ARTIFICIAL INTELLIGENCE

EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRE

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Survey 1:

J. R. Martinez-de Dios and B. C. Arrue, A. Ollero (2008)

‘Computer vision techniques for forest fire perception’

This work presents computer vision techniques for forest fire perception involving measurement of forest fire properties (fire front, flame height, flame inclination angle, fire base width) required for the implementation of advanced forest fire-fighting strategies. The system computes a 3D perception model of the fire and could also be used for visualizing the fire evolution in remote computer systems. This system integrates the processing of images from visual and infrared cameras. It applies sensor fusion techniques involving also telemetry sensors, and GPS. The paper also includes some results of forest fire experiments.

Survey 2:

B. Ko and S. Kwak (2012)

‘Computer vision based natural disaster warning systems’

The algorithm uses YCbCr color space which is better in separating the luminance from the chrominance and has good detection rate. five fire detection rules are applied to detect the fire. The performance of the algorithm is tested on data set consisting of 6 videos collected from Internet, four of which were actual fire videos, while two were fire-like objects videos. TP-rate and TN-rate were calculated. The results show that the proposed algorithm achieves good detection rates. These results indicate that the proposed method is accurate and can be used in automatic forest fire-alarm systems.

Survey 3:

V. Vipin (2012)

‘Image processing based forest fire detection’

In this research work a rule based color model for forest fire pixel classification is proposed. The proposed color model makes use of RGB color space and YCbCr color space. From this a set of seven rules were defined for the pixels to be classified as fire pixel. The performance of the proposed algorithm is tested on two sets of images; one containing fire and the other with no-fire images. The proposed model achieves 99% flame detection rate and 14% false alarm rate. The arithmetic operations of this model are linear with the image size. Also, the algorithm is cheap in computational complexity. This makes it suitable to use in real time forest fire monitoring system.

Survey 4:

C Emmy Premal and SS Vinsley (2014)

‘Image processing based forest fire detection using YCbCr colour model’

In this paper image processing based forest fire detection using YCbCr colour model is proposed. The proposed method adopts rule based colour model due to its less complexity and effectiveness. YCbCr colour space effectively separates luminance from chrominance compared to other colour spaces like RGB and rgb(normalized RGB). The proposed method not only separates fire flame pixels but also separates high temperature fire centre pixels by taking in to account of statistical parameters of fire image in YCbCr colour space like mean and standard deviation. In this method four rules are formed to separate the true fire region. Two rules are used for segmenting the fire region and other two rules are used for segmenting the high temperature fire centre region. The results obtained are compared with the other methods in the literature and shows higher true fire detection rate and less false detection rate. The proposed method can be used for real time forest fire detection with moving camera.

Survey 5:

T, Celik, H. Demirel, and H. Ozkaramanli (2006)

'Automatic fire detection in video sequences'

This paper propose a real-time fire-detector which combines foreground information with statistical color information to detect fires. The foreground information which is obtained using adaptive background information is verified by the statistical color information which is extracted using hand labeled fire pixels to determine whether the detected foreground object is a candidate for fire or not. The output of the both stages s analysed in consecutive frames which is the verification process of fire that uses the fact that fire never stays stable in visual appearance. The frame processing rate of the detector is about 30 fps with image size of 176x144 which enables the proposed detector to be applied for real-time application.

Survey 6:

Y. Zhu, L. Xie, and T. Yuan (2012)

'Monitoring system for forest fire based on wireless sensor network'

Wildfires erupt annually around the world causing serious loss of life and property damage. Despite the rapid progress of science and technology, there are no effective means to forecast wildfires. Various wildfire monitoring systems are deployed in different countries, most depend on photos or videos to identify features of wildfire after the first outbreak, while the delay of confirmation varies with technology. An autonomous forest wildfire early warning system is presented in this paper, which employs a state-of-the-art unmanned aerial vehicle (UAV) to fly around a forest regularly according to established routes and strict procedures, to collect environmental data from sensors installed on trees, to monitor and predict wildfire, then provide early warning before eruption if a danger emerges. Bluetooth Low Energy (BLE) is employed to exchange data between UAV and the host of sensors. The collected monitoring data, such as temperature and humidity, is effective to reflect the real condition of the forest, which could result in early warning of wildfires. The application of this system in the environment will enhance the ability of wildfire prediction for the community.

Survey 7:

D. Doolin and N. Sitar (2005)

‘Wireless Sensors for Wild Fire Monitoring’

This paper describe the design of a system for wildfire monitoring incorporating wireless sensors, and report results from field testing during prescribed test burns near San Francisco, California. The system is composed of environmental sensors collecting temperature, relative humidity and barometric pressure with an on-board GPS unit attached to a wireless, networked mote. The motes communicate with a base station, which communicates the collected data to software running on a database server. The data can be accessed using a browser-based web application or any other application capable of communicating with the database server. Performance of the monitoring system during two prescribed burns at Pinole Point Regional Park (Contra Costa County, California, near San Francisco) is promising. Sensors within the burn zone recorded the passage of the flame front before being scorched, with temperature increasing, and barometric pressure and humidity decreasing as the flame front advanced. Temperature gradients up to 5 C per second were recorded. The data also show that the temperature slightly decreases and the relative humidity slightly increases from ambient values immediately preceding the flame front, indicating that locally significant weather conditions develop even during relatively cool, slow moving grass fires. The maximum temperature recorded was 95 C, the minimum relative humidity 9%, and barometric pressure dropped by as much as 25 mbar.

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