Seasonal Forest Disaster Prediction using Machine Learning Models

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***Abstract*—The forests are natural barriers that help prevent natural disasters such as heavy rainfall, heavy winds, etc. Because these disasters affect the forest, they make way for more disasters in surrounding areas including other forests, affecting animals, cities, and villages, especially tribal populations. This project aims to find solutions by analyzing the forest and its historical data including disaster incidents. The Seasonal Forest Disaster Analysis project harnesses advanced Machine Learning to investigate and mitigate the impact of forest disasters comprehensively. In essence, the Seasonal Forest Disaster Analysis project stands as a testament to the potential of cutting-edge technology and collaborative efforts in tackling some of the most pressing challenges facing our natural world. The Seasonal Forest Disaster Analysis project is a comprehensive endeavor that harnesses advanced Machine Learning & Deep Learning techniques to deeply investigate and mitigate the impact of forest disasters. Three models like CNN with Grad-CAM, ResNet and XceptionNet were proposed, out of which CNN with Grad-CAM produces an Accuracy of 94 %. By integrating a diverse array of datasets, including satellite imagery, climate data, and historical records, the project is geared towards effectively identifying, categorizing, and predicting a spectrum of seasonal forest disasters, including but not limited to wildfires, droughts, and floods. This integration enables the creation of a sophisticated framework that not only examines past occurrences but also foresees potential future hazards through predictive modelling.**

Keywords —Image Datasets of Various Forest Disasters, Land slide, Wild Fire, Drought, Earthquake, Water Disaster

I. INTRODUCTION

Seasonal catastrophes in forests, such as wildfires, drought conditions, and floods, happen to have enormous risks for nature and human communities alike. This project employs advanced machine learning technology to create profound insights into mechanisms, impacts, and trends about these catastrophes to ensure proper management and sustainable development.

Leveraging this data, we aim to develop a data-driven framework that can detect, classify, and predict forest disasters. Machine learning algorithms will play a pivotal role in this analysis. The objectives encompass data integration, spatial and temporal analysis, and the creation of predictive models. We also emphasize the importance of interdisciplinary collaboration, as this project involves the expertise of specialists in environmental science and geography. RGB (Red, Green and Blue) is a color model commonly used in digital imaging and computer graphics. In this model, colors are represented as combinations of red, green, and blue light. Each color channel (R, G, B) has intensity values ranging from 0 to 255, where 0 represents no intensity (absence of color) and 255 represents full intensity (maximum brightness of the color) for Image Datasets determine the color of each pixel.

Furthermore, we are committed to make our findings accessible to a wide audience. This includes the development of a user-friendly interface to enable policymakers, researchers, and the general public to benefit from the knowledge generated by this research. Our ultimate goal is to enhance our ability to manage and mitigate the impact of seasonal forest disasters, fostering greater resilience in the face of a changing climate.

A. Background

Seasonal forest disasters, including wildfires, droughts, and floods, pose significant threats to both natural ecosystems and human communities. Understanding the dynamics, impacts, and trends of these disasters is imperative for effective disaster management, environmental conservation, and sustainable development. This project focuses on the innovative use of machine learning to provide comprehensive insights into seasonal forest disasters. With the advent of advanced technology, we have access to vast amounts of data, including climate information and historical records. Leveraging thisdata, we aim to develop a data-driven framework that can detect, classify, and predict forest disasters. Machine learning algorithms will play a pivotal role in this analysis.

B. Motivation

The aim of the ”Seasonal Forest Disaster Analysis Using Machine Learning” project is multifaceted and encompasses several key objectives, all geared towards enhancing our understanding of and response to seasonal forest disasters. The overarching aims include:

a) *Comprehensive Understanding:* Acquire a deep and comprehensive understanding of seasonal forest disasters, including their types (wildfires, droughts, floods) causes, patterns, and impacts on ecosystems and communities as Image Datasets.

b) *Early Detection and Classification*: Refine machine learning models capable of early detection, accurate classification, and prediction of forest disasters.

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