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FOREST FIRE PREDICTION

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ABSTRACT

Forest fire prediction constitutes a significant component of forest fire management. It plays a major role in resource allocation, mitigation and recovery efforts. This paper presents a description and analysis of forest fire prediction methods based on artificial intelligence. Forest Fire Prediction is a key component of forest fire control. This is a major environmental problem that creates ecological destruction in the form of a threatened landscape of natural resources that disrupts the stability of the ecosystem, increases the risk for other natural hazards, and decreases resources such as water that causes global warming and water pollution. Fire Detection is a key element for controlling such incidents. Prediction of forest fires is expected to reduce the impact of forest fires in the future. Many fire detection algorithms are available with a different approach towards the detection of fire. In the existing work processes the fire affected region is predicted based on the satellite images. To predict the occurrences of a forest fire the proposed system processes using the meteorological parameters such as temperature, rain, wind and humidity were used.

Keywords: Forest fire, mitigation, global warming

I. INTRODUCTION

Forest fires cause significant material damage in the natural environment followed by violation of the functions in the natural systems and large number of fires is caused by humans, although other factors like drought, wind, topography, plants etc., have important indirect influence on fire appearance and its spreading. Fire threats are increasing by processes of abandonment of farmland and gradual growth of forest and growth of recreation in the natural environment. Fire prevention is a very important way of reducing the damage that can appear if fire occurs. The estimation of fire movement is important for fire prevention, organization of prevention measures and optimal storage of firefighting resources. An important tool for fire movement estimation is modelling the relations between the fire threat and the influence factors, because these areas are more determined by the partial stressed factors. Forest fires are of common occurrence all over the world, causing severe damages to valuable natural environment and loss of human lives. In order to reduce damages due to forest fires, it is useful to utilize a system that can quickly and precisely predict the occurrence and progression of forest fires

II. METHODOLOGY

The methodology stage involves defining the steps required to solve the problem. In the context of forest fire prediction using machine learning, the following methodology can be adopted:

Data Collection: The first step is to collect the required data. Historical data on weather conditions, forest type and past forest fires can be collected from relevant sources such as weather stations and forest management agencies.

Data Pre-processing: The collected data needs to be pre processed to remove any inconsistencies or errors. This involves data cleaning, normalization, and transformation.

Feature Selection: The relevant features that can help in predicting forest fires need to be selected. These features can include weather conditions, forest type and past forest fires.

Model Selection: The appropriate machine learning model needs to be selected. This can include decision trees, random forests, neural networks, and support vector machines.

Model Training: The selected machine learning model needs to be trained using the pre processed data.

Model Deployment: The final step is to deploy the trained model for real-time forest fire prediction. This can be done using a web application or a mobile application.

III. MODELING AND ANALYSIS

Datasets:

Forest fire prediction using machine learning is an important application that involves utilizing historical data to predict the likelihood of a forest fire occurrence. The datasets used in this task include Cov1, Covtype, Forest_Fire, Losses, Pollution, and Names. The Cov1 dataset provides information about the topography of the area, including elevation and slope, while the Covtype dataset describes the type of forest cover present in the region. The Forest_Fire dataset contains details about the fire events that have occurred in the past, such as location and date, and the Losses dataset records the monetary damages caused by these fires. The Pollution dataset provides information about the air quality in the area, and the Names dataset contains the names of different regions or parks where the forest fires occur. By using machine learning algorithms on these datasets, it is possible to develop accurate forest fire prediction models that can help prevent and mitigate the impact of these events.

Training the Model

This comes under the category of Supervised Learning. We train our machine learning mode using the following 3 learning models and compare the accuracies:

1. Linear Regression
2. Logistic Regression
3. Support Vector Machine

Since we obtain the highest accuracy of Logistic Regression, we opt that model. A brief explanation about Logistic Regression is given:

Logistic Regression:

1) This is a machine learning model that outputs the probability of a particular input instance belonging to a particular class.

2) In this case output class are binary:'0'(a forest fires likely to take place), '1'(Forest fire unlikely to take place).

3) Hence, we can obtain prioritized list of places with the places with most likely probability of a forest fire taking place at the top.

Principle of Wildfire detection

The detection of a wildfire is primarily dependent upon 3 factors

1) Oxygen Level:

For any fire take place, high oxygen content is required. So higher the oxygen more is the probability of a wildfire taking place

2) Temperature:

Obviously for a fire to take place, heat is favourable. Hence high temperature increases the probability of fire in any region.

3) Humidity:

Obviously Humid weather is unfavourable for a fire, whereas a dry weather is. Therefore, higher the humidity, lower the probability of a fire taking place.

IV. RESULTS AND DISCUSSION

The implemented model on fetching the required attribute values from API produces a prediction value successfully.

Accurate predictions of the likelihood and severity of forest fires, allowing authorities to take preventative measures and allocate resources accordingly.

Improved early warning systems for residents living in high-risk areas, enabling them to evacuate or take other precautions before a fire occurs.

Better resource allocation and management for fire suppression efforts, reducing the damage caused by fires and protecting human life and property.

Improved understanding of the factors that contribute to forest fires, leading to better management practices and policies in the future.

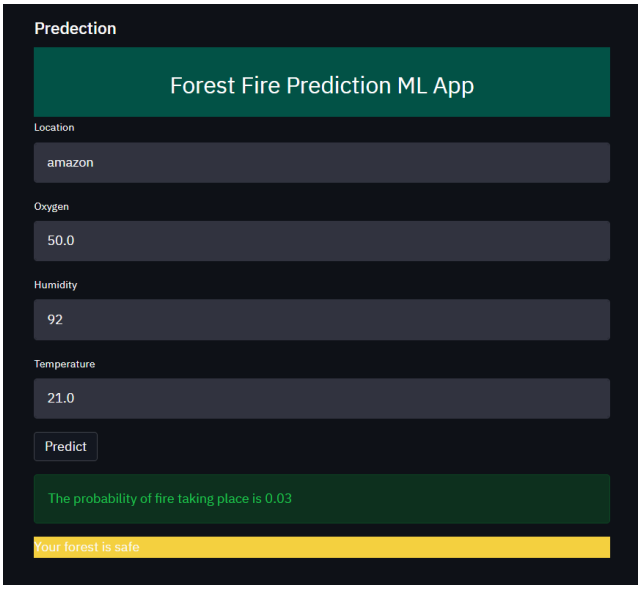

Figure 1: Prediction by entering Location

Figure 2: Visualization of data with Heat map

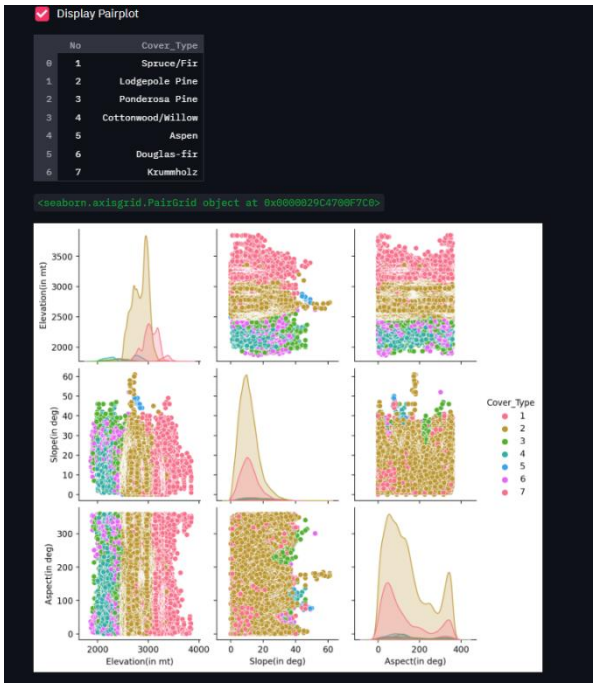

Figure 3: Visualization of data with Pairplot

V. CONCLUSION

Forest fire prediction using machine learning is a promising approach to prevent and control wildfires. By analyzing various environmental and weather variables, machine learning algorithms can identify patterns and predict the likelihood of a fire occurring. This can help forest managers and firefighters to take necessary preventive measures and plan their actions in advance.

Overall, forest fire prediction using machine learning is a valuable tool for preventing and controlling wildfires. It can help to save lives, protect property, and preserve our natural resources.

VI. REFERENCES

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