

# LITERATURE SURVEY

1. T.Chen et al. developed a set of rules to separate the fire pixels using R, G and B information.
2. B.U. Totryin et al. used a mixture of Gaussians in RGB colour space which is developed from a training set of fire pixels, instead of using a rule base colour model .
3. Wen- Homg et al. used HSI colour model to separate the fire pixels. They have developed the rules for brighter and darker environments. After segmenting the fire region based on HSI rules the lower intensity and lower saturation pixels are removed to avoid fire aliases (fire like region). They also formed a metric based on binary counter difference images to measure the burning degree of fire flames such as no fire, small, medium, and big fires. Their result includes false positives and false negatives. But there is no way to reduce the false positives and false negatives by changing their threshold value.
4. Akshata & Bhosale. proposed another method where Local Binary Pattern acts as a base for fire detection and Wavelet Decomposition is used to detect fire. Pixel level analysis is required in this method. This method uses YCbCr color model to detect fire. Detection is based on three phases. The first phase involves segmentation of image using LBP. LBP is a texture operator whose value is computed using image's center and neighboring pixel values. Further accuracy is improved using Wavelet Transform and complicated data is classified using this approach. 2D Discrete Wavelet Transform is used for decomposition in this system. 2 images should be used as input and the sub bands of every image are compared with the other, if sub bands are equal the images are same else different.

5. T. Celik et al. [5] formed number of rules using normalized (rgb) values in order to avoid the effects of changing illumination. In this method statistical analysis is carried out in rg, rb and gb planes. In each plane three lines are used to specify a triangular region representing the region of interest for fire pixels. A pixel is declared as fire pixel if it falls in to the triangular region of rg, rb and gb planes. Even though the normalized RGB colour space overcomes the effects of variation in illumination to some extent further improvement can be achieved by using YCbCr colour space which separates luminance from chrominance.
6. Turgay Celik et al. [9] proposed a generic colour model to segment the flame pixel from the background using YCbCr colour model. This method segments the flame region except the flame centre. But this method classifies fire pixels only based on colour information.
7. G. Marbacr et al.[7] used YUV colour space for the representation of video data, where the candidate fire pixels are obtained by the derivative of the luminance component Y and the candidate fire pixels are confirmed by using the information from the chrominance components U and V. But in this method the number of test conducted was not mentioned.
8. Dimitropoulos (2015) [1] proposed an algorithm where a computer vision approach for fire-flame detection is used to detect fire at an early stage. Initially, background subtraction and color analysis is used to define candidate fire regions in a frame and this approach is a non-parametric model. Following this, the fire behavior is modeled by employing various Spatio-temporal features such as color probability, flickering, spatial and spatiotemporal energy. After flame modeling the dynamic texture analysis is applied in each candidate region using Linear Dynamical Systems, Histogram and Mediods. LDS is used to increase the robustness of the algorithm by analyzing temporal evolution of pixel intensities. Pre-processing is done after this to filter non-candidate regions. Spatio-temporal analysis is done to increase the reliability of the algorithm.

The consistency of each candidate fire region is estimated to determine the existence of fire in neighboring blocks from the current and previous video frames.

9. Osman Gunay and Habiboglu [4] proposed a system based on Covariance Descriptors, Color Models, and SVM Classifier. This system uses video data. Spatio-temporal Covariance Matrix (2011) [13] is used in this system which divides the video data into temporal blocks and computes covariance features. The fire is detected using this feature. SVM Classifier is used to filter fire and fire-like regions. This system supports only for clear data not for blur data.
10. Vipin V[10] proposed a model to segment the fire from the image which uses RGB and YCbCr colour space. This method does not work well under all environmental conditions and is not reliable.