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Aid to Detect Fire and Smoke in Open Space Surveillance

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Abstract: As we know artificial neural network is use for analysing and training the sensed data which gathered by different channels. In this paper we use different combinations of techniques to detect smoke and flame detection algorithms in a video. The past sensed data cannot respond quickly and fire and smoke may not capture quickly. The region partitioning technique is proposed, which will increase the accuracy and also reduce test data so that rather than using a whole frame in a video it uses on part of that frame. The flame characteristics are used for normalization data we are processing. The use of neural network in combination with image processing can improve the accuracy and also help to predict the data. In improvement the wrong alarm problem is decreased. The double band method is use to detect fire. The region which we are analysing for detecting fire and smoke is calculated directly so that it can reduce computational time.

Keyword: Artificial Neural Network, Flame Detection, Image Processing., Smoke, Surveeillance

I. INTRODUCTION

With the development of economy, the number of large high buildings is increasing with cities. Generally, for the more complex and high density populated area, there were high load of fire and intensive staff, so the major property damage and heavy casualties like huge economy loss and may be a lot of death will be easily caused if fire happens in these places, it has a bad social impact. So difficult technical problems of fire detection and alarm are urgently be solved to obtain more valuable time for extinguish and evacuation.

In large rooms and high buildings, conventional fire detectors can hardly detect characteristic parameters of fire like smoke, temperature, vapour and flame in the very early time of fire, and cannot meet the demand of early fire detection in these places. Compared to conventional fire detectors, video fire detectors which have many advantages, such as fast response, long distance of detection, large protection area et al, are particularly applicable to large rooms and high buildings.

But most of current methods for video fire detection have high rates of wrong alarms. Researchers all over the world have done a lot of work on this new technique. Up to now, most of methods make use of the visual features of fire flame orsmoke including colour, textures, geometry and motion. Yamagishi and Yamaguchi [1, 2], Celik et al. [3], Chen et al. [4] used colour information to segment flame regions. Liu and Ahuja [5] and Yuan et al. [6] do Fourier coefficientsanalysis to flame contours. Ugur et al. [7], and Dedeoglu et al. [8] propose temporal and spatial wavelet method to analyse flame. Compared to flame, the visual characteristics of smoke like colour and grads are less trenchancy, and smoke is harder to be differentiated from its disturbances. So the extraction of smoke features becomes more complicated. In the study of Xiong et al. [9], they thought smoke and flames were both turbulent phenomena, the shape complexity of turbulent phenomena might be characterized by a dimensionless edge/area or surface/volume measure. Yuan [10] gave an accumulated model of block motion orientation for smoke detection. Toreyin et al. [11] extracted the edge blurring feature of smoke in wavelet domain. There are few studies on video fire detection that can detect both flame and smoke. In Ho [12] actually recognize flame and smoke individual with different models. Chen et al. [4] and Çelik et al. [13] establish a colour model to recognize fire flame and smoke. Generally speaking, most of studies of video smoke detection focus on greyish smoke from the smouldering phase, while few on black smoke produced with flame. With the high growth of current market demand, video fire detection techniques that could detect both flame and smoke will be applied to more scenes will certainly be the development trend in the future.

II. APPROACH

Since fire is a complex but unusual visual phenomenon, from this I can decide a multi-feature-based approach for algorithm. The hope and the goal of such an algorithm are to find a combination of features whose mutual occurrence leaves fire as their only combined possible cause. Fire has distinctive features such as colour, motion, shape, growth, smoke behaviour and edges of smoke as well as flame. For this project i focused on features such as colour, motion and edges, hope to include also additional feature analysis in

future work. To reduce the total computational load, the first stepof our algorithm is to perform frame differencing to get arough idea where motion occurred and extract the images from the given video that are captured by surveillance camera.

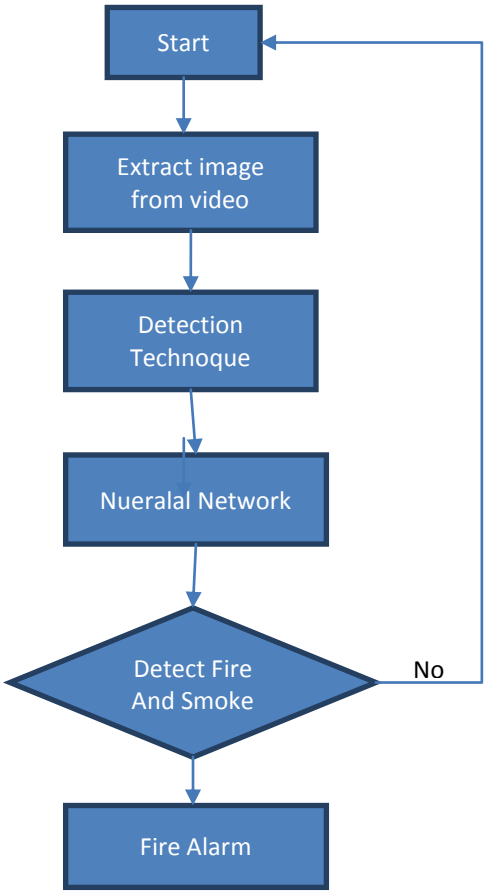

Figure 1.state diagram of detection of smoke

The regions of the videowhich are moving are fed to a fire colour classification algorithm.There are a number of different ways of detecting firecolouredpixels. In [14], the authors used a mixture of Gaussianin the RGB colour space to classify pixels as being fireor not. In [15], pixels whose colour landed in a specific segment of the HSV colour space were classified as beingfire coloured. So the decision is to use a multilayer perceptron,like [16], to classify pixels as being fire coloured or not. Spatialclustering and analysis is performed on the pixels thatget classified as being fire coloured.The next stage involves grabbing a short 50 to 100 framesequence of the video focused and centred at each of thesemoving fire-coloured regions. These short video sequencesare then fed to a module which performs dynamic textureanalysis it. so that target region is being fire or not is to be observed.

III. RESEARCH METHODOLOGY TO BE USED

A. Edge detection:

The Edge detection is use to detect the point in a image where the pixel brightness changes drastically, more formally or dis continuously. The point in image where brightness changes drastically are arranged into a set of curved line segments term is called edges. The problem of finding unorganized one dimensional signals is called step detection, similarly finding a unorganized signals over time is called change detection. Edge detection is fundamental tool in image processing and computer vision, particularly in the area where feature is used. Edge detection is widely used in operation where we want to find the pattern or processing in image. The main reason is to use Edge detection for forming the outline of an object. An edge is boundary between the background and the object in the image.Also, to identify boundaries between overlapping objects. This means that if the edges in image can be identified accurately, all of the object can be located and basic property such as area, perimeter and shape can be measured. Since computer vision involve the identification and classification of object in an image, edge detection is an essential tool. In fire and flame detection the edge detection used to find particular pattern and shape of flame. So that it can distinguish between the actual fire and another source of light such as streets light, vehicles light etc.

Figure. 2 (A) Original image.

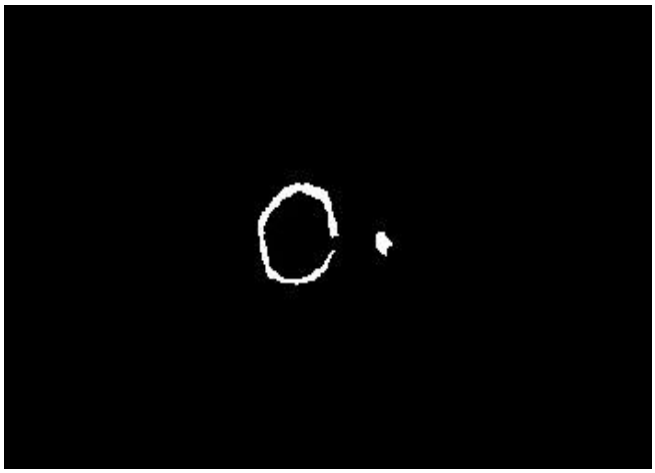

Figure. 2(B) Image after applying edge detection.

Fig.2(a) shows the original frame i.e frame 1 and the Fig. 2 (b) which is the result of the detected edge of this image. The edge detection system compares the intensity difference in the image and provides an image with black and white colour space where high intensity area is filled with white colour and low intensity area is filled with black colour. The intensity difference is categorized using a global intensity threshold which is separately calculated for each image by MATLAB/Simulink, the output will provide a

shape of the flame. Thus, the edge detection can be used to analyse colour detection of fire [17].

B. Colour detection:

A fire is an image can be described by using its colour properties. This colour pixel can be extracted into the individual elements as R, G and B, which can be used for colour detection. Noda et al. [18] have used R and G elements and find out that there is a correlation between G/R ratio and temperature distribution, whereas temperature increases, G/R ration also increases. So, due to this, colour of flame can provide useful information to guess on the temperature of a fire and also fire phase. In terms of RGB values, this fact corresponds to the following inter-relation between R, G and B colour channels: $R > G$ and $G > B$. The combined condition for the fire region in the captured image is $R > G > B$. Besides, R should be more stressed than the other components, because R becomes the dominating colour channel in an RGB image of flames. This imposes another condition for R as to be over some pre-determined threshold, RT . However, lighting conditions in the background may adversely affect the saturation values of flames resulting in similar R, G and B values which may cause non flame pixels to be considered as flame coloured [21].

Figure. 3Original RGB images

C. Motion detection:

Motion detection is use to detect the change of motion in a continuous video frames so the it can be calculate the fire flame extractionin other hand it will also detect the expansion of flame so that it can detect fire intensity. The change in background and the object that changing its position is known as object is moving from one point to another point.it is important to detect the motion of fire so that it can distinguish between constant light and the fire flame which change its position in video stream [19].

The first step is to compute the binary frame difference map, by thresholding the difference between two consecutive input frames. At the same time, the binary background difference map is generated by comparing the current input frame with the background frame stored in the background buffer. The binary background difference map is used as primary information for moving pixel detection. In the second step, according to the frame difference map of past several frames, pixels which are not moving for a long time are considered as reliable background in the background registration. This step maintains an updated background buffer as well as a background registration map indicating whether the background information of a pixel is available or not. In the third step, the binary background difference map and the binary frame difference map are used together to create the binary moving pixel map. If the background registration map indicates that the background information of a pixel is available, the background difference map is used as the initial binary moving pixel map. It is done by analysing a different between two consecutive images [20].

Figure.4(A) motion of first flame.

Figure.4(B) motion of second flame

IV. BAYESIAN NEURAL NETWORK

The Bayesians network is a probabilistic approach for relationship between different variables.it is class of model called artificial neural network. Bayesian learning neural network helps to come closer to realize an optimal and robust result in classification problems.it also help to use probabilistic approach for proper treatment of uncertainties.it has main features in image processing such as image segmentation,optimal and robust result,probabilistic approach with proper treatment of uncertainties. Bayesiannetwork is used to modelling knowledge in computational biology.

Bayesian learning of neural networks could take us another step closer to realizing optional and robust results in classification problems. It also allows a fully probabilistic approach with proper treatment of uncertainties. But, of course, the key question is: does the averaging help? The answer, in principle, is yes. More to the point, we have found the answer to be yes, in practice in effect, a

comparison of 100 single neural networks with the Bayesian average over all of them. A study of these distributions reveals that the area under the ROC curve (the plot of the signal efficiency vs. background efficiency) is larger for the "Bayesian-average network" than for any one of the individual networks, which is an indication that the averaging helps. A large number of points is needed so that one can abstract a subset of (several Hundred) networks that are approximately statistically independent.

A BNN-based method has following main features:

a. Image Segmentation.
b. Optimal And Robust Result.
c. Probabilistic Approach With Proper Treatment Of Uncertainties.
d. Predication for future cases.

V. CONCLUSION

In this paper we discuss a technique which is helpful to detect the fire and smoke in a open space where the fire safety as well as ground patrol is important. The use of neural network in this method is because of classification and prediction of the data so that it can detect fire and smoke before it will go in extreme condition.In fire and smoke images recognition method the criteria is deside according to th flame and smoke features. Then the data is input to neural network so that it can calculate undergoing data for prediction. This method will surely reduce the false alarm problem and result come before it will under process.

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