**Forest Fire Prevention Using Machine Learning**

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**Abstract**— Every year, forest fires destroy vast areas of forest cover, causing large-scale destruction of flora and fauna. Forest fires significantly contribute to the extinction of thousands of wildlife species each year. Artificial intelligence (AI) can be instrumental in predicting future events, and its application in this domain can effectively help us predict forest fires and protect wildlife. Any fire essentially depends on three factors: oxygen, temperature, and humidity. This research aims to predict the likelihood of a forest fire occurring, given the oxygen, humidity, and temperature of a specific location. A conceptual website is also proposed that takes inputs from the user and predicts the probability of a forest fire in real-time.

**I. INTRODUCTION**

Forest or wildlife fires are uncontrolled fires in areas of combustible vegetation. Depending on the scale of the fire, they can be classified as bushfires, forest fires, etc. These fires pose a significant risk to wildlife, making it crucial to develop solutions to counter them. The main challenge is detecting or predicting a wildfire before it starts, as it becomes extremely difficult to extinguish once it begins, leading to large-scale irreversible damage. Machine learning (ML) involves learning from data to predict future events. Therefore, we aim to model some parameters crucial for any forest fire to take place and predict the possibility of a forest fire occurring based on those parameters.

**1.1 Principle of Wildfire Detection**

The detection of a wildfire primarily depends on three factors:

* **Oxygen Level**: For any fire to occur, high oxygen content is required. The higher the oxygen level, the greater the probability of a wildfire occurring.
* **Temperature**: High temperatures favor fire, so increased temperature raises the probability of fire in any region.
* **Humidity**: Humid weather is unfavorable for fires, whereas dry weather is conducive to fires. Therefore, higher humidity lowers the probability of a fire occurring.

**II. ALTERNATIVE WORK IN THE FIELD AND THEIR DRAWBACKS**

* **Camera Surveillance**: This approach uses drones or camera equipment to monitor forest areas for fires. However, detection can only be done once a fire has already started. Additionally, it is not economically feasible to cover large forest areas with cameras and drones.
* **Forest Fire Reservoirs**: This system involves creating water supplies near forest areas to extinguish fires early. However, it only works after a fire has started and does not help in the early detection of forest fires.
* **Proposed System**: Machine learning models are trained on data. We collect real-life data on forest fires and use it as input, focusing on oxygen, humidity, and temperature levels, and the output as 0 (no fire) or 1 (fire). By creating a large enough dataset, we can develop a machine learning model that successfully predicts the probability of a fire occurring in a specific area based on these three parameters. Authorities can then take necessary precautions in areas with a high probability of fire outbreaks.

**2. Development of Machine Learning Model**

* **Input**: Oxygen, Humidity, Temperature
* **Output**: Probability of Fire Occurrence
* **Dataset**: We start with a dataset of 100 values, which can be expanded as the project scope increases to achieve higher accuracy.

**2.3 Learning Algorithm**

This problem falls under the category of Supervised Learning. We train our machine learning model using the following three algorithms and compare their accuracies:

1. Linear Regression
2. Logistic Regression
3. Support Vector Machine (SVM)

Based on the highest accuracy obtained using the scikit-learn library in Python, we select the Logistic Regression model.

**Logistic Regression**:

* Logistic Regression is a machine learning model that outputs the probability of a particular input instance belonging to a specific class.
* In this case, the output classes are 'Fire' (Forest fire likely to occur) and 'Not' (Forest fire unlikely to occur).
* This allows us to prioritize areas based on the likelihood of a forest fire occurring.

**2.3.1 Large Scale Application**

* With access to more data, the accuracy of the machine learning model can be further improved.
* On a large scale, this model can be deployed by forest authorities to generate a prioritized list of areas with the highest likelihood of a fire.
* This model can be integrated into a web application to provide an interface for authorities, enabling smarter patrolling of forests.

**2.3.2 Web Application**

* When applied to web development, we can create an application that takes three inputs from the user to predict the forest fire probability.
* This application can also be used by citizens, allowing them to patrol forests and alert authorities in case of danger.

**III. CONCLUSION**

Machine learning can significantly aid in predicting the possibility of a forest fire. By integrating this model with web or app development, it can be applied on a large scale to prevent and detect wildfires globally.