AI Based Forest Fire Smoke Detection Capstone Project

AI-Based Forest Fire & Smoke Detection Using Aerial Imagery

Dataset:

https://docs.google.com/spreadsheets/d/1aszzbqsZ3G_LmH81EvRL06i5jDwJDl1SyDJXgxsbygM/edit?gid=0#gid=0

Capstone Overview

In this capstone, you will design an end-to-end AI pipeline to detect forest fire and smoke regions from aerial imagery using feature-level analysis. The project emphasizes practical machine learning, robust evaluation, and spatial risk interpretation for drone-based disaster monitoring.

Dataset Provided

You are provided with a dataset representing tile-level features extracted from aerial imagery. Each row corresponds to a spatial tile with spectral, intensity, and texture-based features relevant to fire or smoke detection. Labels indicate fire/smoke presence.

Objectives

- Understand visual indicators of fire and smoke in aerial imagery
- Apply supervised machine learning for disaster detection
- Evaluate model reliability using precision, recall, F1-score, and ROC-AUC 4 Perform spatial aggregation and risk visualization
- Interpret AI outputs for drone-based emergency response

Capstone Tasks

Task 1: Data Understanding

Explore the dataset and explain the relevance of each feature to fire or smoke detection.

Task 2: Machine Learning Model

Train a classifier and evaluate it using precision, recall, F1-score, confusion matrix, and ROC-AUC.

Task 3: Spatial Risk Analysis & Visualization

Aggregate predictions spatially and generate fire-risk heatmaps.

Task 4: Drone & Disaster Response Interpretation
Recommend drone deployment strategies based on predicted risk.

Task 5: Reflection

Discuss dataset limitations and potential improvements.

Deliverables

- Jupyter Notebook with code and outputs
- Fire/smoke risk heatmaps
- Short technical interpretation report