Fire images/Video dataset.

Procedure (P),

P= 1. Train the dataset (Fire dataset)

Step 2. Pre-processing

Step 3. Feature Extraction

Step 4(a). Segmentation

Step 4(b). Classification (used CNN algorithm)

Step 5. Create Model.

Output (O)-

O= System detect Fire or Not.

1. CNN layer is calculated as : "inputsize-(filtersize-1)"

2. To calculate padding: inputsize + 2 * paddingsize - (filtersize - 1).

3. To calculate the number of parameters the network learned. (n*m*l+1)*k

Where,

n = Width of filter.

m = Height of filter.

l = Number of input feature maps.

k = Number of output feature maps[2].

$$G[m,n] = (f * h)[m,n] = \sum_{j} \sum_{k} h[j,k] f[m-j, n-k]$$

It is a process where we take a small matrix of numbers (called kernel or filter), we pass it over our image and transform it based on the values from filter. Subsequent feature map values are calculated according to the following formula,

Where,

f = input image,

h = kernel,

m = indexes of rows,

n = indexes of columns.

V. Results

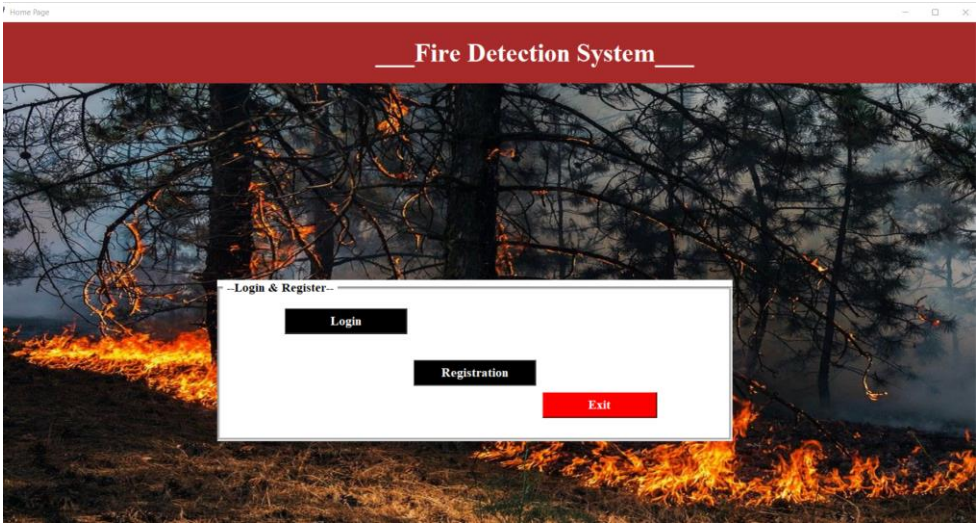

Fig1.2: Main Window

As shown in Figure 1.2. This is the Main Window of the proposed Fire Detection System. Here, First the user has to create his/her account. After creating an account user has to login with his/her Userid i.e Username and Password. These data is saved into the database. The proposed system uses SQlite database for storing the data and the records.

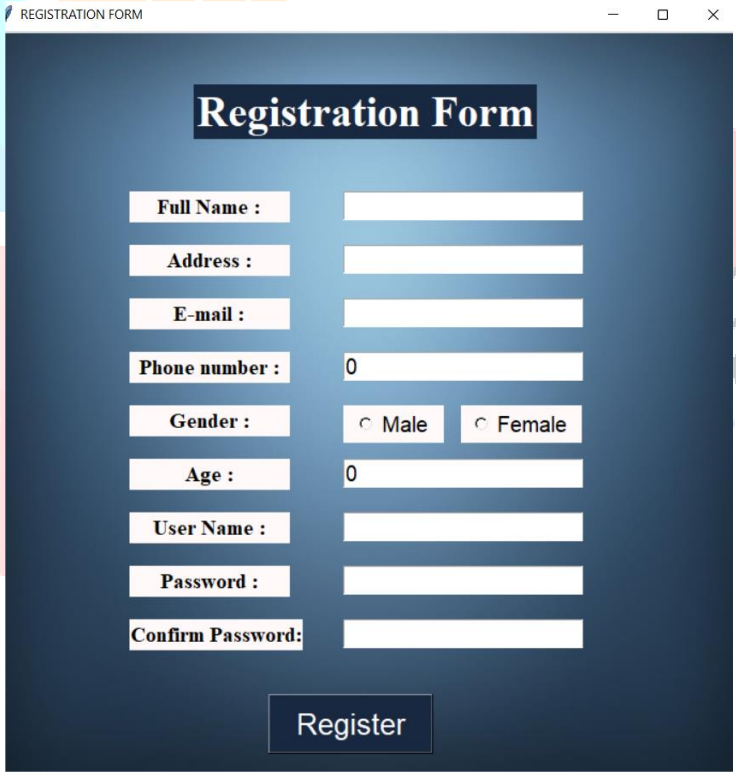

Fig1.3: Registration Window

As shown in figure 1.3, The Proposed System has Registration Window through which user has to register his/her account. The System has predefined format which user has to follow while registration.

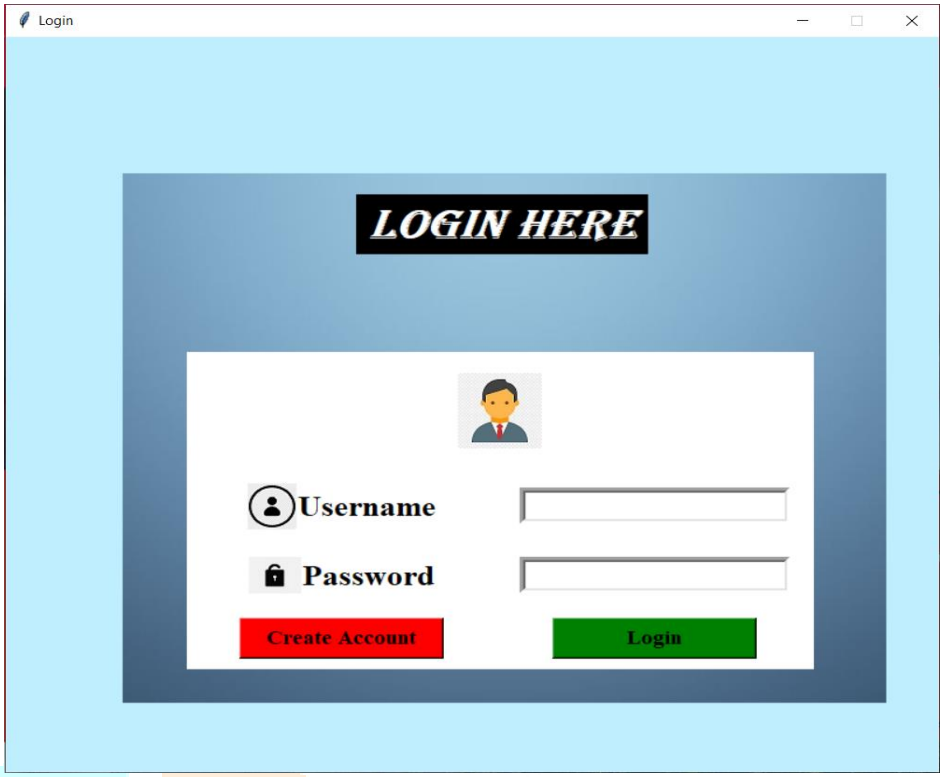

Fig1.4 User Login Window

As shown in figure 1.4, Here The Proposed System consist of Login window through which a user can login to his account. The Username is the one which he/she has provided while registration. Only valid account will be get logged in and he/she can access the Fire Detection System.

Fig1.5: Fire Detection Window

As shown in figure 1.5, This is the Fire detection window. Here we have a Fire detection button through which we will take the input data which will be in terms of Video. The System will perform various modules to determine whether fire is there or not.

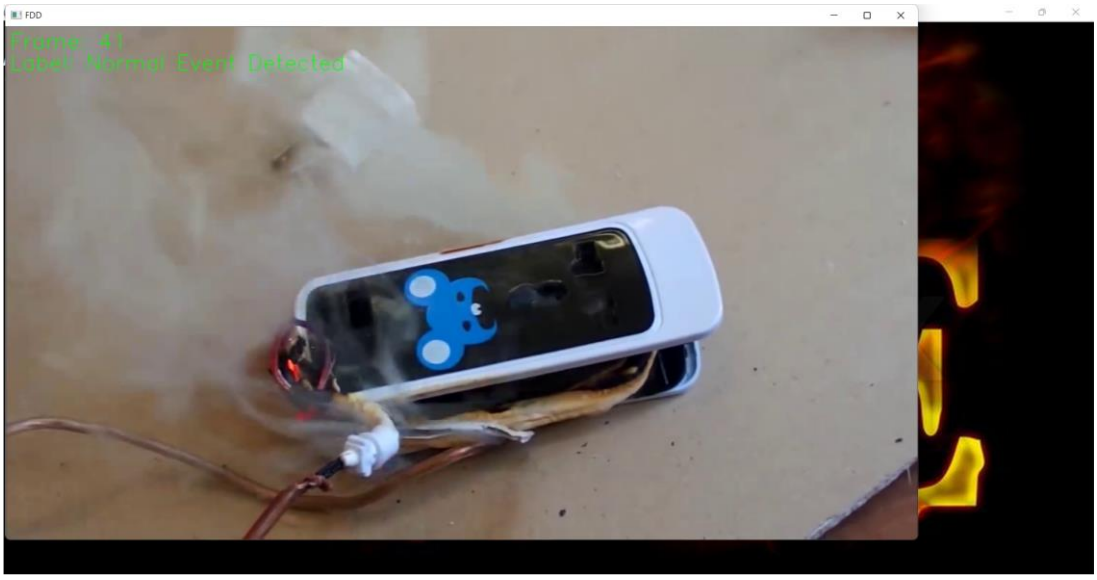

Fig1.6: Fire Detection Frame 1

As shown in figure 1.6, here we have taken input data set as a video and with the help of the video frames we are detecting the fire at initial stage it is observing the environment and according to this it will give alert message.

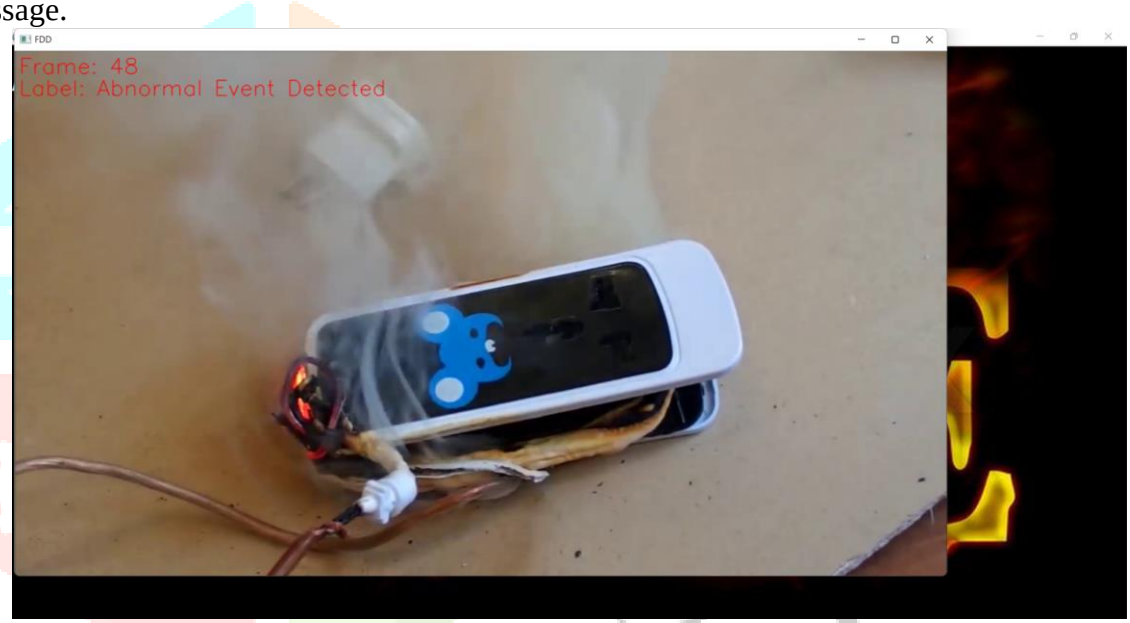

Figure 1.7: Fire Detection Frame 2

As shown in figure 1.7, In this Frame as we can see that the fire has been detected an according to that the abnormal activity detected it will send alert message to the user.

Sr. No.	Parameters	Previous System	Proposed System
1	Time Consumption	10	8
2	Response Time	10	4
3	Computation Cost	8	6
4	Performance Accuracy	3	8
5	Scalable and user friendly	3	10

Table2.1: Previous and Proposed System Table

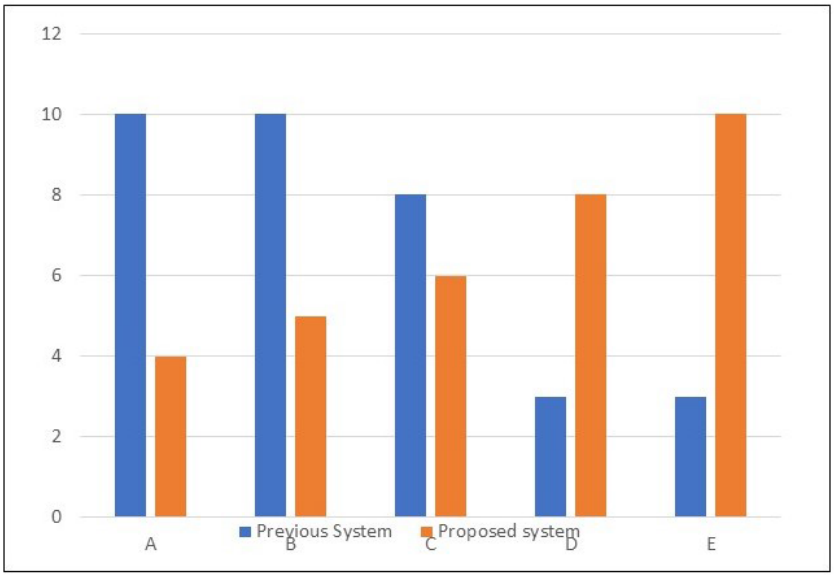

Figure1.7:Previous System Proposed System

VI. CONCLUSION

In summary, an aerial based forest fire detection method has been examined through a large database of videos of forest fires of various scene conditions. To enhance the detection rate, at first the chromatic and motion features of forest fire are extracted and then corrected using rule to point out the fire area. Secondly, to overcome the challenge of heavy smoke that covers almost the fire, smoke is also extracted using our proposed algorithm. Proposed System framework proves its robustness with high accuracy rate of detection and low false alarm rate in practical application of aerial forest fire surveillance. Future studies may focus on making challenging and specific scene understanding data-sets for fire detection methods and detailed experiments. Furthermore, reasoning theories and information hiding algorithms can be combined with fire detection systems to intelligently observe and authenticate the video stream and initiate appropriate action, in an autonomous way.

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