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WILDFIRE AND FIREACCIDENT PREDICTION AND IMMEDIATE RESPONSE USING YOLOV3

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Abstract - *Fire accidents are one of the most common forms of accidents plaguing the society at large. Fire accidents arealso the cause of huge loss to lives and property. Such a accident need a good detection system for reducing the loss of lives and property. There are a quite a few such existing systems, however they are not as much effectiveas the situation demands to need. So we have proposed anew system to detect fire from infrared images. We are making use of computer vision and machine learning techniques to make it efficient and reliable. Also the system uses brightness classification along with image processing and histogram based segmentation. All these are made to increase the accuracy and also makes the system more suitable for real time implementation. Thus the proposed system not only solves the existing problems but also provides a new and efficient approach.*

Key Words: **Convolutional Neural Network, Deep Learning, Forest fire, Loss Function, Machine Learning, Optimization Algorithm, YOLOv3.**

1. INTRODUCTION

Fire accidents are common in wildlife and always need an accurate system for tagging and prevention at early stages. By detecting a fireplace quickly and accurately (i.e., by not sacrificing speed or causing false alarms) and providing early warning notification ,a fire- detection system can limit the emission of toxic productscreated by combustion, also as global-warming gases produced by the hearth itself. These environmental effects often are overlooked, but undoubtedly occuraltogether fire scenarios. Therefore, reducing the likelihood of a fireplace is a crucial a part of protecting wildlife.

EXISTING SYSTEM

Sensor technology has been widely utilized in fire detection, usually counting on sensing physical parameters like changes in pressure, humidity, and temperature, also as chemical parameters like CO2, carbon monoxide gas, and dioxide. However, it's hard to use these systems in large open areas for a spread of reasons like high cost, energy usage by the sensors, and therefore the necessary proximity of the sensor to the hearth for accurate sensing leading to physical. The existing system is predicated on CNN. The existingsystem uses outdated machine learning techniques that aren't updated and ineffective to the fashionable world, Also the prevailing system doesn't add a stable manner and it's said to be unstable during high data inputs. In a wireless sensor-based fire detection system, coverage of huge areas in forest is impractical thanks to the need of normal distribution of sensors in close proximity and also battery charge may be a big challenge Most of themsensors based are generally limited to indoors. They detect the presence of particles generated by smoke and fire by ionization, which needs an in depth proximity to the hearth. Consequently, they can't be utilized in large covered area. More over,they cannot provide information about initial fire location, direction of smokepropagation, size of the hearth ,growth of the hearth etc. to urge over such limitations image fire detection systems are used.The reaction time of image processing model is best then that of existing image processing systems and also less than the prevailing system.

PROPOSEDSYSTEM

The idea is to deploy this model on a transportable Neural Network compute stick like one made by Intel. The camera of UAV captures the imagery in real time and that we capture frames from the feed of 30fps at 1 frame for every 120 frames which provides us a yield of around 1 frame every 4 seconds using open source computer vision OpenCV. This frame is then run through the model which provides the prediction of wildfire and using geo-spatial tagging we will locate the precise location of fireside. the situation tagging done using GISmodule, study of which is beyond the scope of this project. We have trained a full image classifier supportedthe positive and negative images. a picture is named negative image if there's no fire patch in it and a positiveimage should contain a minimum of one fire patch. Sincewe've a moderately small dataset, training a full image classifier from scratch may suffer from over fitting. One efficient thanks to train a YOLOv3 classifier on a little dataset is that the fine-tuning technique, which may transfer the previously learned network parameters to the new model. Performance may be a very crucial requirement, since YOLOv3s are complex models with many learnable parameters. Therefore YOLOv3s are usually trained on graphics processing units(GPUs) rather than central processing units(CPUs). GPUs are hardware, specifically optimized for executing manyparallel matrix operations as needed for graphics processing. YOLOv3s have a inherently

parallel structure and thus similarly enjoy a high level of parallelization. Learning algorithm used is Rmsprop Optimization Algorithm.

ADVANTAGES

- The proposed system also has a accuracy of 86% which is comparatively higher.
- The proposed system is power efficient.

II. METHODS AND MATERIAL

LITERATURE SURVEY

[1]. Optimization of Geographic Information Systems for Forest Fire Risk Assessment

Forest fires are natural disasters defined as uncontrolled and unrestrained movements of fire across forested areas. They pose a permanent hazard of forest and forested land loss. The increasingly more frequent forest fires are often of great magnitudes, threatening not only forests but also crops, residential areas, and human lives. Forest fire fighting involves three crucial stages: prevention, detection, and extinguishment. This paper discusses the preventive measures against forest fires as well as methods of forest monitoring as a means of preserving forest biodiversity. Using modern information technology, such as geographic information systems (GIS), can improve strategic and tactical planning and actions aimed at fire prevention. The paper showcases the application of selected information system as forest fire protection in Serbia.

[2]. Evaluation of Random Forest model for forest fire prediction based on climatology over Borneo

Indonesia has entered an alarming condition related to forest fires. It is becoming a seasonal hazardous phenomenon in tropics. As the largest tropical forest in Indonesia, Borneo is the most susceptible area to fire especially in dry condition. Forest fires are threatened by climate, human activities, and ecosystem processes, but only climate variable can be quantified well in Borneo. This research aims to evaluate random forest model in predicting forest fires based on the climate variables and satellite data of burned area. Prediction of forest fires is expected to reduce the impact of forest fires in the future. Based on analysis of spatial and annual variability, the random forest model with all selected climate variables can represent the forest fires event over Borneo.

[3]. Aerial Forest Fire Surveillance - Evaluation of Forest Fire Detection Model using Aerial Videos

Unmanned Aerial Vehicles (UAVs), which can provide an aerial view for fast responding in large-scale zones of disaster, are recently utilized for forest fire monitoring.

In this paper, one general model of forest fire detection using aerial videos is investigated to prove its robustness for practical application of aerial forest fire surveillance. Fire pixels are extracted using the color and motion characteristics of fire. The fire detection performance is evaluated through a large database of various scene conditions to show the efficiency as well as deficiency of our fire detection model in previous study. Our database consists of 49 aerial videos with total of 16898 examined frames of forest fires. The accuracy rate of our forest fire detection model is 93.97 % while the false alarm rate and the miss rate are 7.08 % and 6.86 %, respectively. Thick smoke which covers almost the fire is found as the main cause of miss detection in our fire detection model. To enhance the detection performance, in this study we propose one more stage of smoke detection. Smoke pixels are segmented using both color and motion characteristics of smoke. The results prove that smoke detection stage give help in detecting the fire area in case of smoke.

[4]. Speculation of Forest Fire Using Spatial and Video Data

Forest fire is a natural calamity which causes immense loss to the ecology. The high severity fire causes most loss to the vegetation. So this fire has to be detected within forest region in order to save vegetation. Currently frameworks are available with the image processing system which does analysis over the static forest fire image which provides information of fire hot spots. The fire motion/movement analysis with forest zone analysis is a challenging task with such static images. This problem can be solved with continuous monitoring of the fire with videos. Hence proposed framework provides novel forest fire flame movement analysis system based on spatiotemporal features using videos.

[5]. Early Detection of Forest Fire Based on Unnamed Aerial Vehicle Platform

As a kind of natural resources, forest is vital to our survival. Once the fire happening in forest is not found in time, it can cause a huge loss. Accurate real-time monitoring of forest fires is not only an important part of forest fire prevention, but also an important means to effectively control the spread of forest fires and reduce economic losses. Forest areas are often geographically widely distributed and inefficient in manual inspections. Therefore, we need a highly mobile early forest fire warning system to ensure the safety of forest resources. UAVs serve as a highly mobile inspection tool to meet inspection requirements of forest fires. Besides, the early flame characteristics are not obvious, and the single source fire detection is easy to false alarm. In view of this, we propose a forest fire detection method that uses optical images to detect smoke and infrared images to detect fire.

III. IMPLEMENTATION

MODULES

1.Model construction and data input

In this module we input the data that is required to predict the forest fires and come up with defined set of values which would state if the wildlife fire is possibly

happening or not, in any cases the main module is the input module where the data are implemented, in this module the data can be directly added via GUI or through an end point connection which can be able to produce the output if there is forest fire or not.

2. Loading the model and augmentation

In this module the previous input data gets preprocessed into the required raw format is processed into the augmentation module to carry over the training module which feeds the data into its machine learning system and compares with those of the pre-trained datasets which essentially makes the process more efficient and easier.

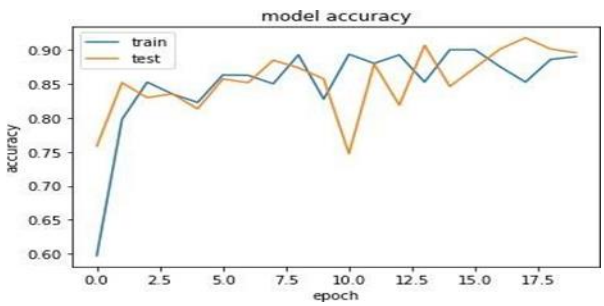
3. Data processing module

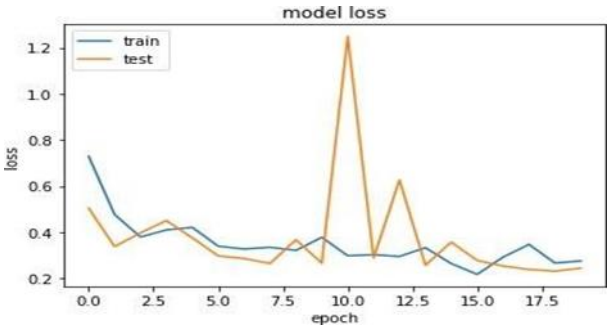
This is the main module where all the data processing and developing happens, this is where the machine learning methods gets trained with the new and existing datasets and develops a graph accordingly to the curve of the output methods which also increases the rate of finding the output module with more efficiency and accuracy to predict and find the forest fire methods that has evolved.

4. Alert system module

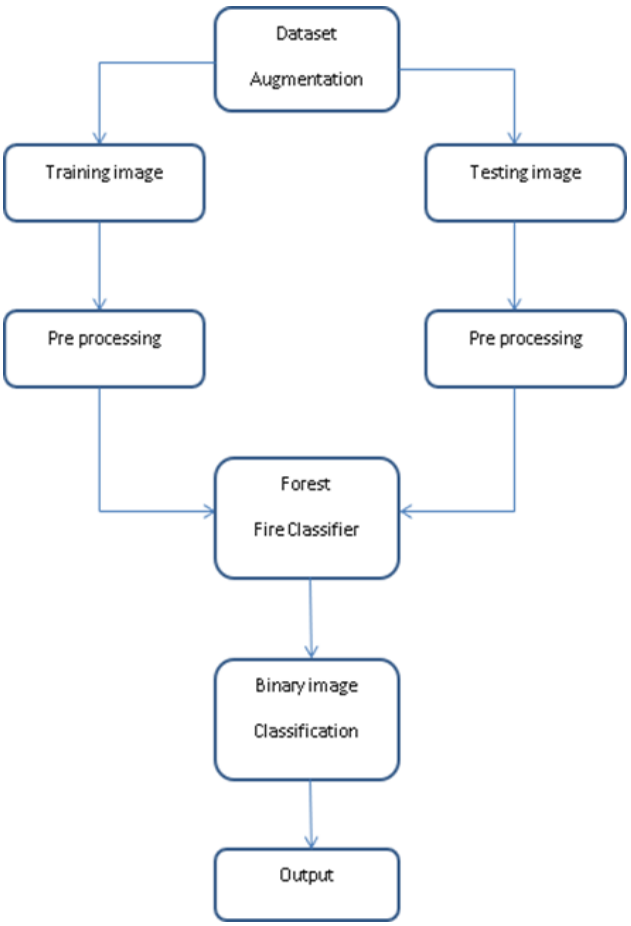
In this module we predict the data and come up with a solution and some key insights which tells us the rate of the prediction and if there is any forest fire in the predicted values the system automatically alerts the required personnel in charge and also send an email to the required connects who can be able to solve the issue immediately, if there is no forest fire there won't be any notification till anything unusual happens in the system of choice to come up with sudden notification on fire as soon as the activity arises in the premises.;

MODEL CONSTRUCTION





ARCHITECTURE DIAGRAM



CONCLUSION

This paper proposes an approach to detection of forest fire through the usage of photographed data of forest area followed by computer processing of the data by a method for reading information, pre-processing of an image color components, the segmentation and data classification using rmsprop optimization algorithm is proposed and predict the accuracy of forest fire. The efficiency of the proposed procedures is shown: 88 % detection accuracy and 27.90% false detection is shown.The proposed method is used in the monitoring systems of the fire area detection.

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