# Emerging Of Early Detection Of Forest Fire

**ABSTRACT**



*Fire detection at an early stage is important for the safety of the people. Lack of information due to manualdetection is the main cause of failure of fire detection. Fire can be detected by using smoke at an early stage as it isthe fire indicator. Generally automatic forest fire detection using image processing techniques represents one of thesignificant aspects of forest fire avoidance earlier. Detection using image and video is effective than using sensors.In image processing the inputs for the fire detection may be an image or a video but the input as a video is quitecomplex process but provides good result. The techniques such as Wavelet decomposition, spatial and temporalanalysis,GaussianMixtureModel, Multi-Featurefusiondetectfireinan accurate manner.*

# Introduction

Wild fires are a significant hazard to ecological systems around the world and poseaserious threat to human safety. People visually look forsigns of fire or smoke appearance to detect fire in older days. To detect fire at early stage we use smoke which is the good indicator of fire which is visible before flames. Characteristics of smoken to be considered such as transparency, its response to environmental condition, it sshape. In open environment smoke detection pose a serious challenge in such areas sensors may be used but this has limitations such as time and wide area coverage. To over come this video fire detection systems are used.

Different image processing techniques canbe used to detect fire and smoke. In image processing image or video is taken as input and the output may either an image or parameters or characteristics of an image. Various tasks like analysis classification, extracting the features, recognizing different patterns can be performed using image processing. The features and textures of smoke can extract using various imageprocessingtechniques.Byusingthesetechniques the dangerous situations causeddue to fire can be avoided and safety of thepeoplecan bepreserved.

# Literature Survey

**Surit, Watchara Chatwiriya** proposed a method to detect fire by smokedetection in video. This approach is basedon digital image processing approach withstatic and dynamic characteristic analysis.The proposed method is composed of following steps, the first is to detect the areaofchange in the current input frame in comparison with the background image, the second step is to locate regions of interest(ROIs) by connected component algorithm,the area of ROI is calculated by convex hull algorithm and segments the area of change from image, the third step is to calculate static and dynamic characteristics,using this result we decide whether the object detected is the smoke or not.The result shows that this method accurately detects fire smoke.

In pre processing unwanted distortions are removed and image is resized and transformation of resized image is performed. High frequencies of an image are eliminated using SWT and the reconstruction of imageis done by inverse SWT. Image indexationis performed to group the intensity colors that are closed to each other.Histogram analysis isused to determine the various levels of indexation.After analysis a comparison is made with non-smoke frame and non-smoke images are eliminated.These three are combined and fire is detected.

**Osman Gunay and Habiboglu** proposed a system based on Covariance Descriptors, ColorModels, and SVM Classifier. This system uses video data.Spatio-temporal Covariance Matrix is used inthissystemwhichdividesthevideodataintotemporalblocksandcomputescovariancefeatures.Thefireisdetectedusing this feature. SVM Classifier is used tofiler fire and fire-like regions. This systemsupportsonlyforcleardatanotforblurdata.

**Dimitropoulos** proposed an algorithm where a computer vision approach for fire-flame detection is used todetectfireatanearlystage.Initially,background subtractionand color analysisis used to define candidate fire regions in aframe and this approach is a non-parametricmodel. Following this, the fire behavior is modeled by employing various Spatio-temporal features such as color probability, flickering, spatial and temporal energy. After flame modeling the dynamic texture analysis is applied in each candidate region using LinearDynamical 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. Finally, a two-class SVM classifier is used to classify the fire and no fire region.

**HamedAdab** proposed another systemwhich is based on Indexing. GIS techniques and remote sensing provides further assistance. The indexing may be structural fire index,Fire risk index,Hybrid fire index.Depending on the geographical condition of the area the indexing differs.Validations of indices are based on hot spotdata.Structural fire indices show static information and it does not change over short time span and used to predict the riskin advance. Fire risk index changes as the vegetation or climate changes.Hybrid index is a combination of Structure and Fireindex. The disadvantage of this indexing isthat wayof combining.

**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 phase. 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 isclassified using this approach. 2D Discrete Wavelet Transform is used for decomposition in this system. 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.

**Celik** proposed a generic modelfor fire and smoke detection without the useof sensors.Fuzzy based approach is used in this system. Color models such asYCbCr, HSV are used for fire and smokedetection. The fire is detected using YCb Crcolormodel samples because it distinguishes luminance and chrominance.Y, Cb, Cr color channels are separated fromRGB input image. A pixel is more likely afire pixel if intensity of Y channel is greater than channel Cb and Cr.

**Cheng** proposed a detection system based on Neural Network; here neural network isused in detection information for temperature, concentration,and smoke density to determine probability of three representative fire conditions. RBF neuron structure is used, the information regarding temperature, CO concentration, and smoke density are collected and data fusion is used to generate fire signal decision.The detectors have continuous analog outputs, when detection limit is exceeded the hard ware circuit sends a local fire indication to fusion center, this force the system detectors to generate final decision. Single-sensor detector is used to generate the final decision.

**Zhanqing** proposed another method using NN and Multi-threshold algorithm. In this method the NN not only classify the smoke, sky, background but also generates a continuous random output representing mixture of these.NN consumes time in case of large areas so multi-threshold algorithm also used as well.These two approaches may be combined orused separately depending on the size of thearea.MultilayerPerceptronNeuralNetwork is used here.

The number of neurons in the output layer is equal to the number of desired parameters of the output vector,whichare“smoke,”“sky,”and“background”.The degree of separation between pixels is identified by Euclidean Distance. Multi threshold algorithm is based on channel wise approach,reflectance of each channel value is used for threshold assumption and is applied toeach and every pixels of the image, smoke pixels remarked and false pixels are removed. Threshold value is set as 0.9 <=channel1reflectance/channel2reflectance<= 1.5. Pixels which reach this threshold are smoke pixels else are false pixels and are removed

**PauloViniciusKoerichBorges** proposed a fire detection method based on probabilistic method and classification. Computer vision based approach is used in this approach. Though this approach is used surveillance it is also used to automatic video classification for retrieval of fire catastrophes in data bases of news cast content. There are large variations in fire and background characteristics depend in gon the video instance. The proposed method observes the frame-to-frame changes of low-level features describing potential fire regions. These features include color, area size,surfacecoarseness,boundaryroughness, and skewness within estimated fire regions.

**Bayesclassifier** is usedforfirerecognition.Inaddition,knowledge of fire events captured invideos is used to significantly improve theresults.The fire region is usually located in the center of each frame.This fact is used to model the probability of occurrence of fire.

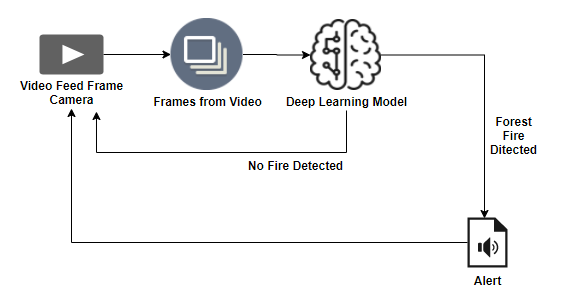
# Conclusion

Different fire detection techniques have been proposed for safety and protection of the people and environment.It is very crucial to develop an appropriate detection system to avoid dangerous situation caused due to fire.Though fire detection using image produce satisfying result we now go for fire detection to produce accurate result.Wavelet based smoke detection is used for smoke detection in video sequences of outdoor environment. Covariance method is for flame detection.This method use temporally extended covarian cematrices representing all the information together.The method works only well when the fire is clearly visible. If the fire is small and if itis far away from the camera or covered by dense smoke the method fails. Wavelet and Color model combined together and detect smoke earlier.Neural Network produces accurate result a situses temperature, smoke density and CO concentration. Fuzzy based approachuses model and detects fire at an early stage. By these approaches we cannot completely protect the forest from fire but we reduce the level of damage. Perception Neural Network along with Multi Threshold algorithm classified image pixelsof cloud, land, smoke, and background and produced accurate result of smoke.

# References

1. KosmasDimitropoulos,PanagiotisBarmpoutis,andNikosGrammalidis(2015).*SpatioTemporalFlameModelingandDynamicTextureAnalysis for automatic video-based firedetection*, IEEE transactions on circuitsand systems for video technology, vol.25, no. 2.
2. Surya.T.S,Suchithra.M.S.SurveyonDifferent Smoke Detection TechniquesUsing Image Processing. *InternationalJournal of Research in Computer andCommunicationTechnology*, 16-19.
3. TurgayCelik, HuseyinOzkaramanl, andHassanDemirel(2007).*FireandSmokedetectionwithoutSensors:Image Processing basedapproach*.15thEuropeansignalprocessing conference (eusipco 2007),Poznan,Poland, September 3-7.
4. OsmanGunay,A.EnisC ，Etin,YusufHakan,Habiboglu.*FlameDetectionmethodinvideousingCovariancedescriptors*,IEEEtransactions,1817-1820.
5. CHENG Caixia, SUN Fuchun, ZHOUXinquan(2011).*OneFireDetectionMethodUsing*Neural*Networks*,TsinghuaScienceandTechnology,ISSN1007-021405/1731-35Volume16,Number 1.
6. HamedAdab,KasturiDeviKanniah,Karim Solaimani. *Modeling forest fireriskinthenortheastofIranusingremotesensingandGIStechniques*,SpringerScience+BusinessMediaDordrecht2012.
7. AkshataPatil, VarshaBhosale 92014).Survey of Local Binary Pattern for fire&smokeusingWaveletDecomposition.*InternationalJournalofResearchinEngineeringandTechnology*.
8. SurapongSurit, WatcharaChatwiriya.*Forest Fire Smoke Detection in VideoBasedonDigitalImageProcessingApproach*.
9. ZhanqingLi,AlexandreKhananian,RobertH.Fraser,andJosefCihlar.*AutomaticDetectionofFireSmokeUsing Artificial Neural Networks andThresholdApproachesAppliedtoAVHRR Imagery*, IEEE transactions ongeosciencesandremotesensing,vol.39,no. 9,September 2001.
10. S.A.Christopher,M.Wang,T.A.Berendes,andR.M.Welch(1998).*The 1985 biomass burning season inSouthAmerica:Satelliteremotesensing of fires, smoke, and regionalradiative energy budgets*, vol. 37, 661–678.
11. Paulo Vinicius Koerich Borges (2010).*AProbabilisticApproachforVision-Based Fire Detection in Videos*, IEEEtransactions on circuits and systems forvideotechnology, vol. 20,no. 5.
12. Jiawei Han,MichelineKamber,JianPei (2012). *Data Mining Concepts andTechniques*,Thirdedition,248-253,350-351.
13. YusufHakanHabibo˘glu,OsmanGünay,A.EnisÇetin(2011).*Covariancematrix-basedfireandflamedetectionmethodinvideo*”,Springer-Verlag,17.
14. RafaelC.GonzalezandRichardE.Woods.*DigitalImageProcessing*.Pearsonpublication, Third Edition.
15. Prerna B. Pagar & A.N.Shaikh(2013). Real Time based Fire & SmokeDetectionwithoutSensorbyImageProcessing,*InternationalJournalofAdvancedElectricalandElectronicsEngineering(IJAEEE),* 26-34.

# List of Figures

****

**Fig.4.Multi-sensor information fusion detection system**

