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FOREST FIRE DETECTION BASED ON CONVOLUTIONAL NEURAL NETWORK ALGORITHM

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***Abstract*— Early detection of forest fires is very important to avoid major forest damage caused by fires. Early fire detection focused on detecting smoke. The forest area is slowly declining due to increased forest fires and human activities. Satellite sensor is used to collect hot forest image in different locations and analyze data from these images to determine the location of the fire if possible. Image processing can effectively predict forest fires. The input image is pre-processed to improve image quality, because the input image has sound, so the pre-processing method is used to eliminate the noise in the system and to improve image quality. The previously processed image is transferred to the splitting process; processes the image to get closer to the forest floor. In this system, the affected area is detected separately, and provides accurate forest fire in this system because the image strength you produce is better than stabilizing the average value of the image. In our proposed system we propose an in-depth learning approach that uses the Convolutional Neural Network (CNN) to predict forest fire detection. The convolutional layer is the main structure of the convolutional neural network. Typically, network layers are fully connected when a neuron in the next phase is connected to all neurons in the previous layer. We will detect fire in the forest effect based on the accuracy we find on the train and test the database based on the CNN algorithm using what we show the effect of the graph..**

Keywords—Convolutional Neural Network, fire detection, Pre-Processing, forest thermal image.

I. INTRODUCTION

Early detection of wildfires is important for the protection and protection of the environment and is one of the most important and major challenges in the public sector and forest fire management. Forest fires are important to reduce forest area. This method of fire detection also lowers human contracts and helps to monitor and protect areas that are difficult to protect. The new strategy is being used to simplify the implementation of systems that allow monitoring to work efficiently in detailed areas, whether wind or day.

The satellite sensor is used to capture the image of a forest fire, but it has a growing list of resolution and space of the forest area. Satellite imagery has provided a fire detection, management, and detection tool for damaging burns in order to understand the corresponding fire range. The goal of separating this fire, like objects from the first fire, is to check the color compatibility. The proposed algorithm fixed the problem and minimized the error. It not only sees fires but also separates fires such as fires and building materials.

The parameters adopted for the operation of our proposed system to analyze forest fires, threshold value, matrix value detection, and the value of a different system matrix. Forests as a whole have become increasingly vulnerable to human activity because of human efforts. Excessive population growth and rapid urbanization have led to the entry of forest areas to build homes, factories, bridges etc. Besides, a lot of illegal activities such as poaching, logging etc. they occur in forested areas. Almost all Maoist activities come from unprotected areas of the forest. Forest rangers can only control a limited area due to inaccessibility, lack of resources and staff shortages. Also, regular monitoring of these forests is tedious and almost impossible.

This module detects human and animal activity using infrared thermal imaging cameras. An IR sensor is used to monitor the entry and exit of people or animals. The relative position of the animals in the forest is measured using an ultrasonic sensor. In addition, readings of temperature and humidity are also collected using the DHT-11 sensor. The whole system is charged using a solar cell. Therefore, this module also detects forest burns at the first level and helps determine forest areas that need more attention. These programs are aimed at assisting forest rangers to use their resources more efficiently and effectively to protect the forest effectively. Forest fires can cause many natural disasters, cause serious economic and environmental losses and endanger human life..

Convolution Neural Network

Convolutional neural networks are a special type of artificial intelligence networks that use mathematical operations called convolution instead of repeating a normal matrix in at least one of them. They are specifically designed to process pixel data and are used for image recognition and processing.

Variable layers combine inputs and transfer their effect to the next layer. This is similar to the response of a neuron to the visual cortex. Each convolutional neuron processes only the data of its receiving field. Although fully integrated

neural feeds networks can be used to study features and separate data, this structure generally does not apply to larger inputs such as high-resolution images. It will require a very high number of neurons, even in a shallow area, due to the large input size of the images, where each pixel is a suitable input element.

This paper suggests another way to detect forest fires in convolutional neural networks. Pre-image processing functions such as histogram measurement and smooth ground filtering are performed before uploading the image to the CNN network. The effectiveness of the proposed method is confirmed by obtaining realistic images of forest fires

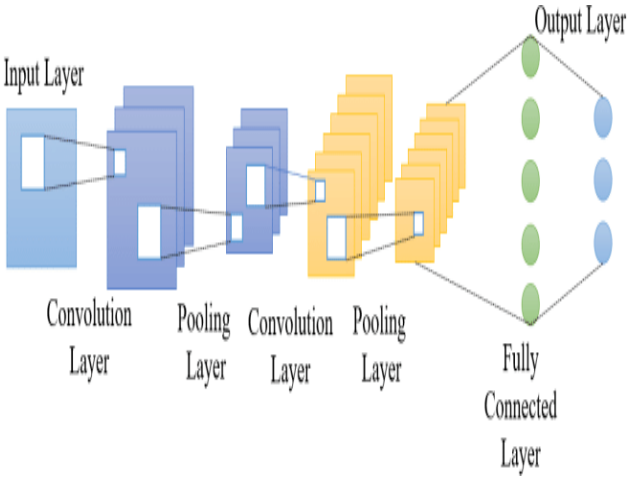


Fig1. Architecture of Convolutional Neural Network

II. LITERATURE REVIEW

Forest Fire Discovery Using the Integrated Architecture of Separable Convolution and Image Processing, 2021
This study proposes the integrated design of CNN's simple and diversified model in general and its limited digital image processing unit. In addition, CNN's simplified statistically sophisticated model costs less (training time 1.36 hours in 39375 images) and displays 100% AUC on the training set and 97% AUC with 92% F points -1 on test set. . Overall, the proposed integrated structure can accurately detect forest fires with a sensitivity of 98.10% and a low specificity of 87.09%, exceeding the performance shown by complex algorithms. But, there, No comparisons are made between the accuracy of several algorithms. The accuracy of the whole class was found to be the same regardless of the kernel types. The occurrence of errors is high in the Feed Forward Neural Network with many hidden neurons. Processing model construction requires fast and cost-effective processors. In the proposed method we perform a subdivision process and determine the amount of burnt area using hue saturation.

Thomas N. Polivka, Jun Wang, Luke T. Ellison, Edward J. Hyer, and Charles M. Ichoku "Improving Night Fire Discovery through the VIIRS Day – Night Band", 2016
The basic premise for this is that the pixels with visible light emissions and the most pronounced BT4 signals may be fires (or volcanoes in some cases). Initially, FILDA and AFARP started out almost identical by testing invalid pixels such as clouds and bad data, although FILDA does not release water pixels. FILDA's additional step also filters pixels with less than 100◦ solar zenith angle, completely clearing out all dark spots and thus focusing on night-time firefighting only. After that, a split correction is applied, and the DNB is merged with the M bands. But, there, tt does not have a hot water vapor belt. Therefore, no clean spirits can be found. The VIIRS day / night band offers an amazing opportunity to bring back the wind during a long polar night (winter).

Khan Muhammad, Student Member, IEEE, Jamil Ahmad, Student Member, IEEE, Zhihan Lv, Member, IEEE, Paolo Bellavista, Senior Member, IEEE, Po Yang, Member, IEEE, and Sung Wook Baik, Member, IEEE , "Efficient Deep Firefighting Based on CNN and Local Performance in Video Monitoring Applications", 2018.
The embedded power of intelligent cameras provided the opportunity to monitor intelligent CCTV systems. A variety of unusual events such as accidents, medical emergencies, and fires can be detected using these smart cameras. Of these, fires are the most dangerous and rare, as failure to control them early can lead to catastrophic losses, resulting in loss of human, environmental and economic health. Encouraged by the powerful forces of CNN, we propose a lightweight CNN based on Squeeze Net architecture for firefighting on CCTV monitoring networks. Our path can detect a fire in the area and identify a guard object. But, there, Cost — Probably the biggest disadvantage of a video surveillance camera system. Hard to Use-If you are not a techie person, you may have a hard time learning how to use your video surveillance camera system as some programs can be very complicated.

Kosmas Dimitropoulos, Panagiotis Barmpoutis and Nikos Grammalidis, "Spatio- Temporal Flame Modeling and Dynamic Texture Analysis for Automatic Video-based Fire Detection", 2013.
We have proposed a real-time fire detection algorithm in the video. By modeling both fire behavior using various spatio-temporal features and the temporary appearance of pixel stiffness in the candidate image block with flexible texture analysis, we have shown that we can have higher detection rates, while minimizing false alarms caused by fire-colored moving objects. The use of the same spatiotemporal force enhances algorithm robustness by using prior knowledge about possible fire presence in neighboring blocks from current and previous video frames. Experimental results with thirty-seven videos containing real fire and moving fire colors have shown that the proposed algorithm exceeds the existing flame detection algorithms. But, there, Mapmaker and map reader, This installation focuses on time map creation and spatiotemporal data, time types, current map modes.

Yogesh Deshpande, Crispin Lobo, Jahnavi Patel, Krishi Savla, Prof. Shivani Bhattacharjee, "cartographer and map reader. This entry focuses on time mapping and spatiotemporal data, time types, current mapping methods", 2013.

This program aims to better monitor the forest. Forest rangers and other relevant authorities can deploy their resources effectively based on the requirements determined by this system. The forest monitoring unit will be located in appropriate locations to provide useful data. This program will make forest monitoring more effective and easier. But, when, As communication is made in an open space, it is less secure.

Yanhong Chen, Youmin Zhang, Jing Xin, Guangyi Wang, Lingxia Mu, Yingmin Yi, Han Liu1, Ding Liu, "A UAV-Based Forest Fire Vision Convolutional Neural Network ", 2019.

Smoke detection method that combines the removal of the LBP element with the SVM separator, using texture features for smoke detection; a method of detecting forest fires based on a convolutional neural network: detection of smoke and flames was performed by two CNN models. Based on the output effect of the feature, "equivalent rotating LBP mode (solid RILBP)" is used for smoke detection. Compared to the CNN-9 model, the CNN-17 model reduces algorithm complexity and improves acquisition accuracy. In addition, the method proposed in this paper finds both smoke and flame. Finally, ef'

III. EXISTING SYSTEM

Pictures of forest fire discovery are based on fire photos and non-burning images. It finds a wildfire in the forest. Finding a forest fire somewhere is not easy to spot. The existing system gets a low level of accuracy fire-based operations occur in the forest. The existing system does not successfully detect and detect fire in a forest area.

DISADVANTAGES OF EXISTING SYSTEM

- No comparisons were made between the accuracy of a particular algorithm
- The accuracy of the categories is generally found to be the same regardless of kernel types.
- Mistakes occur a lot in the Feed Forward Neural Network with a large number. of hidden neurons
- Processing model design requires fast and cost-effective processors.

IV. PROPOSED SYSTEM

The proposed model was introduced to overcome all problems from the existing system. This system will enhance the accuracy of the deep neural network results by separating the forest fire image database using the Deep learning algorithm. Improves the performance of the total segmentation results. In the pre-processing process we performed a separation process to identify the fire area. Finding forest fire in different images to get the most reliable accuracy.

ADVANTAGES

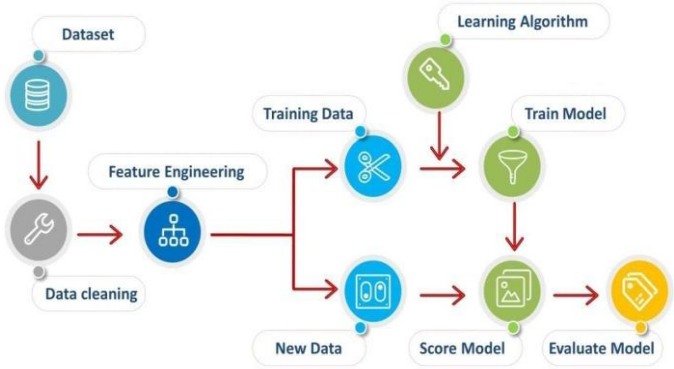
- High performance.
- The separation process is easy to detect in a forest fire.
- The Convolutional Neural Network is used to obtain the most accurate accuracy.

Modules Used:

Data Selection and Loading

Data selection is the process of selecting fire detection data In this project, a fire database is used to predict forest fires. Database that contains information about forest fires and related areas Data uploading is the process of copying and uploading data or data sets from a source file, folder or application to a similar website or application. as a process of determining the appropriate type of data and source, as well as the appropriate data collection tools. Data selection precedes actual practice.

Fig2. Data Selection and loading



Data Pre-Processing

Pre-image Data Processing is the process of obtaining measurement data from the database.

Resize image data set: Reset fire image size to 200.

Data acquisition: That category data is defined as a variable with a limited set of recalculated values. Those very advanced learning algorithms require array input and output output.

Pre-data processing, part of data processing, describes any two types of data processing performed on raw data to prepare for other data processing processes. Traditionally it has been an important first step in the data mining process.

Fig3. Sample Fire and Non-fire mages

Segmentation

In digital image processing and computer visualization, image separation is the process of dividing digital image into several parts (pixel sets, also known as image objects). The goal of classification is to simplify and / or transform the representation of an image into something logical and easy to analyze. Image classification is often used to find objects and borders (lines, curves, etc.) in images. More precisely, image classification is the process of labeling all pixels in an image so that pixels with the same label share certain features.

The result of a photo segment is a set of segments that cover the whole picture, or a set of concerts drawn from the picture. Each pixel in the area is the same in relation to a particular feature or computer-generated material, such as color, thickness, or texture. Nearby regions are very different in terms of (features). When applied to a wide range of images, common in medical imagery, post-split image concerts can be used to create 3D reconstruction with the help of translation algorithms such as marching cubes.

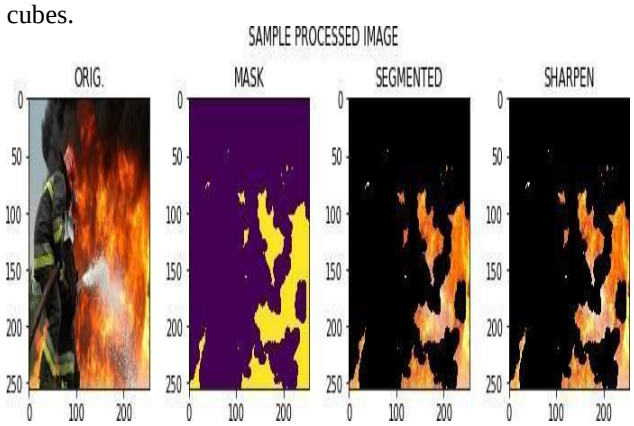


Fig 4: Sample Processed Image

Splitting Dataset Into Train And Test Data

Data segregation is the act of dividing available data. Two parts, usually designed for verification purposes.

One part of the data is used to improve the prediction model and the other is used to evaluate the performance of the model.

Separating data into training and testing sets is an important part of testing data mining models.

Typically, when separating data set from a training set to a test set, more data is used for training, and a smaller portion of data is used for testing.

Classification

CNN In deep learning, the convolutional neural network (CNN, or ConvNet) is a class of deep emotional networks, often used to analyze visual images. They have applications for image and video recognition, complimentary programs, image classification, medical image analysis, natural language processing, brain-computer communication, and a series of financial periods. CNNs are standard versions of multilayer perceptrons. Multilayer perceptrons usually refer to fully connected networks, that is, each neuron in a single layer is connected to all the neurons in the next layer. The "full connection" of these networks makes them prone to data entry. Typical stopping methods include adding a certain amount of weight loss measurement to the weight loss function. CNN takes a different approach to familiarity: they use a data category pattern and integrate complex patterns using simple and simple patterns. Therefore, in terms of connectivity and complexity, CNNs are at a very low level. Convolutional networks are promoted by biological processes in that the pattern of communication between neurons is similar to that of the visible corporations of animals. Each cortical neurons respond to stimuli only in a limited area of the visual field known as the receptor field. The receiving fields of different neurons are so intertwined that they close the entire field of view.

Prediction

It is a process of forest fire from a database.

This project will successfully retrieve data from the database by improving the performance of all guessing results.

V. RESULT AND DISCUSSION

In Convolutional Neural Network Memory Short-term Memory (CNN) used to develop forest fire detection methods based on satellite imagery is suggested. The ability to compile information has been demonstrated to measure both the calculation results and the size of the images obtained by forest fires. The importance of using satellite imagery structures, different types of early research, and other commonly used techniques were advised to explain the ongoing development of satellite imagery. Test results show that the proposed model works well in terms of fire detection accuracy; provides a low level of falsehood in large areas. This model presents various studies of the techniques and processes for the separation of satellite imagery. The improved system can be continuously improved by using a qualitative survey of the expansion of the natural scale. In the future, we will implement this process in different forums. Image processing is one of the most widely used methods to extract data from different sources and to organize it for better use. The system can be developed using a combination of different color rules; however, the challenge is to choose the right rules in different colored areas to build the path.

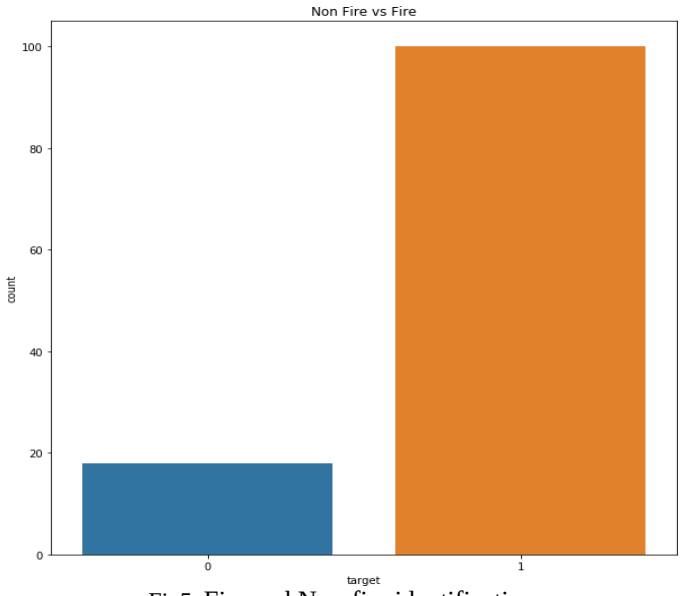


Fig5. Fire and Non-fire identification matrix

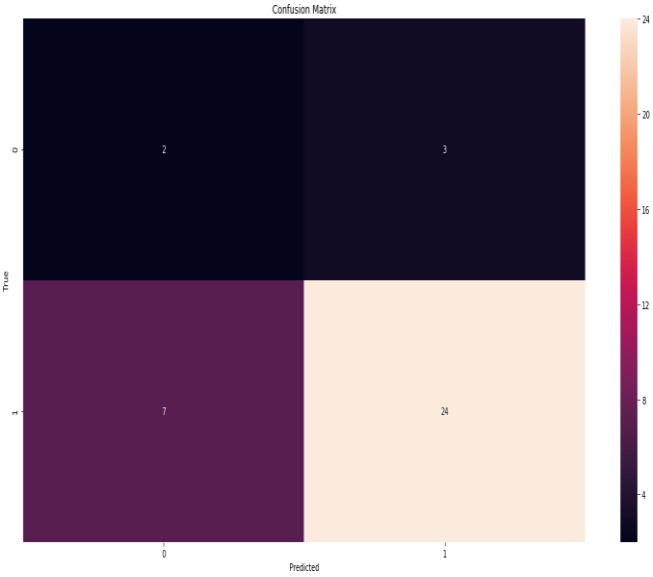


Fig6. Fire and Non-fire confusion matrix

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