A Survey Paper on Forest Fire Prediction using Convolution Neural Network

Aadira Pillai
Department of Computer Engineering
Indira College of Engineering and Management
Pune, India
aadirapillai1999@gmail.com

Aishwarya Gaikwad
Department of Computer Engineering
Indira College of Engineering and
Management Pune, India
gaikwadaishwarya121@gmail.com

Dipali Dande
Department of Computer Engineering
Indira College of Engineering and Management
Pune, India
dipalidande0134@gmail.com

Prof. Deepali Dhadwad
Department of Computer Engineering
Indira College of Engineering and
Management Pune, India
deepali.dagale@indiraicem.ac.in

Abstract: ***Real-time object detection to enhance surveillance methods is one among the sought-after applications of Convolution Neural Networks (CNNs). This research work has approached the detection of fireside and handguns in areas monitored by cameras. This paper also studies the effects of climatology data: temperature, relative humidity, wind speed and daily precipitation on the risk of forests fire occurrence. These impacts urge the modification of certain techniques that could help to predict fires and thus avoid their happening. Artificial Neural Networks have been utilized for the purpose. We have studied the effects of both the number of neurons in the hidden layer and the training technique on the network's performance and the mean squared error. This is an demonstration of the good acquisition of such network in adopting its predicting decision. In this paper comprehensive survey on various machine learning techniques used for fire prediction is presented.***

Keyword— Machine learning, Fire Prediction, Data mining, forest firefighting, formation control, Neural Network, Surveillance System, Wireless Sensor Network(WSN). Convolution Neural Network(CNN)

I. INTRODUCTION

Forest fires, usually occurring in the forest area or wild land, are uncontrolled fires and cause significant damage to natural and human resource, which are the most treacherous disasters to the ecological environment. Common causes of forest fire include lighting, human activities, extreme conditions of weather such as heat and aridity, etc. High incidences and destructiveness of forest fires determine that it is importance of forest fire precluding or prediction for all the countries in the world to spare no effort to this end. Numerous factors contribute to forest fires occurrence, which are complicated relatively and difficult to be quantified accurately. Hence, it is extremely possible to predict forest fire before it destroys forest. The rapid development in micro-electronics and sensor technology has promoted the Wireless Sensor Networks (WSN) to be a promising technology, which have been a topic of much interest to researchers due to their wide-ranging applications. The technology of (WSN) makes it is possible for forest fire early detection and prediction based on weather parameters, which significantly promotes the development of forest fire controlling techniques, evolving from the human-based approach to satellite-based remote sensing approach and (WSN) based instant approach. But research work uses YOLO (You Only Look Once) object detection system which uses Convolution Neural Networks(CNN) for object detection. It is one of the faster algorithms that performs without much degradation in accuracy. The training of this model has been done on the cloud to save hundreds of hours of GPU time on a local runtime. Using hosted runtime can also be favourable in fine-tuning the model to near excellence. Furthermore, the detection must be in real-time with relatively high accuracy as the scenario being processed could be time-sensitive. Also, there must be low number of false positives since the authorities are being alerted once a detection above the threshold is made.

II. LITERATURE SURVEY

Lebanon is considered the gate to east and west, with an area of 10452 km2. Its location has made of it a main destination for tourists from all over the world. Besides, it is rich in caves and mountains are covered with different kind of trees. Cedars and Pine trees are there in Lebanon since ancient times. Yet Lebanon has been facing a censorious threat of losing its green mountains

and fields. Forest fire has caused the dropping of many green acres in the past years. This paper studies the effects of climatology data: temperature, relative humidity, wind speed and daily precipitation on the risk of forests fire occurrence in Lebanon. These impacts impose the adaptation of certain techniques that could help to predict fires and thus give a wide berth to its occurrence. Artificial Neural Networks have been utilized for the purpose. The weather data of the year 2012 collected from North Lebanon, Kfarchakhna station are taken for study. We have studied the effects of both the number of neurons in the hidden layer and the training technique on the network's performance and the mean squared error. This is an indication of good performance of such network in adopting its predicting decision. [1]

As the most important factors, local weather observations, environments and human behaviors characteristics are found highly correlated to forest fire occurrence. Therefore, we initiate a set of fuzzification to evaluate fire risk in the study area and establish a quantitative potential fire risk scheme. The wireless sensor network's technology was utilized for collecting 24-hour weather data continuously, which provides a high chance to reflect precisely the status of forest environment. Depending on the system, we can obtain which days are the high probability of forest fires danger and pay special regard to prevent forest fire for forest guards. [2]

Forests, one of the most valuable and necessary resources and protect earth's ecological balance, are a natural habitat to animals and forest products are essential in our lives in many direct and indirect ways. But wildfires can cause critical damage to grounds and many other resources like properties, human life, wildlife in superabundant amounts. Wildfires burn acres of land and destroy everything in their paths in mere minutes. Wildfire destroys homes, animals, trees and plants, wildlife as well as vegetation. The effects of wildfires are several and wide-ranging. it causes a hugely notable impact on the economy, environment, heritage and social fabric of rural areas. Naturally caused wildfires can be predicted using factors like temperature, humidity, soil moisture, pressure and many more. In this the prediction of forest fires by machine learning using some operational monitoring over a region and come up against changes in climate using different sensors are advocated. The Wildfire Prediction System monitors and records changes in climatic parameters and predicts the intensity of forest fire based on real-time data, thus avoiding the massive loss due to forest fires. [3]

It is an Oxyrrhis Marina stimulated search and dynamic formation control (OMS-DFC) framework for multi-unmanned aerial vehicle (UAV) systems to expertly search and countervail a dynamic target in an uncertain environment. The OMS-DFC framework consists of two stage, viz., the target identification stage without communication between UAV and the mitigation stage with restricted communication. In the first stage, each UAV makes a alteration to proposed OMS with three levels to select between Levy flight, Brownian search, and direction-ally driven Brownian (DDB) search for accurate target identification. The preference of each level is based on the available sensor information about the possible fire location. In the second stage, the UAV that identified a fire location fly in a dynamic formation to quench the fire using water. The proposed formation is achieved through decentralized control, where a UAV computes the control action based on the fire profile and also the angular position and angular separation with its triumph neighbour. The proposed formation control law guarantees asymptotic convergence to the desired time-varying angular position profile of UAV based on the nature of fire spread. To assess the act of the proposed OMS-DFC for the multi-UAV system, a search and fire extinguish mission in a typical pine forest is provoke. A Monte Carlo simulation study is carried out to assess the average performance of the suggested OMS-DFC based multi-UAV mission, and the result clearly highlight the advantage of the suggested OMS-DFC in forest fire prediction. [4]

To prevent forest fires, predictions need to be made to find out areas of land that have the potential to burn based on meteorological conditions acquired from the sensor, it is expected to lessen the spread of fire before the fire roll out. Meteorological conditions used in the study to predict areas of land that will be affected by forest fires are temperature, wind, humidity, and rainfall. The method used in this study is a neural network with Extreme Learning Machines (ELM) training model. To improve the performance of the ELM method, in this study several tests will be carried out so that the resulting predictions are the best.[5]

III. CONCLUSION

The main focus of this paper is to discuss about decision parameter, attribute, and features used for predicting the Fire. The method also throws lights on importance of different classification methods for prediction of fire in the datasets. The datasets considered in so many existing techniques that we have discussed using Sensor which is not very cost effective and requires maintenance after every regular period of time.

REFERENCES

[1] Studying the Factors Affecting the Risk of Forest Fir Occurrence and Applying Neural Networks for Prediction Nizar Hamadeh, Bassam Daya, Alaa Hilal, Pierre Chauvet *SAI Intelligent Systems Conference 2015 November 10-11, 2015* IEEE Xplore ISBN: 978-1-4673-7606-8

[2] A forest fire prediction system based on rechargeable wireless sensor networks Gao Demin1,2, Lin Haifeng2, Jiang Anna2, Wu Guoxin1 2014 IEEE Xplore(2019)ISBN: 978-1-4799-4734-8

[3] IoT Sensor and Deep Neural Network based Wildfire Prediction System Mrs Vidya Zope, Tarun Dadlani, Ashutosh Matai, Pranjali Tembhurnikar, Richa Kalani Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS 2020) IEEE Xplore ISBN: 978-1-7281-4876-2

[4] Multi-UAV Oxyrrhis Marina-Inspired Search and Dynamic Formation Control for Forest Firefifighting K. Harikumar, J. Senthilnath, and Suresh Sundaram1545-5955 2018 IEEE Explore

[5] Prediction of Forest Fire using Neural Network based on Extreme Learning Machines (ELM) Mochammad Anshori, Mukhammad Wildan Alauddin, Wayan Firdaus Mahmudy, Farhanna Mar'I 2019 IEEE Explore ISBN:978-1-7281-3880-0