LITERATURE SURVEY

TOPIC:

AI – EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRES

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1) Title: Artificial intelligence for forest fire prediction

Authors: George E.Sakr , H.Elhaji , George Mitri , Uchechukwu C.Wejinya

Publication year: July 2010

Abstract:

Forest fires are wildfires that spread uncontrollably, burning plants, animals, grasslands, and brushlands that fall in their path. The wind spreads the fire rapidly , causing for longer changes. Forest fire prediction constitutes a significant component of forest fire management. A novel forest fire risk prediction algorithm, based on support vector machines ,is presented . The algorithm depends on previous weather conditions in order to predict the fire hazard level of a day.

Introduction:

Forest fire prediction, prevention and management measures have become increasingly important. Systems for forest fire danger prediction represent an essential tool to predict forest fire risks, back up the forest fire monitoring and extinction phase, and to assist in the fire control planning and resource allocation. At present many fire risk models make use of forest fire databases to construct and asses probabilistic models. The probability estimation is helpful for fire fighters resources allocation. Gis based forest fire risk model is implemented to study the vegetation,climate, topography, and their associated factor to causing forest-fires.

Techniques and algorithms used:

Gis (graphic information system technology), density based spatial clustering of application with noise, spatio-temporal data mining, multiple regression (MR), decision tree, random tree, Neural networks, support vector machines. The overall performance was measured using two techniques: The mean absolute deviation, Root mean square error. In order to perform prediction, it is required to specify the parameters monitored during the day that are used in the prediction algorithm.

They are feature selection, support vector machines, detection architecture. The method introduces a fire risk index on a scale of 1 to 4, where 1 corresponds to the lowest fire risk and 4 to the highest fire risk. This index corresponds to the potential number of fires that could occur on a specific day and hence can be used to estimate the actual number of fires on that day.

Results:

The proposed method introduces a fire risk index on a scale of 1 to 4, where 1 corresponds to the lowest fire risk and 4 to the highest fire risk. This index is based on the number of fires that occurred on a specific day and hence can be used to estimate the actual number of fires that could happen on that day. The above architecture could be used for monthly prediction, by associating the average weather parameters of a month with a scale for the following month. Or it could be used for annual prediction by associating the average weather of the year with the scale of the next year.

2) Title: Early forest fire detection using drones and artificial intelligence

Authors: Diyana Kinaneva, Georgi Hristov, Jordan Raychev, Plamen Zahariev

Publication year: may 2019

Abstract:

The solution mainly aim to mitigate the damage caused by the fires, using methods for their early detection. In this paper, we discuss a new approach for fire detection and control, in which modern technologies are used. In particular, we propose a platform that uses Unmanned Aerial Vehicles (UAVs), which constantly patrol over potentially threatened by fire areas. The UAVs also utilize the benefits from Artificial Intelligence (AI) and are equipped with on-board processing capabilities. This allows them to use computer vision methods for recognition and detection of smoke or fire, based on the still images or the video input from the drone cameras. Several different scenarios for the possible use of the UAVs for forest fire detection are presented and analyze in the paper, including a solution with the use of a combination between a fixed and rotary-wing drones.

Introduction:

The most important factors in the fight against forest fires include the earliest possible detection of the fire event, the proper categorization of the fire and fast response from the firefighting departments. This involves two types of UAVs – a fixed-wing drone and a rotary-wing drone. Both UAVs will be equipped with cameras, which will be optical, thermal or both. The platform is completely automated since both drones have on-board computers and processing capabilities.

Technology and techniques used:

UAV (unmanned aerial vehicle), GPS, neural networks. Fire detection systems for outdoor environment could be implemented by using specialized cameras, which are able to capture multispectral images. It consists of two types of

UAVs, which will fly at different altitudes. The neural networks are specialized computer models, which can be trained to perform different tasks. They are used for classification of images, speech recognition, translation of texts and more complex tasks, like control of autonomous vehicles, etc. Input neurons represent the data, Neurons hidden in the middle layers usually perform mathematical computations, Each neuron in the network has activation function, which is extremely important for the final result. A good separation of the dataset is about 75% of the images for training and 25% for testing. Training can be done either locally or on the cloud. GPU processing unit with at least 2GB memory is acceptable for local computing.

Conclusion:

If more images are used for the input dataset, the model could become more accurate, but in that case, there is a tradeoff between the model speed and the model accuracy that one must consider. The described system uses machine learning algorithm to monitor the activities of the forest.

3) Title: Case study of forest fire detection systems

Authors: Igorce Karafilovski, Vladimir Zdraveski, Dimitar Trajanov

Publication year: April 2014

Abstarct:

The fires are mainly caused by humans, then lightning and other reasons, that contribute to easy start of fires, as the global warming. The global warming and the frequent forest fires are the greatest evils, that is happening to the world today. They are key motivation factor in development of systems for an early prevention and detection of forest fires. In this paper, we review the general architecture of a forest fire system, present several existing systems and pilot-projects, describe their specific architectures and emphasize the main mutual similarities and differences.

Introduction:

The prevention of fires is very complex, it requires a lot of work, that includes the long-term process of changing the consciousness of the population and a short-term protection of the forests with a regular maintenance. Several methods and technics are known and used in the world, such as satellites, spy planes, surveillance pillars, heat sensors and the combination of these methods. In the world, there are several systems and pilot-projects, which have been created for an early prevention and detection of forest fires. There are many scientific studies that have covered this issue from different aspects. The starting point in the almost all researches is the great number of forest fires in recent years and the need to act preventive and to deal faster, easier and simpler.

Technology and techniques used:

Web Map Service (WMS) that generates maps in an image format online, Web Feature Service (WFS), which generates vector data using Geographic Mark-Up Language (GML) and Web Coverage Service (WCS) that offers raster or grid data. early warning and detection of forest fires by the use of Optical Sensor System (OSS).

Conclusion:

A different approach for a fire forest detection is the integrated system for a forest fire detection. The most effective way to minimize the damages caused by the forest fires is the early detection of forest fires and a fast appropriate reaction. In that direction, in the future, more effective forest fire detection systems need to be developed, that will also utilize the new technologies as smart phones. The appearance of smart phones is a good way to use them as a mobile measuring stations and video detection device.

4) Title: Forest fire detection using machine learning

Authors: Pragati, Sejal Shambhuwani, Piyusha Umbrajka

Publication year: 2019-2020

Abstract:

Forest fire detection should be fast and accurate as they may cause damage and destruction at a large scale. When the event detection information is passed to the base station and decision is taken. Due to the static configuration of such sensor data in WSN generally lead to false alarm generation [2]. In such a scenario we can use machine learning algorithms to prevent false alarm since they get configured efficiently in dynamic nature, that too automatically.

Introduction:

The forest fire has become a threat to not only to the forest wealth but also flora and fauna and ecology of the environment of the region. The main cause of forest fires can be categorized under natural and man-made classes. High atmospheric temperature, lightening and dryness (low humidity) offer positive environment for a fire to start which are the natural causes for forest fire. The fire is also caused by Man-made sources like naked flame, cigarette, electric spark, etc. In this paper it is propose that a decision tree machine learning approach for event detection. Various models have been generated. The performance of the proposed approach is determined in terms of complexity and accuracy.

Technology and algorithms used:

Machine learning uses algorithms which accept and study input data to forecast output values for an acceptable range. Two algorithms namely Support Vector Machine (SVM) and Decision Tree. The operator provides the algorithm with a dataset that includes inputs and outputs. The first step towards implementation is data collection. e. The data of each node is recorded. Next step is dedicated to training the agent to generate an accurate and flexible model. The same dataset is divided into two parts.

Conclusion:

The conclusion is that that decision tree has a remarkable accuracy of 99% in predicting fires in forest areas. This reduces the chances of false alarm to a great extent. Our system is able to differentiate various forest fire scenarios, from initial case (no fire) to detection of fire, fairly accurately. It can accurately determine the growth of fire. This will help in early stages of fire detection and help to confine fire to limited areas before much damage occurs.

5) Title: Detection of forest fires using artificial intelligence

Author: Antoine Cajot

Publication year: 2020-2021

Abstract:

This work implements and compares different deep learning architectures for flame semantic segmentation on RGB images of fires occurring in a natural environment taken from the ground or from an unmanned aerial vehicle (UAV). The Corsican Fire Database is exploited after comparing it to other candidate public datasets. Results are compared in terms of the intersection over union (IoU), the mean squared error (MSE), the binary accuracy and the recall metrics as well as their number of network parameters.

Introduction:

Forest fires — as opposed to other types of wildfires, such as brush fires or grass fire — are alleged to have been ravaging forests for almost as long as trees have existed,87 id est at least 300 million years. Prevention, prediction, forecasting and post-incident damage assessment are key components of the fight against forest fires; however, this work will focus essentially on detection and ongoing incident damage assessment. In particular, the methods exploiting neural networks will be given special attention since these families

of algorithms have been known to show state-of-the-art performances at many tasks including detection and assessment.

Technology and techniques used:

Convolution neural network (CNN), A convolutional layer is the composition of multiple feature maps in a way that different types features can be extracted at each location of the image. Semantic segmentation, sometimes referred to as image segmentation or simply segmentation, is the task of determining which class (e.g. door, human, background, dog, ...) each pixel of an image belongs to. Though the original Fully Convolutional Network (FCN) idea is older, it was first used for segmentation. The U-Net was designed upon the foundations laid by Long et al. and their FCN segmentation architecture with the intent that it would yield more accurate results as well as require a lot less of training samples to reach this result compared to the FCN.

Conclusion:

The problem of flame segmentation in a natural environment is considered, more specifically, on the Corsican Fire Database which is an evolving dataset of fires in a natural environment from around the world.99 Despite the fact that they were not numerous, it was still possible to find some architectures that had either been evaluated on the Corsican Fire DB or on similar datasets.