Detection of Human in Flames Using HOG & SVM

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***Abstract*— The project helps in finding people who are trapped in the fire. The project can be divided into two overlapping segments: the first is identifying the fire, and the second is detecting the human. The module operates using the colour standard YCbCr, and the fire detection algorithm identifies fire and flames in the environment if they are there. To find a human in the fire, it employs the Histogram of Oriented Gradients (HOG) and the Support Vector Machine (SVM). It details needed motion-based selected features for human activity recognition as videos. To make the two modules function together, we integrated them. For such detection of a fire, we used a learning method that makes use of a trained model with a wide range of human feature sets. Color median filter and background differencing are used in four separate rules to detect moving objects. The requirement that if a Fire occurs, then humans must be discovered using the method unites the two algorithms. The major goal of this technique is to locate the trapped people in the flames so they may be immediately rescued. This can aid firefighters in making important plans and locating dangerous zones.**

Keywords— OpenCV, Machine learning Algorithms like Histogram of Oriented Gradients (HOG) and the Support Vector Machine (SVM)., **Image processing, YCbCr component , Motion detection.**

I. INTRODUCTION

Fires are becoming a more serious hazard to people's lives and property. We merged the motion and colour detection of the flame during the preprocessing stage of the fire. This method significantly reduces the amount of computation required to screen the fire candidate pixels. Second, despite its irregularity, the flame remarkably resembles the order of the image.The risk that fires pose to people's stuff and lives is getting worse. When preprocessing the fire, we included movement & aspect of such a flame. The amount of work needed for screen the flame candidates pixels is greatly reduced by this technique. Second, despite its inconsistency, a flame strikingly reflects the image's order. Today, a variety of detection of fire tools are easily accessible locate flames and activate fire alarms. However, once exposed to cigarette smoke, the sensors may issue false alarms since they pick up chemical particles in the air. Secondly, with its inconsistency, the flame closely resembles the order of the picture. Many fire detection devices automatically trigger fire alarms after seeing a fire. support vector machine (SVM) and histogram-oriented gradient (HOG) classifiers. However, this tactic can be strengthened by putting this technology to create a robots that can save lives by rescuing trapped in a fire in Fig 1.

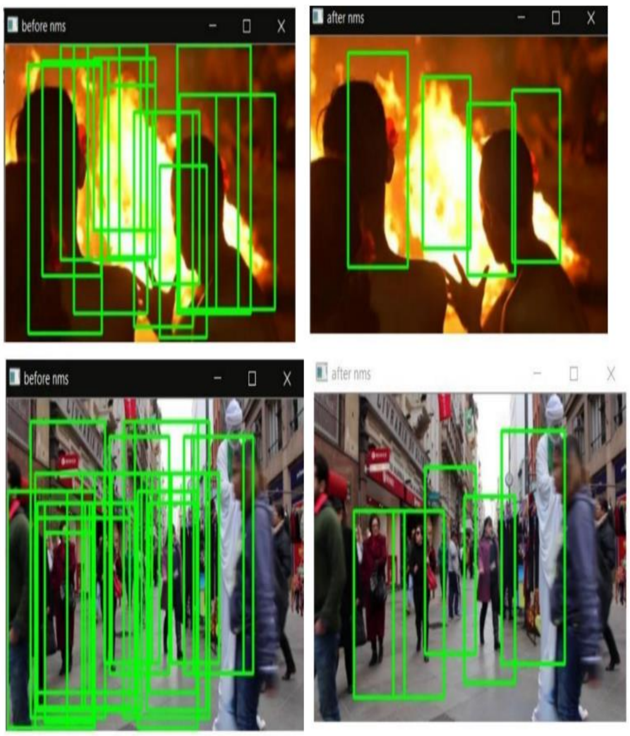

Fig. 1. Human detection before and after

To solve this problem, we employed computer imaging and vision processing to discriminate between people and fire using the YCbCr colour space as well as the classification method using the Histogram of Oriented Gradient [hog] and Support Vector Machines [SVM]. By integrating this information into a robotic that can safeguard people engulfed in flames, protect humans trapped in a fire from being destroyed, this strategy might be improved. In other words, it serves two purposes: first, it helps identify fires more precisely than currently used traditional methods, and second, it prioritises saving individuals who are stuck in 'fires,' which happen frequently. Experimental findings suggest that, when compared to the conventional approach, it might increase accuracy and decrease the number of false alarms.

A. Existing System

It is a challenge to interpret that the results are correct. High error-susceptibility- a considerable amount of time is taken to identify the source and longer to correct one Machine learning models are open for Improvement but that depends upon Time and resources available, this proved to be a sturdy barrier to the accuracy of the model.

B. Proposed System:

Fast and Efficient functioning- the use of HOG removed the bottleneck for the model now it is invariant to geometric and photometric transformations, except for object orientation. Increased accuracy by providing an adequate amount of training data in both scenarios one with humans and the other where there were no humans. Efficient Algorithms like the sliding window, are used for feature comparison and other operations and this overall reduces the complexity of the system.

II. LITERATURE REVIEW

The present research trends emphasise the two study areas that are combined and seek to develop new solutions for reducing the loss of lives due to fire. the development of computer vision technologies. Szeliski, R [1] has developed a lot of new advancements in digital image processing. R. J. Schalkoff [2] proposed employing computer vision-based systems to replace traditional and conventional smoke detection alarms with image modification. Since the system is based on image processing, there is a lower chance of producing false alarms. The process comprises 3 steps: locating the fires pixels, segmenting moving objects, and finally analysing the candidate region. A frames buffer filled with following images of the input video is used to apply an edge detection breakthrough utilising a frame differencing technique to distinguish moving particle from non-moving pixels. In order to raise a fire alarm, more frames are looked just at plasma plume that are also classified as fire alarm.

As this technique is strong enough to categorise people and other objects, it makes use of dense grids of oriented histograms of gradients (HOG). This process often takes a while, thus Qiang Zhu and Shai Avidan [8] created a quick human detection algorithm utilising variable blocks. Histograms for Local and Oriented Gradients (HOG) Derivative Patterns (LBP) were employed by Xiaoyu Wang [7] as the feature set. The approach uses both a global detector for the whole scanning window and a part detector for local areas, and the detection outcome is satisfactory. To recognise persons, colour information is employed. A human detection system built on a saliency mechanism and colour characteristics is presented in Sebastian Montabone & Alvaro Soto[10]. Here, we only employed the Histogram of Oriented Gradients to identify people, but future work may also take into account the Local Binary Pattern (LBP) and the Histogram of Oriented Gradients (HOG), which might advance technology.

A. Previous work

Also, prior work has been done in this field, which includes: Khan et al [7].'s technique of static indoor flame identification employing the colour, boundary, size, and fullness of the flame was based on video and utilised flame dynamics. A little fire, like a candle, is seen as an unnecessary component in their technique.

This approach may have a significant issue with early fire alerts since it removes and then applies the fire growth characteristics to assess. Although Burnett and Wing [8] employed a new, inexpensive camera that has great RGB and HSV detection capabilities and can eliminate smoke's influence on the flame, there are still certain restrictions on the usage and acceptance of this camera.

Using the combination of HSV and YCbCr, Seebamrungsat et al. [9] suggested a rule. Although their technique just employs the static properties of the flame, their methodology takes more colour space conversion than utilising a single method, which is why it is superior. It is not sufficiently stable, and the procedure is relatively brittle.

III. METHODOLOGY

A. Fire Detection

Fig 2, The module uses the colour format YCbCr, Celik, and Demirel to detect fire and flames in the surroundings if they are present [1]. This colour space was chosen because, compared to other colour spaces, it is better able to distinguish between illumination and chrominance information. The YCbCr colour space may be translated using the principles established for the RGB colour space to identify potential candidates for fire or smoke pixels, and analysis can then be done. The guidelines, however, are unable to produce a single quantitative indicator that may pinpoint the likelihood that a specific pixel is a fire pixel. The Y, Cb, and Cr colour channels of the fire samples exhibit some of the following predictable properties, which are illustrated below:

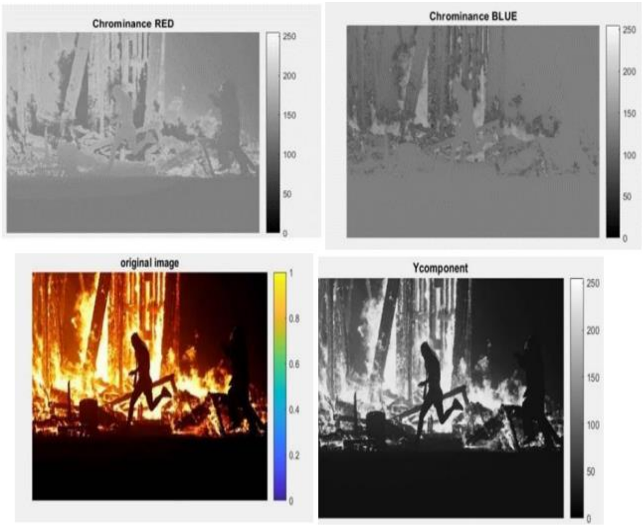

Fig. 2. YCbCr image human in fire.

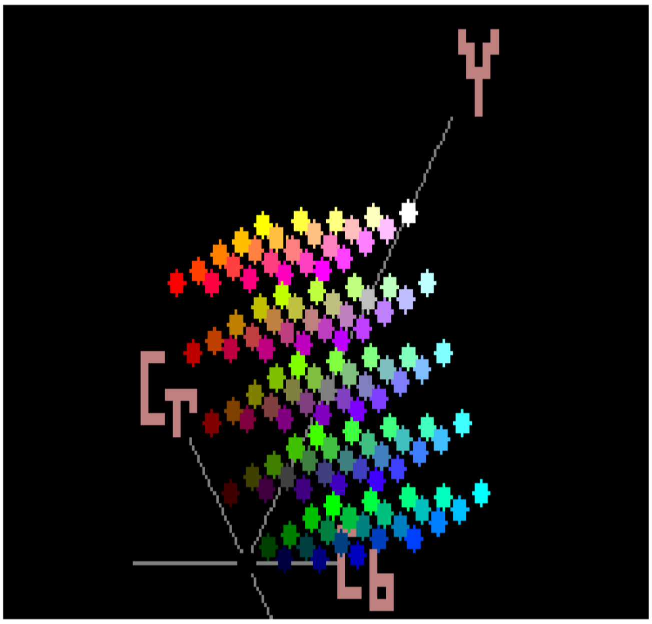

Fig. 3. Visualisation of YCbCr

Fig 3, The various YCbCr components are retrieved from of the RGB channels of a original image as seen in the figures above. The fundamental distinction between this colour format and the YUV colour format is that the YUV colour is analogue while the YCbCr colour is digital. The following describes how YCbCr is visualised:

We separate the the RGB channel's YCbCr component inside the video sequence or picture, and then apply additional filters to further reduce noise from the image for improved clarity. In this case, we employed a Gaussian filter. The second stage involves applying background subtraction via frame differencing, which compares two consecutive frames to find moving objects. Once a moving object is found, the fire pixel in that location is then found.

Finding the moving object, which is a fundamental component of object identification, is the most crucial stage in video sequencing. To order to accomplish this, we have used frame differencing, which is accomplished by contrasting two frames simultaneously. As an illustration, we choose two frames from time instances t-1 and t-2 of the single time clock as we are aware that the frames are produced at a rate of 24 frames per second and can be used to identify moving objects in the movie. This strategy has had great success.

Fig 4, A trained model with a variety of human features was applied in our learning technique, which is how we found human presence. There are four alternative criteria for moving object detection that use colour thresholding and background differencing for the detection of fire. In order to combine the two algorithms, a requirement must be met: if a fire is detected, then the algorithm must also be used to detect humans. The major goal of this technology is to identify the trapped people in the flames so they may be quickly rescued. In terms of quick planning and dangerous zone detection, this can aid firefighters. The flowchart of the following algorithm is:

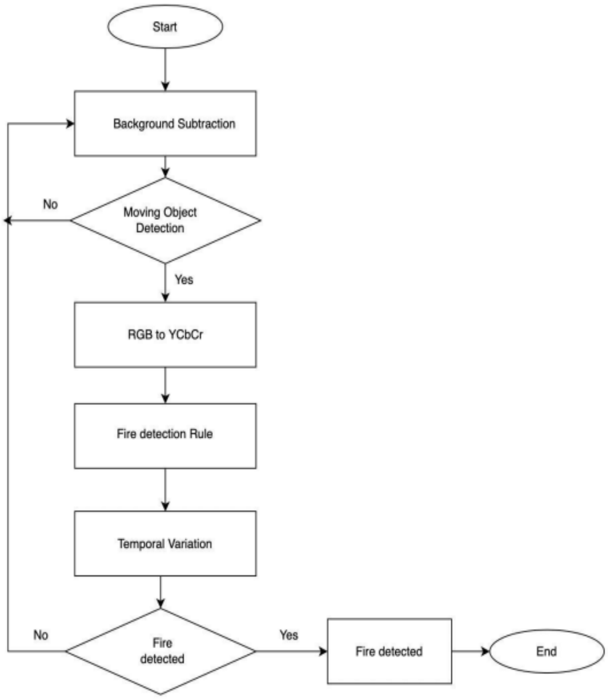

Fig. 4. The flowchart of Fire detection

B. Human Detection

This study introduces and assesses the efficacy of motion-based selected features for basically a device in videos. It focuses in particular on oriented histograms of diverse local differentials or changes in optical flow as movement characteristics, assessing them both independently and together with the

Histogram of Oriented Gradient (HOG) appearance descriptors that we originally developed for human detection in static images Papageorgiou, Oren, and others [2]. Since humans have different types of poses, gestures, articulation, and other characteristics that make it difficult for any typical classifier to identify humans when they are surrounded by various types of objects, feature selection is a challenging task for human detection. Many researchers use body and silhouettes to distinguish between humans and other objects. Support Vector Machines (SVM) have been employed as classifiers and pattern recognizers to get around this kind of scenario. The DFD working model for human detection looks like this.

The technique makes use of dense grids with oriented histograms gradients (HOG), which are strong enough to categorise people and other objects. This approach often takes a long time, thus Qiang Zhu and Shai Avidan [3] created a rapid human detection algorithm utilising variable blocks. Histograms for Oriented Gradients (HOG) and Local Binary Pattern (LBP) were utilised by Xiaoyu Wang [4] as the feature set; the approach contains a global detector for full scan windows and a local area part detector; the detection result is satisfactory. Human detection is done using colour information. A human detection system built on colour characteristics and the visual saliency mechanism is presented by Rodrigo Montabone and Alvaro Soto.

IV. EXPERIMENTAL RESULTS

The aforementioned analysis is put to the test under various circumstances in order to assess the performance and accuracy of the algorithms and guarantee the technology's dependability. The fire detection algorithm has been put to the test on a variety of images, and the results are encouraging. Videos of all definitions were used to determine the algorithm's effectiveness, and a variety of pictures with various backgrounds were used. It was discovered that the algorithm performs well enough to identify the flames and fire in the In addition, it can identify forest fires, however occasionally when either the sun is rising or setting, it interprets it as the sun's colour intensity being near the flames and treats the sun similarly to a fire, Deep learning and neural networks are two solutions that may be used to solve this issue since they reduce the number of false fire alarms. We found wow a terrible video requires less processing time and can anticipate the output more quickly than high-quality video when using using crappy video as a test input to technology for detecting fires is tested.

For human detection, we employed 1800 training photos, both positive and negative. Positive photographs had humans in them, whilst negative images did not; nevertheless, both images had the same backdrop, thus the model must be trained before and prevent False positives, there were more negative than positive images. The algorithm works well on high definition (1920 x 1080) movies only since it is time-consuming; thus, In order to perform better, we may utilise HOG+LBP for quicker and and improved outcomes. We tested the technique on various videos and photos to confirm the human detection algorithm. The classifier and training have an impact on the algorithm's accuracy. The photos of a running video that has been used to illustrate how it truly works are provided below. It can be plainly seen that it does not identify smoke as fire delivers the desired result, which is the detection of fire, and that it is accurate up to extremely fine details in Fig 7.

Fig. 5. Running module (Detected Humans)

V. ACKNOWLEDGEMENT

In this research, a movement fire and humans detection system is introduced. We had combined the ideas of 2 different studies, respectively, both detecting of fire and the recognition of persons, which are not yet the topic of operations. When compared to projects working with related issues, this one is functioning well with an efficiency rate of 81%. We employed image processing in the YCbCr colour space for fire detection, which separates the luma element from the image and analyzes it further to choose the fire pixel and determine the output. Testing of real-time video has demonstrated its efficacy and validity and shown that small tweaks can enhance its state's function and performance, enable it to utilised for safety and surveillance. We implemented the program in Python 3.7 and used image processing to detect humans and fires. The modules can, however, be developed in more recent Python versions for better results. For greater performance and much more real-time application, this technique can even be implemented in autobots and racialized using deep learning.

VI. REFERENCE

[1]. Dalal, N., Triggs, B., & Schmid, C. “Human detection using oriented histograms of flow and appearance”, IEEE (2021, May).
[2] George Christober,J. Shanthi,S “Detection of fire flows in videos by SVM classifiers with EM segmentation method”, IEEE, 2014.
[3] Ha Dai Duong, Dao Thanh Tinh “An efficient method for vision-based fire detection using SVM classification”, IEEE, 2013.
[4] Jesus Oliveras Mercado, Karina Toscano-Medina, Gabriel Sánchez Perez “Early fire detection on video using LBP and spread ascending of smoke”, IEEE, 2019.

[5] Jing Wu,Chun xue, WuYan Wu "Real time fire detection model based on Cascaded Strategy" , IEEE, 2018.
[6] Tian Qiu, Yong Yan and Gang Lu "An Autoadaptive edge detection algorithm for flame and fire image processing",IEEE , 2012.
[7] Dr.M.PSivaram Kumar, Shyamala, Priyanka, Sneha "Predicting the Forest Fire Using ImageProcessing",IEEE ,2016.
[8] G.Marbach, M. Loepfe, T. Brupbacher "An image processing technique for fire detection in video images", IEEE , 2016.
[9] N.Prabhuram, Vibin Mammen Vinod, V.Mekala, M.Manimegalai "A Fast And Energy Efficient Path Planning Algorithm For Offline Navigation Using Svm Classifier", IEEE , 2019.