SMOKE DETECTION ON CNN BASED VIDEO SURVEILLANCE SYSTEM

By:
Faris Rai Fadhil [1)]
Ari Purno Wahyu Wibowo [2)]
Universitas Widyatama, Bandung [1,2)]
E-mail:
faris.rai@widyatama.ac.id [1)]
ari.purno@widyatama.ac.id [2)]

ABSTRACT

Forest fires are a serious problem that can cause extensive forest land and plantation areas to be damaged, this damage not only disrupts the habitat but the ecosystems in the forest, several studies have made an experiment to prevent forest fires, one of which is by using the help of electronic sensors installed in forest areas, this sensor works chemically by detecting heat or a change in the composition of the atmosphere present in the air and room temperature, from these changes the data is sent to the central station and a fire will be predicted, this method has a weakness including the number of sensors installed is very limited and does not allow it to be installed in a large area and the sensor may be damaged and lost as well as the use of a limited power source, causing readings to become disruptive and less than optimal. The solution to this problem is to use a UAV or drone technology which is felt to be very effective and quickly moves areas to scan a very large area, while the fire detection process uses an image processing method based on a computer vision algorithm, this method reads forest fire data and calculates the area directly. and can be used to detect the impact of damage caused, the accuracy of this image processing system depends on whether it is clear or not the reading of the data captured by the UAV predicts an accuracy of up to 80%.

Keyword: Forest Fires, Image Processing, Computer Vision

1. INRODUCTION

In general, the design of a fire detection system based on video-based images with GPU (Graphic Processing Unit) support, this system works by reading video frame data, each video frame will be read by analyzing the model of the stages of reading the model, namely for Adaptive-GMM, making color tables, processing video frames, motion detection with Adaptive-GMM, fire color segmentation and finally a process for detecting fire from a combination of the results of motion detection and fire color segmentation and displaying the detection results on the screen. GPUs are used in methods that require high computations such as color conversion to grayscale color space and HSV of color changes taken from motion detection and fire color segmentation.

Forest fires in Indonesia are influenced by several factors, including land clearing that is used to open new agricultural areas, this land includes traditional agriculture and plantations on a very large scale, uncontrolled forest fires will cause air contamination, large area control is not possible to monitor manually so that surveillance is needed by air or by using drone assistance, with this tool the surveillance system can be carried out in real time and quickly, processing fire detection data using image processing or computer vision assistance, a more sophisticated method is using a deep system learning that is able to read the movement of fire and at the same time calculate the area affected by the forest fire.

Many forest fires can't be extinguished early because of the difficulty in locating the source of the fire. The location of the fire source that is difficult to reach by forest firefighters is one of the factors that influences the spread of fires to become widespread and uncontrollable. Forest fires will not spread and disrupting the effects of forest fires will not cause new problems. Another method for detecting a forest fire is to use the unimodal-Gaussian method. this method works by reading a fire movement and combining it into a color reading pattern in RGB form, from this study shows a relevant result or a movement and the color of the fire (Celik, T., Demirel, H., dan Ozkaramanli, H, 2006)

Whereas another method, the Adaptive-Gaussian Mixture Model, has a way of working that is almost the same as detecting the movement of fire but detecting color using the HSV method, this system can be implemented in real time on the basis of GPU detection, this system works by applying a filter that can increase a precision and calculation of object reading accuracy (Fung, J. dan Mann, S.,, 2008)

In general, the design of a fire detection system is based on video image processing with GPU support for reading video frame data, detecting fire from a combination of motion detection results and fire color segmentation, and displaying the detection results on the screen. GPUs are used in methods that require high computation such as color conversion to grayscale color space and HSV motion detection and flame color segmentation. (Adhi Prahara).

Modern technology is currently one of the mapping solutions in a very large area is to use an UAV (Unmanned Aerial Vehicle) aircraft, this tool is capable of flying over a very large area and is able to map an area in the form of a video or photo in the form of a frame, this system can work directly with the computer vision system and can be integrated directly with

the communication network, the network will be connected to the control channel on the ground (Denny Hardiyanto ; Dyah Anggun Sartika , 2018)

Color image processing is part of the field of digital image processing computer science where there is an element of color in image processing and is one of the factors in digital images that are able to provide information as well as a description of information from the object being read. Color processing is considered very important because related to color processing can easily identify and extract objects in images. In addition, the human eye can distinguish thousands of colors including their intensity. Image processing itself is capable of processing an image in such a way as to produce an image that is more in line with our wishes (Setyawan Widyarto; Feriadi ; Andri, 2012)

2. LITERATUR REVIEW

In this test, the data analysis process will be carried out using a UAV-based camera, data retrieval can be used in real time with the data analysis method on each fire object in the form of a frame, each frame will be processed using the color segmentation method for each movement of the fire and changes in color composition.

- Data reading

  In this section the main image data will be calculated in the form of a matrix on each image pattern which will later become information, the standard parameters for calculating color composition, the color composition is in the form of calculating horizontal and vertical data into the x and y axes where each color parameter value has its own value.

- *Grayscale*

  in this process the algorithm will calculate a gray degree process which serves to sharpen the image of the image, this image is in the form of forest object data taken by air which may have a level of image reading that is still unclear so that fire objects are difficult to see, the pixel value has a degree value at a maximum of 0-256, the sharpening of the greyscale will distinguish fire objects and moving images.

- Image Segmentation

  In the color segmentation process, data will be processed using the greyscale method. This stage process uses the full method, namely by separating an image of a forest fire object which is done automatically by displaying IDs and labels that show the x-axis and y-axis

performance values which will later be used to calculate fire area.

Figure 1.1 smoke detection in forest fires

In Figure 1.1 is an image data collection process on forest fires, in that image a surveillance camera or drone reads a change and movement of smoke, the image processing technique then performs a conversion process which generally the color of the fire will be displayed in red, the algorithm then creates a barrier visualization that will depict the area of forest fires and display them in an x and y axis coordinate or better known as the technique of reading fire coordinates on a map.

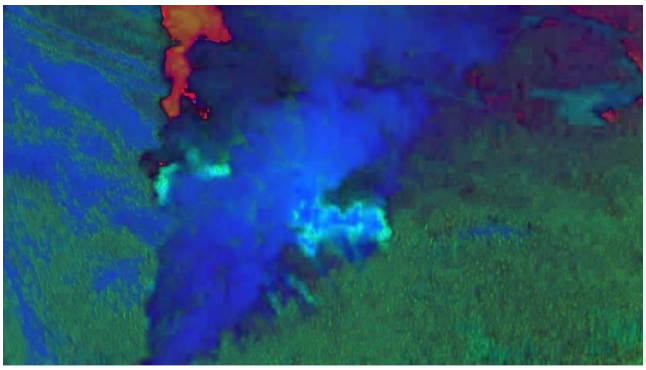
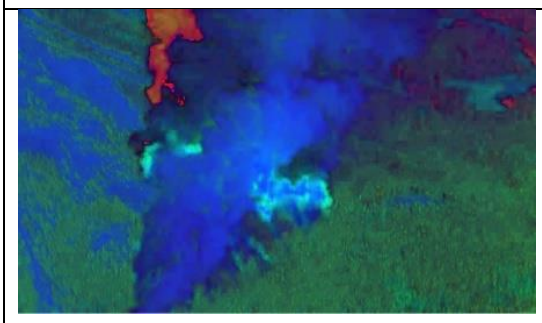
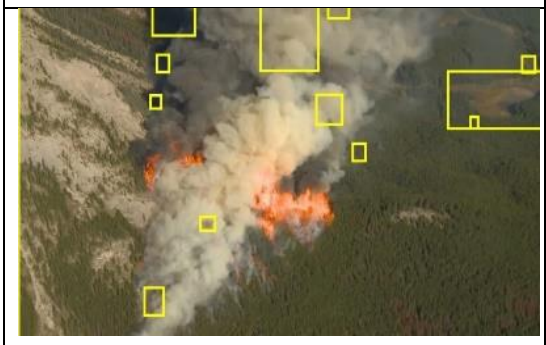


Figure 1.2 smoke detection with color conversion process

In the picture above is an RGB convention that functions to read the gradation effect of color changes in the fire area, this function is useful so that the fire area can be read clearly and does not affect other colors when read by the ground fire system. The area around the hotspot location is a fire-prone area because the location of the fire source is still far below the ground surface

Table 1.1 Testing process on forest objects

Images of forest fires	explanation

	In the picture beside is the original image of the forest fire map taken via drone or using Landsat satellite imagery, the data is used as a sample of large fire areas and the number of burnt areas will be calculated.
	In this image, the RGB color identification process is made in black and white, the function is to sharpen a fire object. This sharpening process is to distinguish an object of fire and smoke or even fog so that the system does not miscalculate and predict the type of object that moves between smoke and fog objects..
	In the fire object section, it is made in the form of HSV to detect color waves from forest objects and the color of fire, the change in color can be used to calculate the temperature parameter which the computer will predict as a flame.
	In this section, the system gives a sign about the number of changes and movements that exist in the object, on the object the computer will automatically predict the impact of damage caused to other areas.
	The picture below is the reading of the x-axis and y-axis coordinate values, the readings on the fire object which will later be calculated to calculate the estimated area of forest fires, the area of the fire area can be used to predict with a simple calculation formula with the formula Length x Width = Axis (X) x with the (y) axis or with the calculation of 216 x 223 = 48.168 M3

3. CONCLUSION

In the testing method for the identification and detection of forest fires using the image processing method, this method can be used as an early warning tool by identifying the movement of smoke or fire which can later be used as a warning tool before the fire spreads. UAV users feel it is appropriate because it can detect a very large area and the data collection process can be done in real time, so an image analysis process is carried out directly or carried out with the help of a computer, this test has an accuracy rate of up to 80% and the algorithm used can detect the presence of fire or smoke objects, while a the process of data reading failure is caused by noise caused by obstruction of fire objects by smoke or fog so that the reading accuracy system becomes wrong, for further development to improve reading accuracy a combination of classic algorithms is needed cation and recognition so that the system can not only display fire areas but can also record and predict future fire areas, this system can use additional sensors in fire-prone areas or by adding algorithms based on Artificial Intelligence.

4. REFERENCES

Adhi Prahara. (t.thn.). *Deteksi Kebakaran pada Video Berbasis Pengolahan Citra dengan Dukungan GPU.* Fakultas MIPA, Universitas Gadjah Mada.

Celik, T., Demirel, H., dan Ozkaramanli, H. (2006). Automatic Fire Detection in Video Sequence . *14th European Signal Processing Conference (EUSIPCO).*

Denny Hardiyanto ; Dyah Anggun Sartika . (2018). *IDENTIFIKASI TITIK API MENGGUNAKAN PENGOLAHAN CITRA FOTO UDARA* . Simposium Nasional RAPI XVII – 2018 FT UMS ISSN 1412-9612.

Fung, J. dan Mann, S.,. (2008). *Using Graphics Devices in Reverse : GPUBased Image Processing and Computer Vision.* USA: NVidia Corporation.

Omid H. Jader, Subhi R. M. Zeebaree, Rizgar R. Zebari. (2019). A State Of Art Survey For Web Server Performance Measurement And Load Balancing Mechanisms . *INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH* .

Setyawan Widyarto; Feriadi ; Andri. (2012). DETEKSI LOKASI TITIK API PADA KEBAKARAN HUTAN MENGGUNAKAN COLOUR IMAGE PROSESSING. *Seminar Nasional Informatika 2012 (semnasIF 2012)* .