

AI Based Traffic Congestion Incident Detection Capstone Project

AI-Based Traffic Congestion & Incident Detection Using Aerial Imagery

Dataset:

[https://docs.google.com/spreadsheets/d/1z5WFArY9DnSyq854vktucDPxs6qvx8sYEDViOfVMp4M/edit?
usp=sharing](https://docs.google.com/spreadsheets/d/1z5WFArY9DnSyq854vktucDPxs6qvx8sYEDViOfVMp4M/edit?usp=sharing)

Capstone Overview

In this capstone, you will design an end-to-end AI pipeline to detect traffic congestion and road incidents using features derived from aerial camera feeds. The focus is on feature-level analysis, machine learning classification, and spatial risk visualization for intelligent traffic monitoring.

Dataset Provided

You are provided with a dataset containing tile-level traffic features extracted from aerial imagery. Each row corresponds to a road segment tile.

Features include average vehicle speed, vehicle density, lane occupancy, queue length, optical flow magnitude, edge density, time-of-day normalization, and illumination effects. Labels indicate normal traffic or congestion/incident conditions.

Objectives

- Understand traffic flow indicators from aerial imagery
- Apply machine learning for congestion detection
- Evaluate model performance using standard metrics
- Perform spatial aggregation and visualization
- Interpret AI outputs for traffic management

Capstone Tasks

Task 1: Data Understanding

Explain the meaning of each feature and its relevance to traffic congestion.

Task 2: Machine Learning Model

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

Task 3: Spatial Visualization

Generate traffic congestion heatmaps by aggregating predictions spatially.

Task 4: Traffic System Interpretation

Propose traffic management or emergency response actions based on results.

Task 5: Reflection

Discuss limitations and future improvements.

Deliverables

- Jupyter Notebook
- Traffic heatmaps
- Technical interpretation