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Iot Based Forest Fire Detection System

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Abstract— Forest fires cause greater effects to forests and endangered wildlife. The forest is praise as one of the most significant and compulsory expedient and forest fire injunction a permanent danger to binomial systems and the environmental aspects. Forest fire detection had become a very important issue in the pre- suppression process which gives rise to a drastic need to perceive forest fires with the greatest speed. The proposed project is based on the study of the detection of flames in a video by using motion and edge detection techniques. It detects the edges of the flames properly by removing the noises in the flames. The optimizing technique to the detection of the flame, which generated because of smoke and spreading of fire pixel and the area spread of flame. These systems can be used to reduce false detection fire. The proposed method is used to control the fire in the earlier stages through notifications. The system also gives the opportunity to adjust the system by applying a different combination of fire detecting technique which will help in the implementation of the system according to the different sensitive area requirements.

Keywords— Forest fire detection, Motion and edge detection techniques, False detection.

I. INTRODUCTION

The increased embedded processing capabilities of smart devices have resulted in smarter surveillance, providing a number of useful applications in different domains such as e- health, autonomous driving, and event monitoring. During surveillance, different abnormal events can occur such as fire, accidents, disaster, medical emergency, fight, and flood about which getting early information is important. This can greatly minimize the chances of big disasters and can control an abnormal event on time with comparatively minimum possible loss. Among such abnormal events, fire is one of the commonly happening events, whose detection at early stages during surveillance can avoid home fires and fire disasters. One of the main reasons is the delayed escape for disabled people as the traditional fire alarming systems need strong fires or close proximity, failing to generate an alarm on time for such people. This necessitates the existence of effective fire alarming systems for surveillance. To date, most of the fire alarming systems are developed based on vision sensors, considering its affordable cost and installation. As a result, majority of the research is conducted for fire detection using cameras. Although, the method dominated state- of-the-art flame detection algorithms, yet there is still space for improvement. In addition, the false alarming rate is

still high and can be further reduced. From the aforementioned literature, it is observed that fire detection accuracy has inverse relationship to computational complexity. With this motivation, there is a need to develop fire detection algorithms with less computational cost and false warnings, and higher accuracy. Considering the above motivation, we extensively studied convolutional neural networks (CNNs) for flame detection at early stages in surveillance videos. The main contributions of this article are summarized as follows: Considering the limitations of traditional hand-engineering methods, we extensively studied deep learning (DL) architectures for this problem and propose a cost- effective framework for flame detection in surveillance videos. Our framework avoids the tedious and time-consuming process of feature engineering and automatically learns rich features from raw fire data. Inspired from transfer learning strategies, we trained and fine-tuned a model with architecture for fire detection, which successfully dominated traditional fire detection schemes. The proposed framework balances the fire detection accuracy and computational complexity as well as reduces the number of false warnings compared to state-of-the-art fire detection schemes. Hence, our scheme is more suitable for early flame detection during surveillance to avoid huge fire disasters.

II. LITERATURE SURVEY

We all know the important of the forest and we are in the position to save it to save our life but in some cases human fault or by nature treads occur to the forest. One of the threads is forest fire and here we are trying to control the spread of the fire in the forest by monitoring the abnormal events happening in the forest by means we are surveilling the forest. Processing the video data using convolutional neural network (CNN) and deep bidirectional LSTM (DB-LSTM) network. First, deep features are extracted from every sixth frame of the videos, which helps reduce the redundancy and complexity. Next, the sequential information among frame features is learnt using DB-LSTM network, where multiple layers are stacked together in both forward pass and backward pass of DB-LSTM to increase its depth. The existing approaches for the fire detection suffer from a high false positive ratio. To solve the problems, we present a patch-based fire detection algorithm with online outlier learning. In the proposed algorithm, the candidates of fire are obtained in the form of patch, while the classical candidates have been based on pixels or blobs. Because the patches of fire have more distinctive shape than the entire fire, the shape classifier can recognize the candidates correctly from fire-like outliers. An efficient video summarization method is used to extract the informative frames using the processing capabilities of visual sensors. When an event is detected from key frames, an alert is sent to the concerned authority autonomously. As the final decision about an event mainly depends on the extracted key frames, their modification during transmission by attackers can result in severe losses. To tackle this issue, we propose a fast probabilistic and lightweight algorithm for the encryption of key frames prior to transmission, considering the memory and processing requirements of constrained devices which increase its suitability for IoT systems.

III. SYSTEM OVERVIEW

Deep learning (DL) architectures for this problem and propose a cost-effective CNN framework for flame detection in surveillance videos. Our framework avoids the tedious and time-consuming process of feature engineering and automatically learns rich features from raw fire data. Inspired from transfer learning strategies, we trained and fine-tuned a model with architecture similar to Google Net for fire detection, which successfully dominated traditional fire detection schemes. The proposed framework balances the fire detection accuracy and computational complexity as well as reduces the number of false warnings compared to state- of-the-art fire detection schemes Based on CNN fire detection information is serially transmitted to controller using UART. When controller receives fire detected information, the information is updated in the server. Buzzer is used for fire indication purpose.

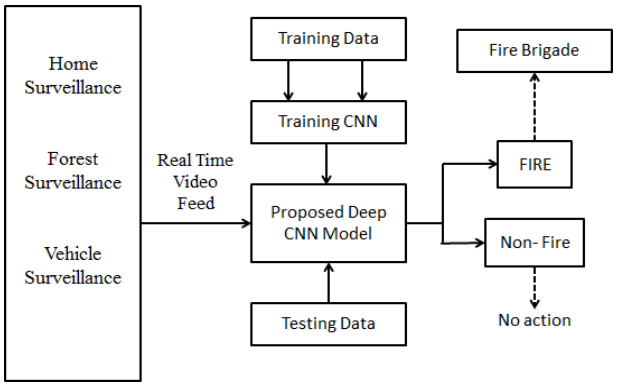

Fig 1. Block Diagram of Proposed System

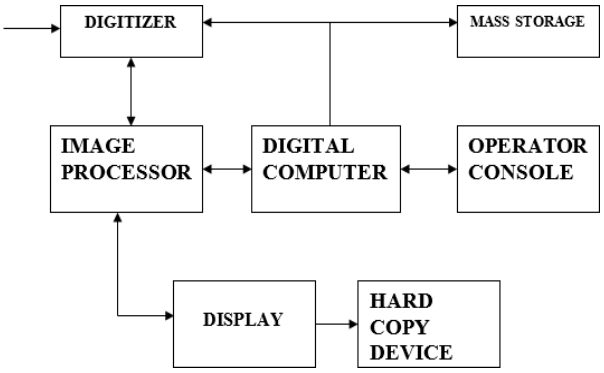

Fig 2. Block Diagram of Image Processing System

IV. IMAGE PROCESSING SYSTEM(IPS)

The System in Fig. 1 the surveillance video converted as N number of frames which is given as input for detecting the fire. Then it involves the image processing technique like preprocessing, segmentation, feature extraction and classification. Based on Convolutional neural network algorithm it detects fire.

Rain removal is a very useful and important technique in applications such as security surveillance, and movie editing. Several rain removal algorithms have been proposed these years, where photometric, chromatic, and probabilistic properties of the rain have been exploited to detect and remove the rainy effect. Current methods generally work well with light rain and relatively static scenes, when dealing with heavier rain fall in dynamic scenes, these methods give very poor visual results. We propose a de-rain formwork which applies super pixel (SP) segmentation to decompose the scene into depth consistent units. Alignment of scene contents are done at the SP level, which proves to be robust towards rain occlusion and fast camera motion. Different classical and novel models such as Robust Principle Component Analysis, and Convolutional Neural Networks will be applied to truthfully preserve the background contents. Extensive evaluations show that up to 5dB reconstruction PSNR advantage is achieved over state-of-the-art methods, the advantage is especially obvious with highly dynamic scenes from a fast-moving camera.

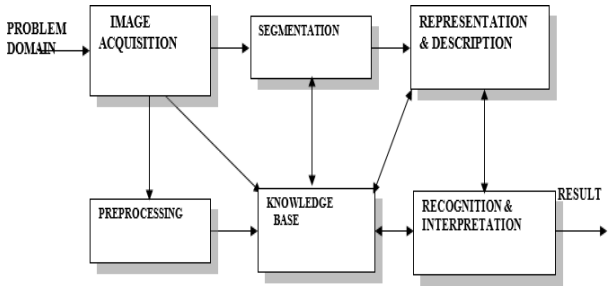

Fig 3. Sequence of Image Processing

The System in Fig. 2 is an image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. The following block diagram gives the fundamental sequence involved in an image processing system.

Fig. 3 describes an image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. The following block diagram gives the fundamental sequence involved in an image processing system.

V. SOFTWARE SPECIFICATION

MATLAB (matrix laboratory) is a fourth- generation high-level programming language and interactive environment for numerical computation, visualization and programming. MATLAB is developed by Math Works. It allows matrix manipulations; plotting of functions and

data; implementation of algorithms; creation of user interfaces; interfacing with programs written in other languages, including C, C++, Java, and Fortran; analyze data; develop algorithms; and create models and applications. It has numerous built-in commands and math functions that help you in mathematical calculations, generating plots and performing numerical methods.

VI. RESULTS AND DISCUSSIONS

By processing the input image in the MATLAB, we detect whether the fire is identified. The sample image results after the classification provided as in below images. The color segmented image is formed with the captured image.

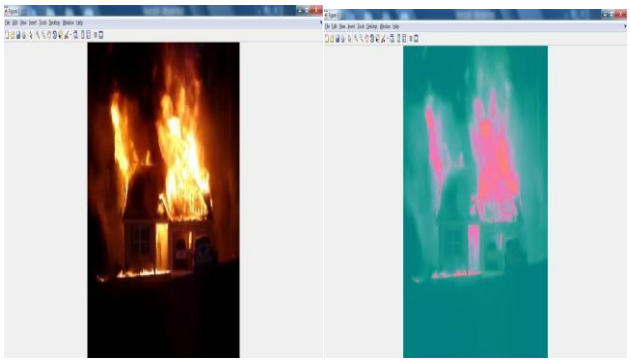

Fig 4. Input and Output Segmentations

To improve this accuracy, we have come up with more features. The below image represents the result of the MATLAB and we identified that the fire is deducted as a result as expected.

Fig 5. Final Output

VII. FUTURE WORKS

With this development of our concept, we have planned to come up with more efficient methods like using Sigfox, which is the wireless technology as well as a local LAWAN for longer- range IoT or M2M applications. Communication is better than the things we are using currently with the high data transmission rate.

VIII. CONCLUSION

The recent improved processing capabilities of smart devices have shown promising results in surveillance systems for identification of different abnormal events i.e., fire, accidents, and other emergencies. Fire is one of the dangerous events which can result in great losses if it is not controlled on time. This necessitates the importance of developing early fire detection systems. Therefore, in this research article, we propose a cost-effective fire detection CNN architecture for surveillance videos.

IX. REFERENCE

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