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FOREST SAFETY MONITORING SYSTEMS USING DENSE UAV MOTION DETECTION AND REGION EXTRACTION MODEL

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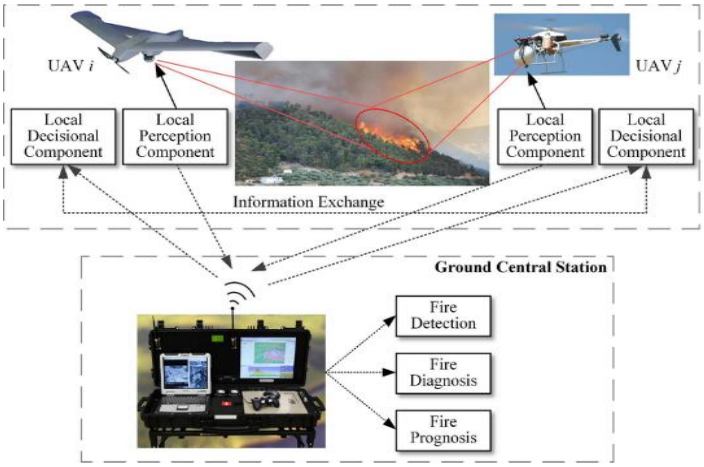
ABSTRACT

Forest is as an important part of the terrestrial ecosystem, is indispensable resource for human survival and social development.The monitoring information of forest fire is obtained by multi-rotor unmanned aerial vehicle (UAV) which carried video acquisition equipment. The real time monitoring and automatic recognition of forest fires are realized by static characteristics of forest fires such as angular second moment, entropy and reciprocal differential moment.

Keywords — forest fire dynamic monitoring; motion detection; motion region extraction; static features; UAV video image.

I.INTRODUCTION

Forest fire poses an extremely serious threat to forest resources which is one of three major forest disasters. Multi-rotor UAV has various advantages such as simple structure, low manufacturing and maintenance costs, convenient deployment and operation merits, which can achieve real - time and efficient forest fire information collecting goals. Several domestic and foreign scholars have studied the smoke detection methods to be applied in forest fire monitoring practices such as histograms of equivalent pattern, Static and dynamic characteristic analysis, video image segmentation as well as Spatial temporal and Dynamic Texture Features.



A novel forest fire monitoring method based on active image analysis for UAV video is presented in this project to automatically identify forest fire.

II PROPOSED WORK

In this project, Traditional video-based forest fire monitoring equipment are usually fixed cameras that are deployed on the top of a mountain, and the background of captured video usually remains static, which is only applicable to long-distance and large-field forest fire monitoring. In addition, there are influential factors such as foggy in videos captured during morning.

III RELATED WORK

Traditional monitoring methods cannot collect forest fire video information in real time and effectively. At present, due to the characteristics of heavy load, long duration and strong wind resistance, eight-rotor unmanned aerial vehicle is widely used in forest fire monitoring field. The eight-rotor aircraft is driven by eight independent motors in which the adjacent motors rotate in the opposite direction to eliminate torque caused by motor rotation. The aircraft can control six freedom degrees of aircraft by controlling the rotational speed of eight rotors. A. Airborne avionics system eight-rotor UAV airborne avionics system designed in this paper includes six parts: flight controller, inertial navigation system, data transmission system, brushless motor controller, power supply system and information acquisition system.

MODULES

USER

ADMIN

ALGORITHM

Convolutional Neural Network Algorithm

Convolutional Neural Network is one of the main categories to do image classification and image recognition in neural networks. Scene labelling, objects detections, and face recognition, etc., are some of the areas where convolutional neural networks are widely used.

CNN takes an image as input, which is classified and process under a certain category such as dog, cat, lion, tiger, etc. The computer sees an image as an array of pixels and depends on the resolution of the image. Based on image resolution, it will see as **h * w * d**, where h=height w=width and d= dimension. For example, An RGB image is **6 * 6 * 3** array of the matrix, and the grayscale image is **4 * 4 * 1** array of the matrix.

In CNN, each input image will pass through a sequence of convolution layers along with pooling, fully connected layers, filters (Also known as kernels). After that, we will apply the Soft-max function to classify an object with probabilistic values 0 and 1.

Convolution Layer

Convolution layer is the first layer to extract features from an input image. By learning image features using a small square of input data, the convolutional layer preserves the relationship between pixels. It is

a mathematical operation which takes two inputs such as image matrix and a kernel or filter.

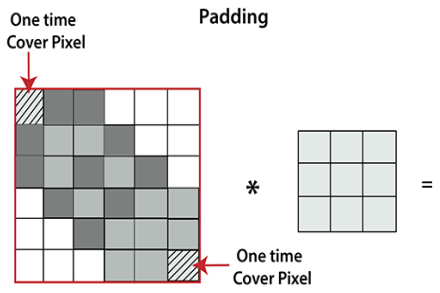
Strides

Stride is the number of pixels which are shift over the input matrix. When the stride is equalled to 1, then we move the filters to 1 pixel at a time and similarly, if the stride is equalled to 2, then we move the filters to 2 pixels at a time. The following figure shows that the convolution would work with a stride of 2.

Padding

Padding plays a crucial role in building the convolutional neural network. If the image will get shrink and if we will take a neural network with 100's of layers on it, it will give us a small image after filtered in the end.

If we take a three-by-three filter on top of a grayscale image and do the convolving then what will happen?



It is clear from the above picture that the pixel in the corner will only get covers one time, but the middle pixel will get covered more than once. It means that we have more information on that middle pixel, so there are two downsides:

- Shrinking outputs
- Losing information on the corner of the image.

To overcome this, we have introduced padding to an image. "Padding is an additional layer which can add to the border of an image."

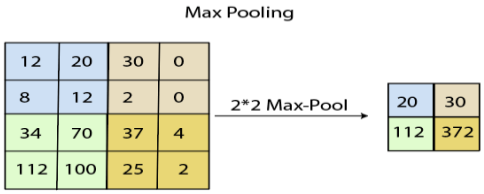
Pooling Layer

Pooling layer plays an important role in pre-processing of an image. Pooling layer reduces the number of parameters when the images are too large. Pooling is "downscaling" of the image obtained from the previous layers. It can be compared to shrinking an image to reduce its pixel density. Spatial pooling is also called down sampling or subsampling, which reduces the dimensionality of each map but retains the important information. There are the following types of spatial pooling:

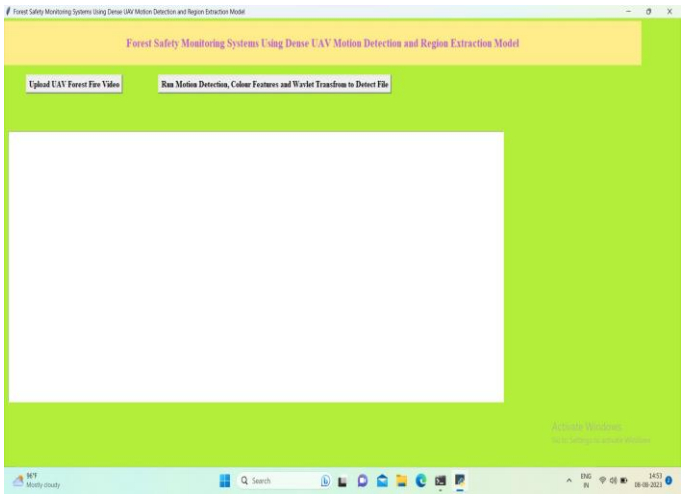
Max Pooling

Max pooling is a sample-based discretization process. Its main objective is to downscale an input representation, reducing its dimensionality and allowing for the assumption to be made about features contained in the sub-region binned.

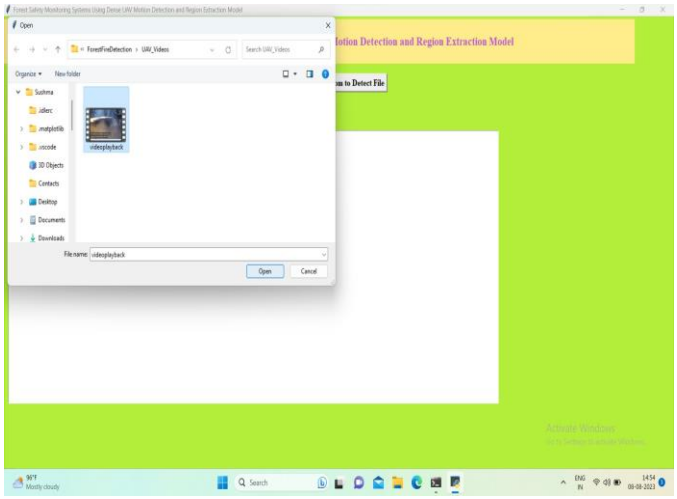
Max pooling is done by applying a max filter to non-overlapping sub-regions of the initial representation.



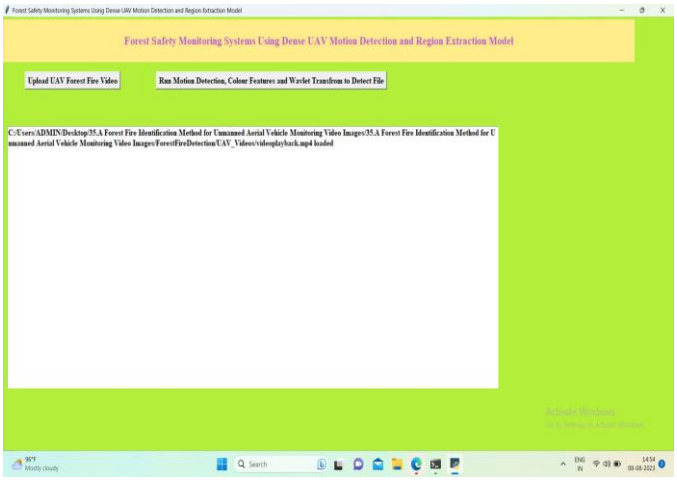
IV RESULTS



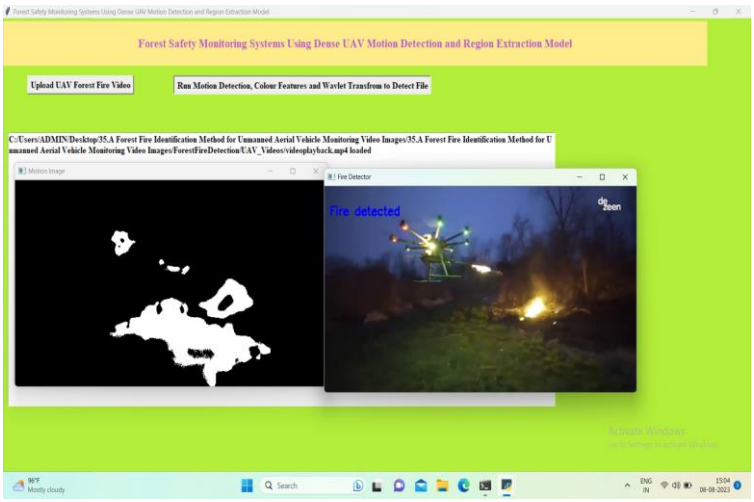
Screen1: In above screen click on 'Upload UAV Forest Fire Video' button to upload Video and get below output



Screen 2: In above screen selecting and uploading video and then click on 'Open' button to upload video



Screen 3: Then click on 'Run Motion Detection, Colour Features and Wavelet Transform to Detect Fire' button to get below output



Screen 4: In above screen, observe the Motion of Fire and Fire detection too

V CONCLUSION

The monitoring information of forest fire is obtained by multi-rotor unmanned aerial vehicle (UAV) which carried video acquisition equipment. The experimental sample image is extracted by frame. This project proposed a forest fire monitoring method for UAV video image based on active analysis. The real time monitoring and automatic recognition of forest fires are realized by static characteristics of forest fires such as angular second moment, entropy and reciprocal differential moment.

FUTURE SCOPE

Enhance the existing Method to achieve real-time fire detection capabilities. This would involve optimizing the algorithm to process video frames in real-time, allowing the identification of forest fires as soon as they occur. Real-time detection can enable prompt response and early intervention to mitigate the fire's impact.

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