THE DETECTION OF FOREST FIRES USING MACHINE LEARNING TECHNIQUE

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ABSTRACT: The wireless sensor network (WSN) has received attention because it is useful for disaster warning. WSN forecasts of natural disasters such as hail, fire, rain, etc. are rare and random. This is an important research topic. The detection of these disasters must be fast and accurate. Because they can cause huge damage and destruction .This article compares different machine learning methods such as SVM, regression, decision tree and neural network. In this document, compared with other machine learning methods, it takes less time to quickly detect forest fires.

Keywords:- Classification, Decision Tree, Regression, SVM, Sensor, Wireless Sensor networks.

I. INTRODUCTION:

A wireless sensor network (WSN) is an area that uses sensors to monitor certain environmental conditions (such as fire, weather) and send this data to a base station for processing. WSN is composed of data processors (sensors) with limited battery life [1]. WSN has its own design and functions, including limited performance, short distance, low bandwidth and limited computing power. The ideal sensor node is smart, energy-efficient, and capable of collecting data quickly, reliably, and economically. And no special care is needed. Event detection is an important part of most applications that use wireless sensor networks to correctly and effectively discover the physical world. The event is classified as a recurring, abnormal or infrequent event [2]. Certain harsh environments may cause pattern matching and monitoring errors. Event detection is one of the data applications. Surveillance in wireless sensor networks. Semantically process a large amount of sensory data, and only send relevant information to the user. Taking into account the hardware limitations and the nature of the data, event processing is carried out in wireless sensor networks with data transmission. The main purpose of event detection is to establish understanding by processing and extracting data in the physical world captured by sensors and adjusting prior knowledge to correlate it with possible events

II. LITERATURE SURVEY:

Prediction of Forest Fire using Neural Network based on Extreme Learning Machines (ELM)-In order to prevent forest fires, it is necessary to make predictions to find possible burning areas based on the meteorological conditions received by the sensors, so that people hope to reduce the spread of the fire before it spreads. In order to predict which areas will be affected by forest fires, they are temperature, wind, humidity and rain. The method used in this research is Extreme Learning Machine Neural Network (ELM).

A comparative study of evolutionary statistical methods for uncertainty reduction in forest fire propagation prediction-Predicting the spread of forest fires is a critical moment for mitigating their consequences. Therefore, various calculation tools or simulators have been developed to predict the fire spread, taking into account the scene (terrain, vegetation type, fire location) and the special conditions of the fire spread. The occurrence of fire (vegetation conditions, meteorological conditions) can predict the spread of fire; however, these parameters are usually difficult to measure or measure.After careful estimation, many of these uncertainties are large. This uncertainty leads to a certain degree of error in the prediction results. Therefore, methods must be used to reduce the uncertainty of input parameters.

Applying genetic algorithms to set the optimal combination of forest fire related variables and model forest fire susceptibility based on data mining models. The main purpose of this research is to use genetic algorithms (GA) to obtain the best combination of variables related to forest fires, and to apply data mining techniques to draw forest fire exposure maps. A vector machine (SVM) was used to create a forest fire vulnerability map for Daiyu County in southwestern Jiangxi Province, China. To this end, the historical forest fires and thirteen forestry variables related to fires are analyzed, namely: Height, slope, aspect ratio, curvature, land use, vegetation coverage, heat load index, normalized differential vegetation index, annual average temperature, annual average wind speed, annual average rainfall, distance to river channels and distance to road network. The factorial method is used to classify and weight 13 variables, and multicollinearity analysis is performed to determine the correlation between the variables and determine their appropriateness. Land use, The heat load index, the distance to the river network and the average annual precipitation.

III. EXISTING SYSTEM AND DISADVANTAGES:

- Loss of valuable timber resources
- Degradation of the catchment area
- Loss of biodiversity and extinction of plants and animals
- Loss of wildlife habitat and depletion of wildlife
- Loss of natural regeneration and reduction of forest coverage
- Global warming, the loss of carbon sink resources and the increase in the amount of carbon dioxide in the atmosphere.

IV. PROPOSED SYSTEM AND ADVANTAGES:

- The incidence of forest fires in the country is on the increase and more area is burned each year. The major cause of this failure is the piecemeal approach to the problem.
- Both the national focus and the technical resources required for sustaining a systematic forest fire management programme are lacking in the country.
- Important forest fire management elements like strategic fire centers, coordination among Ministries, funding, human resource development, fire research, fire management, and extension programmes are missing.
- Taking into consideration the serious nature of the problem, it is necessary to make some major improvements in the forest fire management strategy for the country
- Prompt detection of fires through a well-coordinated network of observation points, efficient ground patrolling, and communication networks. Remote sensing technology is to be given due importance in fire detection. For successful fire management and administration, a National Fire Danger Rating System (NFDRS) and Fire Forecasting System are to be developed in the country.
- Fast initial attack measures.
- Vigorous follow up action

V. ALGORITHM TECHNIQUES

A dataset based on collection of parameters acquired from sensor having n instances for which the accuracy has to be maximized.

MAXIMUM_SENSOR_ACCURACY (Level)

I) Initially all instances and attributes in the model.

2) Give appropriated level to class attribute according to 'Level' given

$$\text{Maxlevel}_i = i * \frac{MaxClassAttr - MinClassattr}{Level}$$

3) Where Maxleveli is maximum value in that level i.

4) Select the attributes that yield the highest Significance/show highest variability.

5) Divide dataset based on months(eg fire could be likely on unlikely in a specific month)

6) Make regression equation based on attributes selected in step3 for each month.

7) Predict the level of fire and raise alarm based on the level of fire. Output: A highly accurate and robust method of detecting fire.

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VI. SYSTEM ARCHITECTURE:

Data mining is one of the most significant approaches such as forest fires can be predicated upon their occurrences. Data mining requires real and clean data for making a prediction. If the data set contains many unknown values, then these values must be ignored or imputed before using them in the modelling. The workflow of data mining goes through several steps. These steps are data collection, cleansing, transformation, aggregation, modelling, predictive analysis, visualization and dissemination.

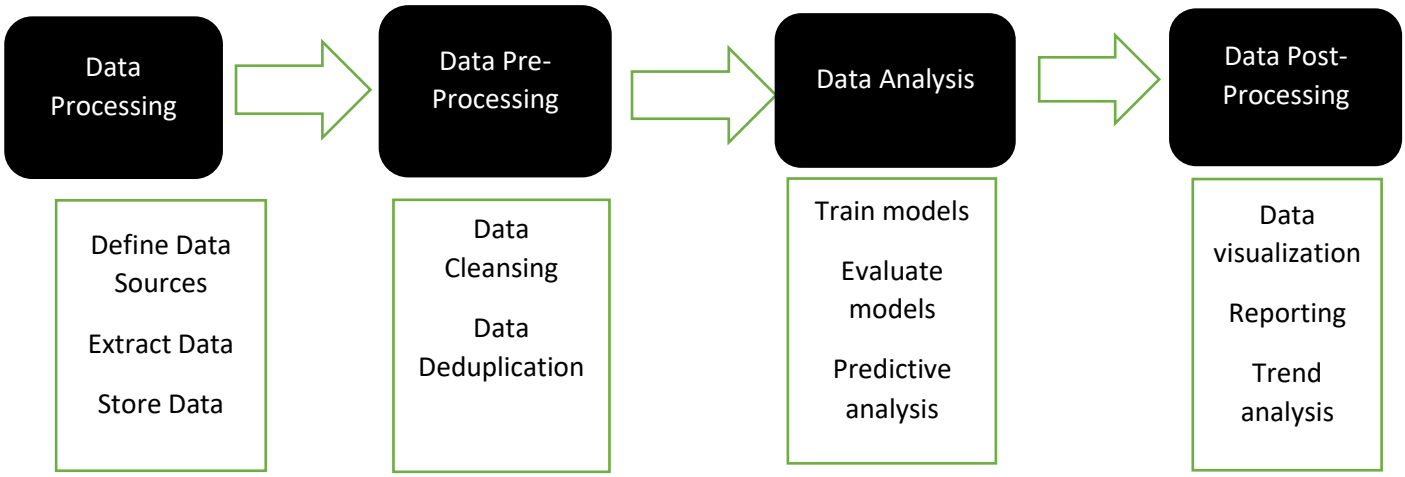


Fig 1: Working function system

The function of the system will be described step by step Collect data about detailed information about the climate. The attribute selection process selects attributes useful for predicting the category of forest fires.

Machine learning models play a major role in the process of evaluation and prediction. Prediction is often done by using the available variables within the data set. Through the available variables within the data set, machine learning models can make predictions for the long term. In this section, linear regression, ridge regression, and lasso regression are presented.

VII. IMPLEMENTATION AND RESULTS

The working of this system is described in a step by step:

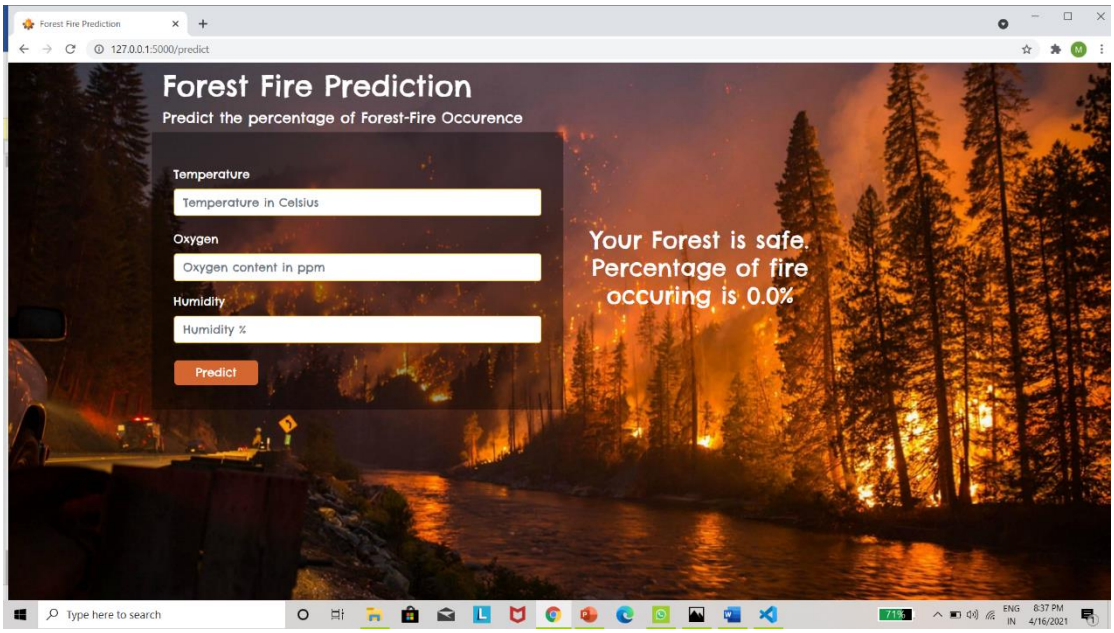
- Dataset collection which contains Climate details.
- Attributes selection process selects the useful attributes for the prediction of Forest fire category.
- After identifying the available data resources, they are further selected, cleaned, made into the desired form.
- Different classification techniques as stated will be applied on preprocessed data to predict the accuracy of forest fire.
- Accuracy measure compares the accuracy of different classifiers.

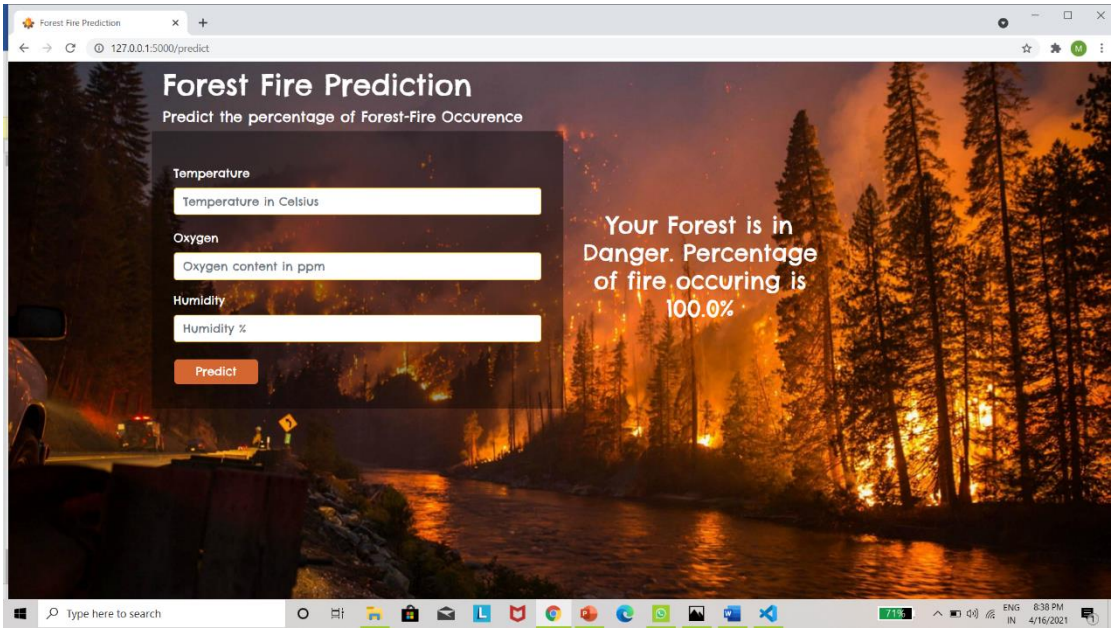
Sample Source Code:

```
from flask import Flask,request, url_for, redirect, render_template
import pickle
import numpy as np

app = Flask(__name__)

model=pickle.load(open('model.pkl','rb'))
```

```
@app.route('/')
def hello_world():
 return render_template("forest_fire.html")

@app.route('/predict',methods=['POST','GET'])
def predict():
 int_features=[int(x) for x in request.form.values()]
 final=[np.array(int_features)]
 print(int_features)
 print(final)
 prediction=model.predict_proba(final)
 output='{0:.{1}f}'.format(prediction[0][1], 2)

 if output>str(0.5):
 return render_template('forest_fire.html',pred='Your Forest is in Danger.\nPercentage of fire occuring is {}%'.format(float(output)*100),bhai="danger")
 else:
 return render_template('forest_fire.html',pred='Your Forest is safe.\n Percentage of fire occuring is {}%'.format(float(output)*100),bhai="safe")

if __name__ == '__main__':
 app.run(debug=True)
```

OUTPUTS:





VIII. CONCLUSION:

In this paper, an algorithm for detection of fire has been proposed by using regression and dividing the datasets according to months. The algorithm achieves low root mean square error and high R-squared. The beauty of the algorithm lies in the way that it can give the result without doing the computation on whole dataset. In future, this approach can be extended by for other disasters as well. Application of certain transfonnation might also improve the model efficiency.

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