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Proposed System of Enhancement in Accuracy for Fire Detection System using Machine Learning Algorithm

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Abstract: ***The video surveillance system has become a important part in the security and protection of cities. The Video surveillance has become an important factor in the cities, since smart monitoring cameras mounted with intelligent video analytics techniques can monitor and pre-alert system by capturing abnormal activity such as fire events. The current world is completely under CCTV for make the various areas secure. The video recorded is unable to find out fire detection at early stage of fire event. After event happened this video sequence is used to find out causes of an event/fire but problem is after event happened system are unable to save loss by that event or accident, so there is need to such system is able to help us in early event detection and pre-alert generation system. Motive behind this proposed work is to invent pre-alert generation system without any hardware as well as sensor. Accuracy of this proposed system may be approx.85-90% or more which is better than existing system.***

Keywords **: *Closed Circuit Television (CCTV), intelligent video surveillance (IVS), conventional neural network.***

I. INTRODUCTION

Alarms are significant in light of the fact that they can give you an early sign to fire occasions that could be sparing heaps of lives. A fire alarm alerts is very essential to make you alert when you are sleeping. In current system does not available any application which detect fire and alert system. The accuracy directly impacts on human lives. So it is very crucial task of implementation in surveillance networks. Video surveillance system has become an important part in the security and protection of modem cities. Recent years, more and more video surveillance devices are deployed as the increasing demands on public security and smart city. Now a day's million monitoring cameras have been equipped for surveillance systems in all over world. So implement focus on video surveillance by giving video contents containing early fire events detection. To overcome existing drawbacks of post investigation techniques of video surveillance systems by providing pre alert generation system.

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Our work is based on machine learning techniques for video analysis with better performance and event detection with advantages of alert generation.

II. LITERATURE SURVEY

Shin-Juh Chen [1] state that fire detection systems located in aircraft cargo compartments are currently based only on smoke detectors. They produce around 200 bogus alerts for each year for U.S. enlisted flying machine. The quantity of bogus cautions is developing as more planes are equipped with smoke alarms and air travel grows. Also, the survivability of an air ship in a fire situation relies upon the early location of the fire. A fire location framework is created dependent on the concurrent estimations of carbon monoxide, carbon dioxide, and smoke. The mix of the paces of ascent of smoke and either carbon monoxide or carbon dioxide focus gives a potential alarm calculation to build the dependability of flying machine smoke alarms, and to lessen an opportunity to caution. The fire recognition framework with the alert calculation identified fires that were not frightened by smoke sensors, and frightened in shorter occasions than smoke sensors working alone.

Khan Muhammad et.al [2] proposes a secure surveillance framework for IOT systems by intelligent integration of video summarization and image encryption. Right off the bat, a productive video rundown strategy is utilized to extricate the enlightening edges utilizing the handling capacities of visual sensors. At the point when an occasion is distinguished from key casings, an alarm is sent to the concerned authority self-rulingly. As a ultimate choice about an occasion principally relies upon the separated key casings, their change during transmission by aggressors can bring about serious misfortunes. To handle this issue, propose a quick probabilistic and lightweight calculation for the encryption of key edges preceding transmission, considering the memory and preparing prerequisites of compelled gadgets which increment its reasonableness for IOT frameworks. Qingjie Zhang et.al [3] proposed a deep learning method for forest fire detection. They train both a full image and fine grained patch fire classifier in a joined deep Convolutional neural networks (CNN). The fire recognition is worked in a fell manner, for example the full picture is first tried by the worldwide picture level classifier, if fire is identified, and the fine grained fix classifier is pursued to recognize the exact area of fire patches. Our fire fix identifier acquires 97% and 90% location precision on preparing and testing datasets individually of different fire identifiers in the network, to fabricate a fire discovery benchmark.

As indicated by our best information, this is the first with fix level explanations.

Ying-li Tian et.al[4] presenting the expanding requirement for advanced observation frameworks and the transition to a computerized foundation has changed reconnaissance into a huge scale information investigation and the executives challenge. Savvy observation frameworks utilize programmed picture understanding strategies to separate data from the reconnaissance information. While most of the exploration and business frameworks have concentrated on the data extraction part of the test, not many frameworks have investigated the utilization of separated data in the inquiry, recovery, information the board and examination setting. The IBM smart surveillance system (S3) is one of only a handful hardly any propelled reconnaissance frameworks which gives not just the ability to consequently screen a scene yet in addition the capacity to deal with the observation information, perform occasion based recovery, get constant occasion alarms through standard web foundation and concentrate long haul measurable examples of movement. The IBM S3 is effectively modified to fit the prerequisites of various applications by utilizing an open-models based design for reconnaissance.

Weihua Xu et.al. [5] introducing the measure of human activity video information is expanding quickly because of the development of interactive media information, which builds the issue of how to process the enormous number of human activity recordings efficiently. Along these lines, devise a novel methodology for human activity closeness estimation in the distributed environment. The efficiency of human activity closeness estimation relies upon highlight descriptors. Existing element descriptors, for example, Local Binary Pattern and Local Ternary Pattern can just separate surface data however can't acquire the item shape data. To determine this, system present another element descriptor, in particular Edge based Local Pattern descriptor (ELP). ELP can concentrate article shape data other than surface data and ELP can likewise manage power fluctuations. In addition, to investigate Apache Spark to perform includes extraction in the disseminated condition. At long last, system present an observational adaptability assessment of the undertaking of extricating highlights from video datasets.

Shaoqing Ren et.al [6] introducing best in class object recognition systems rely upon area proposition calculations to speculate object areas. Advances like SPPnet and Fast R-CNN have diminished the running time of these discovery systems, uncovering area proposition calculation as a bottleneck. In this work, application present a Region Proposal Network (RPN) that offers full-picture Convolutional highlights with the recognition arrange, along these lines empowering almost without cost district recommendations. A RPN is a completely convolutional arranges that at the same time predicts article limits and abjectness scores at each position. RPNs are prepared start to finish to create high quality district recommendations, which are utilized by Fast R-CNN for location. With a basic substituting streamlining, RPN and Fast R-CNN can be prepared to share Convolutional highlights.

Jeany Son et.al [7] proposed Quadruplet Convolutional Neural Networks (Quad-CNN) for multi-object following, which figure out how to partner object discoveries crosswise over edges utilizing quadruplet misfortunes. The proposed systems consider target appearances together with their transient adjacencies for information affiliation. In contrast to traditional positioning misfortunes, the quadruplet misfortune implements an extra imperative that makes transiently contiguous identifications more firmly situated than the ones with enormous transient holes. The likewise utilize perform various tasks misfortune to mutually learn object affiliation and bouncing box relapse for better limitation. The entire system is prepared start to finish. For following, the objective affiliation is performed by mini-max mark engendering utilizing the measurement gained from the proposed system. Multi-object following calculation on open Witticism Challenge datasets, and accomplish extraordinary outcomes.

Tong Xiao et.al [8] states existing individual re-recognizable proof benchmarks and techniques mostly center on coordinating trimmed passerby pictures among inquiries and competitors. Be that as it may, it is unique from genuine situations where the explanations of passerby bouncing boxes are inaccessible and the objective individual should be looked from a display of entire scene pictures. To close the hole, propose another profound learning structure for individual pursuit. Rather than separating it into two separate undertakings—walker location and individual re-recognizable proof, together handle the two perspectives in a solitary convolutional neural system. An Online Instance Matching (OIM) misfortune capacity is proposed to prepare the system viably, which is adaptable to datasets with various characters. To approves our methodology, to gather and comment on an enormous scale benchmark dataset for individual hunt. It contains 18, 184 pictures, 8, 432 personalities, and 96, 143 walker bouncing boxes. Investigations demonstrate that our system beats other separate approaches, and the proposed OIM misfortune capacity merges a lot quicker and better than the ordinary softmax.

III. EXISTING SYSTEM APPROACH

In existing work done is based on machine learning and surveillance techniques come on conclusion that there is not any promising solution for fire identification and alert generation. All alert systems are based on sensors and hardware devices which is very expensive. Existing work on video surveillance is used recorded video sequences for abnormal event investigation which post investigation process. In post event investigations chances of overcome risk and loss is very less. So there is need of pre-event identification systems in video surveillance and monitoring with the addition of alert generation for better accident prevention techniques. So these applications are working on smart surveillance system for giving most promising solution over existing post prevention methods.

Limitations in Existing work done:

The work done in this paper is fully based on smoke images not for video sequences. So work is only limited for smoke detection using internet image data having low diversity. The work is for forest smoke detector in which hard to classify actual smoke by eliminating greenery from actual color density images of forest which limits to gain accuracy.

As available forest fire smoke images for training deep models are limited in scale and diversity, They produced only synthetic forest smoke images by inserting two kinds of smoke, real smoke and simulative smoke, into forest background.[1] Does not proposed fire detection system on UAVs for real world forest fire detection. The size of the benchmark and make finer grained annotations are limited. Besides, these devices cannot be deployed in large scale outdoor environments, eg forest, wild area. There is no standard dataset and evaluation protocol in the previous literatures which makes it difficult to compare various fire detection methods. [5] Fire detection systems located in aircraft cargo compartments are currently based only on smoke detectors. They produce around 200 bogus alerts for each year for U.S. enrolled air ship. The quantity of bogus alerts is developing as more planes are equipped with smoke alarms and air travel extends. This technique builds the necessary calculation and memory stockpiling when contrasted with different frameworks. [4]

IV. PROPOSED SYSTEM APPROACH

In a proposed system fire detection and pre-alarm generation. The current work is totally depends on accuracy factor of video processing and correct alert generation over existing false alarm rate. The main objective of this system entire activity is to for fire detection system using machine learning likes:

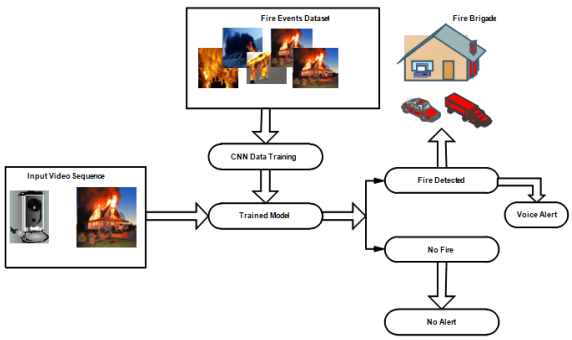


Fig 1: Block Diagram of Proposed System

1. To invent fire detection and alert generation system based on video sequences.
2. To facilitate pre-alarm generation for fire event detection.
3. The prime objective behind this work is to invent pre fire event identification method over post investigations.
4. Our aim is to develop system should smartly work under video surveillances by accurate pre fire event detection using machine learning to save loss in such events.

In a proposed system, to overcome existing drawbacks of fire alert systems and existing techniques of video surveillance systems by providing pre alert generation system. Our work is based on machine learning techniques for video analysis on fire video sequences with better accuracy over pre work and fire detection with advantages of alert generation. This system consists of following modules:

1. Input of video sequence
2. Fire events dataset
3. Training model
4. Fire detection model
5. Alert generation model

In this propose system figure no.1,consist of mainly 5 modules. In first module gives input of various fire video which consist different video sequence. In second module consist various fire event dataset. In third module with the help of CNN system make a training model with features of fire. In fourth model of fire detection system detect the fire in various places or not. In fifth and last model of the system generate the alert when any place fire is detected. The development of video processing solutions has become one of the most popular use cases for Convolution neural networks. A CNN can perceive feelings, motions, discourse, and penmanship, identify and arrange questions, and distinguish and perceive activities in the video. In our project, to define Fire detection as classifying fire and no fire based on a series of regions of interest (ROIs) for a fire sequence of images. However, there are many challenges in using CNNs for recognizing and detecting fire from the video. Recently, system worked on a project where the major goal was to detect a fire frame in a video stream. While working on this project, facing a few major challenges likes:

- Finding a balance between accuracy and performance
- Working with real time fire video sequences.

Nowadays, detecting fire from video remains one of the most challenging tasks in terms of both accuracy and performance. For detecting fire in real time video, it's crucial to deal with spatial features of images (what object recognition methods do) as well as temporal ones.

V.METHODOLOGY USED

Convolutional Neural Network (CNN):-

In propose work, using CNN algorithm which takes video frames as an input. After getting frames from video it will processed using image processing techniques for feature evaluation. System can extract different features from those images regardless of their events in it consists by using series of mathematical functions to identify the fire events. Every layer in CNN has capability to find out weights of images by using matrix evaluations which converts input to output with valuable functions. Layers of CNN used to identify fire events from extracted frames and give prediction by preserving high accuracy and less time.

- **Step 1**- Input fire and no fire video
- **Step 2**- Frame extraction from video
- **Step 3**- Image processing by using CNN
- **Step 4**- Feature Extraction from images
- **Step 5**- Model generation
- **Step 6**- Fire event recognition
- **Step 7**- Alert generation in the form of voice

Four main layer working approach of CNN explained below:-

a) Convolutional Layer

To extract different features of frames like pixel weight matrix calculations by using feature kernels. Perform mathematical convolutions on frames, where every function uses a unique filter. This outcome will be in different feature maps. At the end, system will collects all of these feature maps and draft them as the destination output matrix of the convolution layer. In figure no.2 shows that various layer of convolutional layer. It is a specialized type of neural network model designed for working with two-dimensional image data, although they can be used with one-dimensional and three-dimensional data.

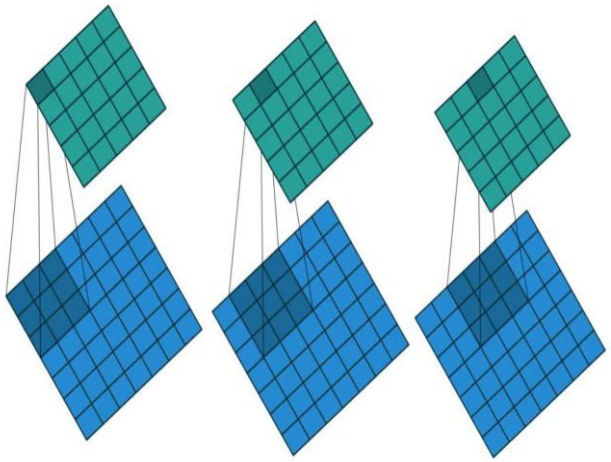


Fig 2: Convolutional Layer

b) Pooling

The expression of pooling is to constantly decrease the dimensionality to limits the number of factors and calculation in the network. This limits the time of training and maintains over fitting problem. The max Pooling extracts out the largest pixel value out of a feature. While pooling average is calculated for the average pixel value that has to be evaluated. In figure no. 3 shows that the pooling layer of CNN which can be distributed into max pooling and average pooling.

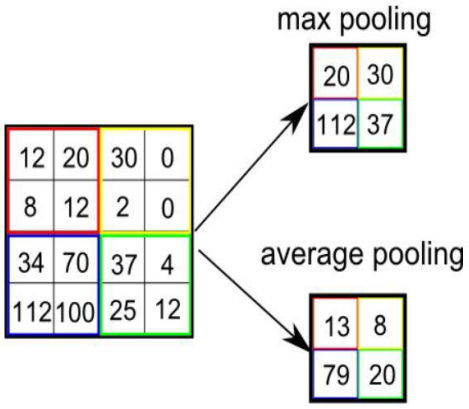


Fig 3: Pooling Layer

c) Flattening

In figure no.4, presents flattening matrix concert 3D matrix data into 1 D matrix data. Put the pooled feature into a single column as a sample input for further layer (transform the 3D matrix data to 1D matrix data)

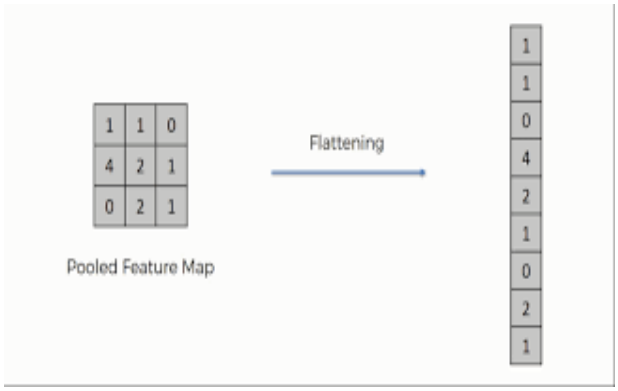


Fig. 4: Flattening Matrix

d) Fully Connection

A fully connected layer has full connections of Neurons to all the nodes in the previous layer. The fusion of more neurons to evaluates accurately. In figure no.5 consist of fully connection layers of CNN. CNN which is contains various number of layers like input layer,1..n hidden layers and output layers.

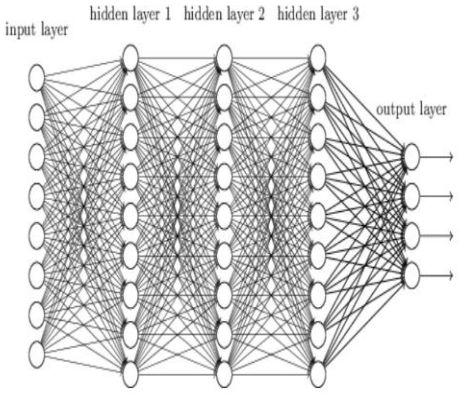


Fig. 5: Fully Connected Layer

and fire detection and prevention systems based on video surveillance with higher accuracy rate may be approx.85-90% or more than existing system and efficiency of our project is high.

VI. COMPARATIVE RESULTS

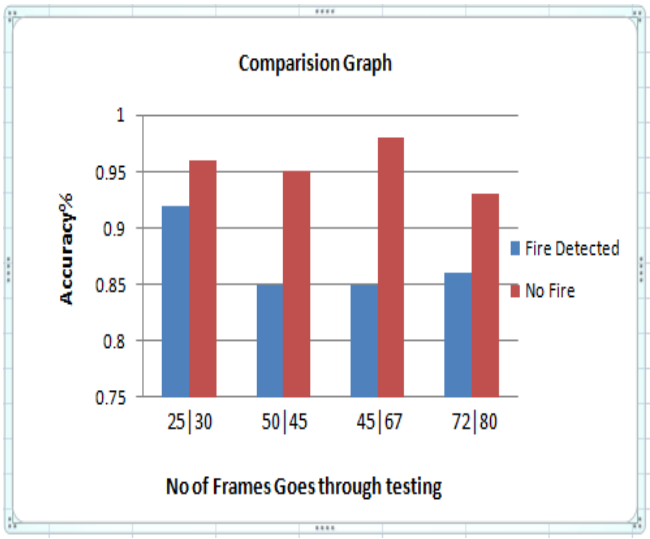
In our experimental setup, as shown in table 6.1, the total numbers of fire and no fire video frames were tested. These frames go through fire detection framework by following feature extraction using our image processing module. Then our trained model of fire detection get classifies the video into fire and no fire categories.

Table 6.1: Classification of fire

Sr. No	Category	Number of frames
1	Positive Frames	750
2	Negative Frames	250

VII. RESULTS

From above data, as shown in graph 7.1, the numbers of frames goes through test module some of found fire detected, some of found no fire.



Graph 7.1: Classification of fire videos

In our experimental setup, as shown in graph 9.1, the total numbers of frames were 414. These frames were then divided into Two subcategories; among which 25,50,45,72 found Fire detected and 30,45,67,80 found No Fire respectively We classified video data into fire and no fire categories based on accuracy factor which is our main motive.

VIII. CONCLUTION

Thus the system concludes that to propose fire detection and prevention systems based on video surveillance with higher accuracy rate . The application is implementing monitoring techniques for saving cost of hardware and gives best result over post-event recognition by our pre-event recognition and alert generation work. For develop fire detection and alert generation system for saving losses due to fire events. All implementation based on video sequences with promising solution by early fire detection and alert generation using machine learning approaches.

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REFERENCES

1. Chen, S. J., Hovde, D. C., Peterson, K. A., & Marshall, A. W. (2007). Fire detection using smoke and gas sensors. *Fire Safety Journal*, *42*(8), 507-515.
2. Muhammad, K., Hamza, R., Ahmad, J., Lloret, J., Wang, H., & Baik, S. W. (2018). Secure surveillance framework for IoT systems using probabilistic image encryption. IEEE Transactions on Industrial Informatics, 14(8), 3679-3689.
3. Zhang, Q., Xu, J., Xu, L., & Guo, H. (2016, January). Deep convolutional neural networks for forest fire detection. In 2016 International Forum on Management, Education and Information Technology Application. Atlantis Press.
4. Tian, Y. L., Brown, L., Hampapur, A., Lu, M., Senior, A., & Shu, C. F. (2008). IBM smart surveillance system (S3): event based video surveillance system with an open and extensible framework. Machine Vision and Applications, 19(5-6), 315-327.
5. Töreyin, B. U., Dedeoğlu, Y., Güdükbay, U., & Cetin, A. E. (2006). Computer vision based method for real-time fire and flame detection. Pattern recognition letters, 27(1), 49-58.
6. Ren, S., He, K., Girshick, R., & Sun, J. (2015). Faster r-cnn: Towards real-time object detection with region proposal networks. In Advances in neural information processing systems (pp. 91-99).
7. Son, J., Baek, M., Cho, M., & Han, B. (2017). Multi-object tracking with quadruplet convolutional neural networks. In Proceedings of the IEEE conference on computer vision and pattern recognition (pp. 5620-5629).
8. Xiao, T., Li, S., Wang, B., Lin, L., & Wang, X. (2017). Joint detection and identification feature learning for person search. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 3415-3424).

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