International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 6 June 2021, pp: 779-783 www.ijaem.net ISSN: 2395-5252

Forest Fire Prediction using Meteorological Data.

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Submitted: 25-05-2021 Revised: 01-06-2021 Accepted: 05-06-2021

ABSTRACT: Forest fire is one of the major threats that our world is facing right now. It creates ecological imbalance affecting our flora and fauna. There has been so many tools and methods to prevent forest fire but most of them are costly and need high maintenance, and this is reason lots of forest still rely on manpower to prevent and detect forest fire. Our project is built on Canadian FWI system which require meteorological and geographical data to predict fire, Meteorological and Geographical data can be easily collected. There are lots of agencies collecting these data. Forest department can take data from it. Once we have these data, we can analyse these data and use our SVM model to predict forest fire in that area.

Keywords : FWI, SVM, Forest Fire.

I. INTRODUCTION

One of the major environmental concern is the forest fires which affect flora and fauna, itcreateeconomic and ecological damage. Such phenomenon is due to natural of manual cause and despite an increasing effort of forest department to control this disaster, each year millions of forest hectares (ha) are destroyed all around the world. Since traditional human surveillance is expensive and affected by subjective factors, there has been an emphasis to develop automatic solutions for this problem. These can be grouped into three major categories satellite-based detection, infrared scanners, and local sensors. Satellites are costly and there is localization delays and resolution are not adequate for all cases. Scanners also have high equipment and maintenance costs. Weather conditions, such as temperature and air humidity, are known to affect fire occurrence. Since automatic meteorological stations are often available across globe hence such data can be collected in real-time, with low costs. In the past, meteorological data has been incorporated into numerical indices, which are used for prevention and to support fire management decisions. In particular, the Canadian forest Fire Weather Index (FWI) system was designed in the 1970s it required only simple calculations using look-up tables with readings from four meteorological observations (i.e., temperature, relative humidity, rain and wind) that could be manually collected in weather stations. Nevertheless, nowadays this index highly used not only in Canada but also in several countries around the world. Even though Mediterranean climate differs from those in Canada, the FWI system can be used in places across globe.

II. REVIEW OF LITERATURE

IEEE 2007, A Data Mining Approach to Predict Forest Fires using Meteorological Data.

This work proposes a Data Mining (DM) approach that uses meteorological data, as detected by local sensors in weather stations, and that is known to influence forest fires. They are not effective on pages that is previous unseen. It is constantly updated to maintain a good accuracy.

IEEE 2017, Data-driven Forest Fire analysis

The algorithms used in fire detection take into account the geometry as well as the characteristics of the images generated. It requires large computation power. It is not efficient.

IEEE 2018, Forest Fire Prevention, Detection, and Fighting Based on Fuzzy Logic and Wireless Sensor Networks

This work aims at performing a short-term estimation of forest fire risks to enhance the response time of emergency corps and existing forest fire prevention, detection, and monitoring systems. Inorder to doit, real-time environmental monitoring of dynamic forest fire risk factors is carried out through WSNs and novel IoT technologies. The URL feature extraction made it very complex.

III. METHODOLOGY--

The Canada Forest Fire Weather Index (FWI) program contains six factors that contribute

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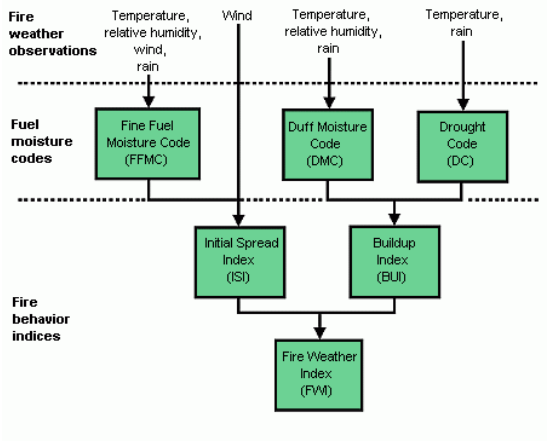
to the effects of fuel humidity and weather conditions on fire behaviour.

The diagram below shows the components of the FWI system. Part calculations are based on continuous daily monitoring of temperature, relative humidity, wind speed, and 24-hour rainfall. The six general categories provide estimates of energy levels related to wildfires.



Fine Fuel Moisture Code

The Fine Fuel Moisture Code (FFMC) is a numeric rating of the moisture content top 1-2 cm forest layer.

Duff Moisture Code

The Duff Moisture Code (DMC) is a numeric rating of the average moisture content of loosely compacted organic layers at 5-10cm depth of Forest Surface.

Drought Code

The Drought Code (DC) is a numeric rating of the average moisture content of deep, compact organic layers present 10-20cm deep.

Initial Spread Index

The Initial Spread Index (ISI) is a numeric rating of the expected rate of fire spread. It is based on wind speed.

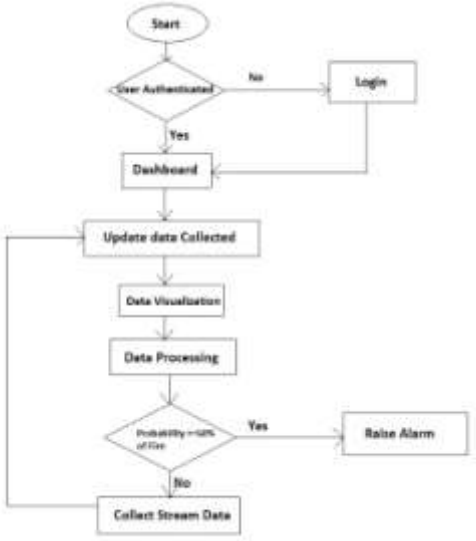
Build-up Index

The Build-up Index (BUI) is a numeric rating of the total amount of fuel available for combustion.

Fire Weather Index

The Fire Weather Index (FWI) is a numeric rating of fire intensity. It is used as a general index of fire danger throughout the forested areas of Canada.

IV. ARCHITECTURE



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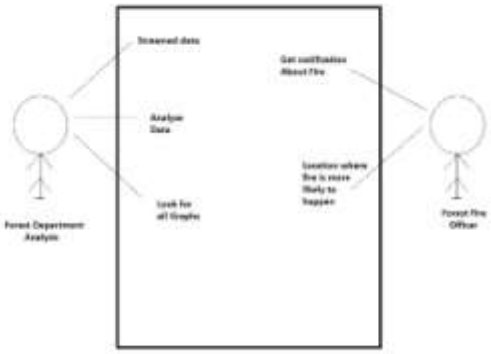
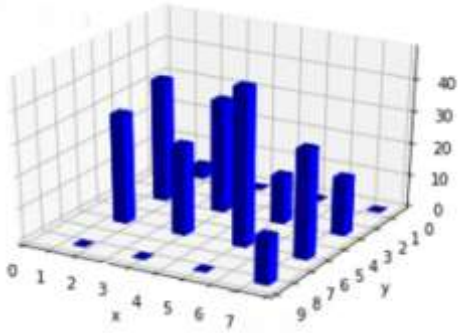
V. USE CASE DIAGRAM



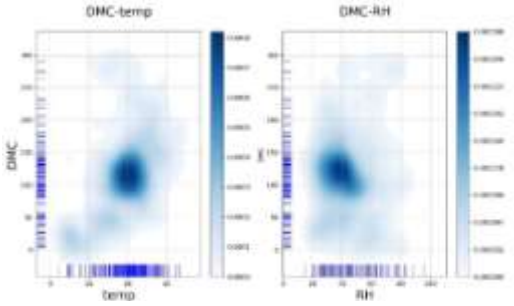
VI. GEOGRAPHICAL ANALYSIS

The Forest area is plot on a map and divided into grids on basis of x and Y co-ordinates. The level of temperature in each grid predicts the chances of Forest Fire.



This is the 3-D Depiction of the Temperature at a particular X and Y Coordinate.

VII. METEOROLOGICAL ANALYSIS



This is relative graph between DMC and temperature & DMC and RH showing the areas prone to Fire.

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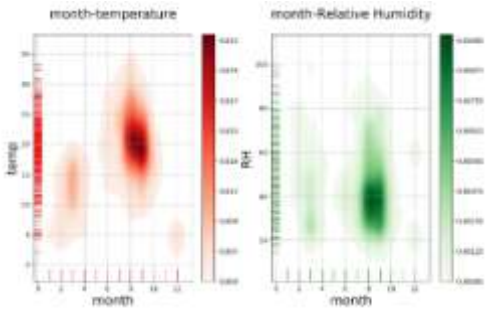
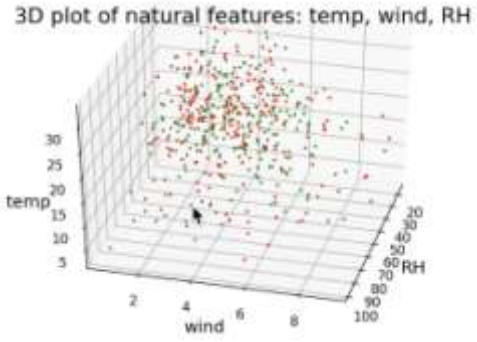
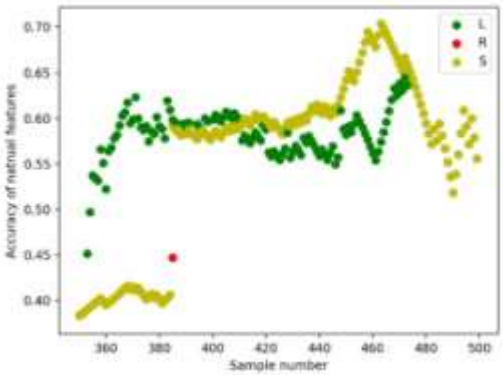


This is relative graph between Temperature and Month & Relative Humidity and Month showing the areas prone to Fire.

VIII. PREDICTION MODEL



This 3-D graphs shows the relative between Temperature, wind, and Relative Humidity to plot Fire Prone Areas.



IX. APPLICATIONS

It helps in coordinating active and deploying members of emergency corporation in the area which at risk of forest fire and ensuring their safety and tracking their location at any time.

It can be also used to predict the temperature using the sensor and if the temperature goes higher than the certain rate according to the history of the forest fire records. It will show that there are the chances of fire.

It also gives result about 90% accuracy.

X. CONCLUSION

We have analysed a dataset collected from Montesinho Park, recorded in the format of Forest Fire Weather Index (FWI). We established relationships between the meteorological factors (e.g., temperature, relative humidity, wind) as well as model features (e.g. FFMC, DMC) correlated to forest fires. After we acquired influence of different factors on forest fires, we then applied the relationship to building a prediction system for forest fires. The system will calculate the parameters input and give feedback on the probability of potential forest fires using SVM.

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[3]. https://www.youtube.com/watch?v=68eYFrPiNF