

# Crack Detection in Buildings using CNNs



Yusuf Olaniyi<sup>1</sup>, Zaynab Awofeso<sup>2</sup>, and Ifihanagbara Olusheye<sup>3</sup>



<sup>1</sup>Department of Civil Engineering, University of Lagos, Lagos, Nigeria; <sup>2</sup>Department of Computer Science, University of Lagos, Lagos, Nigeria; <sup>3</sup>Department of Systems Engineering, University of Lagos, Lagos, Nigeria

Corresponding author email: olaniyiyusuf2000@gmail.com

## Motivation

- ❖ Can Convolutional Neural Networks (CNN) be leveraged for detecting building defects?
- ❖ Given the scarcity of locally curated data on building defects, can we collect a sufficient dataset for research in this area?
- ❖ Can we develop a robust solution to accurately detect and classify critical cracks in building images?

## Data Collection and Preprocessing

- ❖ Collected images of cracks on buildings within the University of Lagos, covering residential areas, faculties, and offices.
- ❖ Annotated the images using Roboflow and classified the cracks into three categories: vertical, horizontal, and diagonal.
- ❖ Applied data augmentation techniques such as brightness adjustment and random flips to enhance the model's performance and reduce overfitting.

## Model Architecture

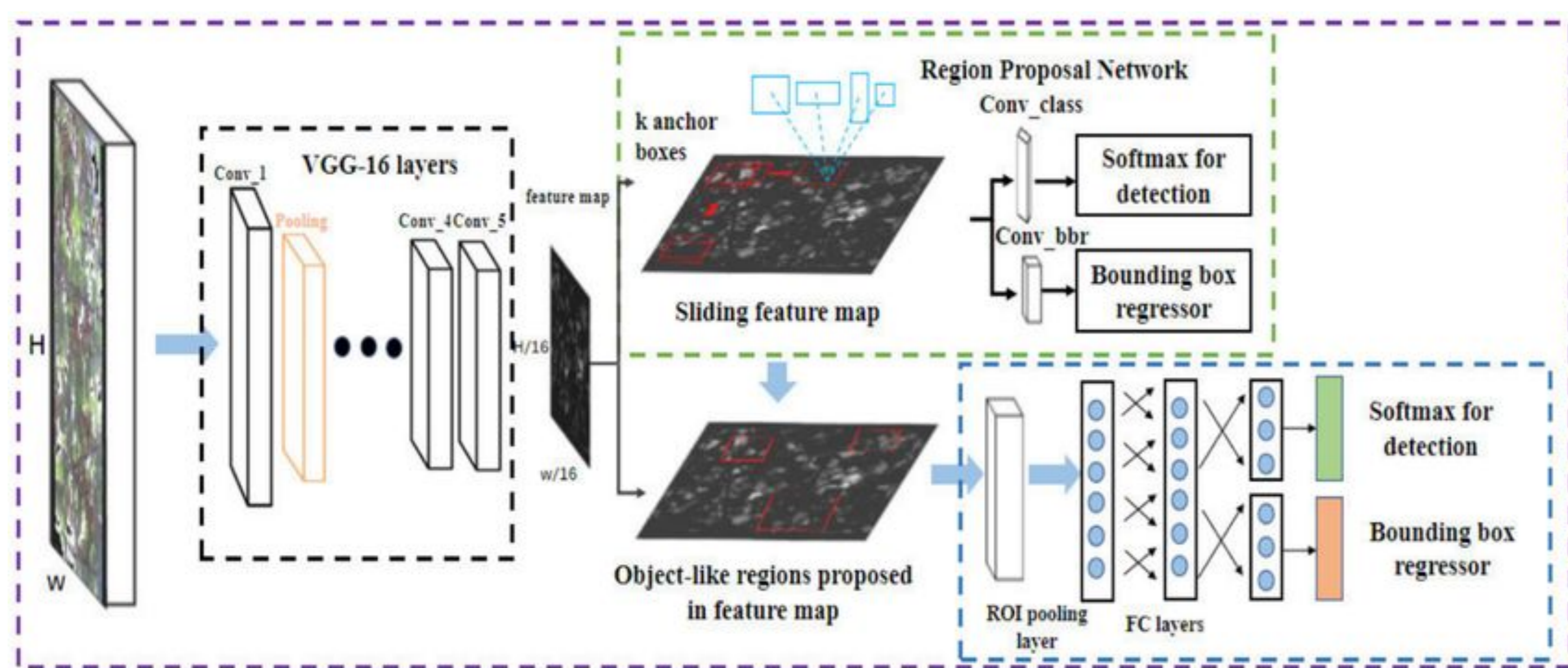


Fig 1: Faster-RCNN

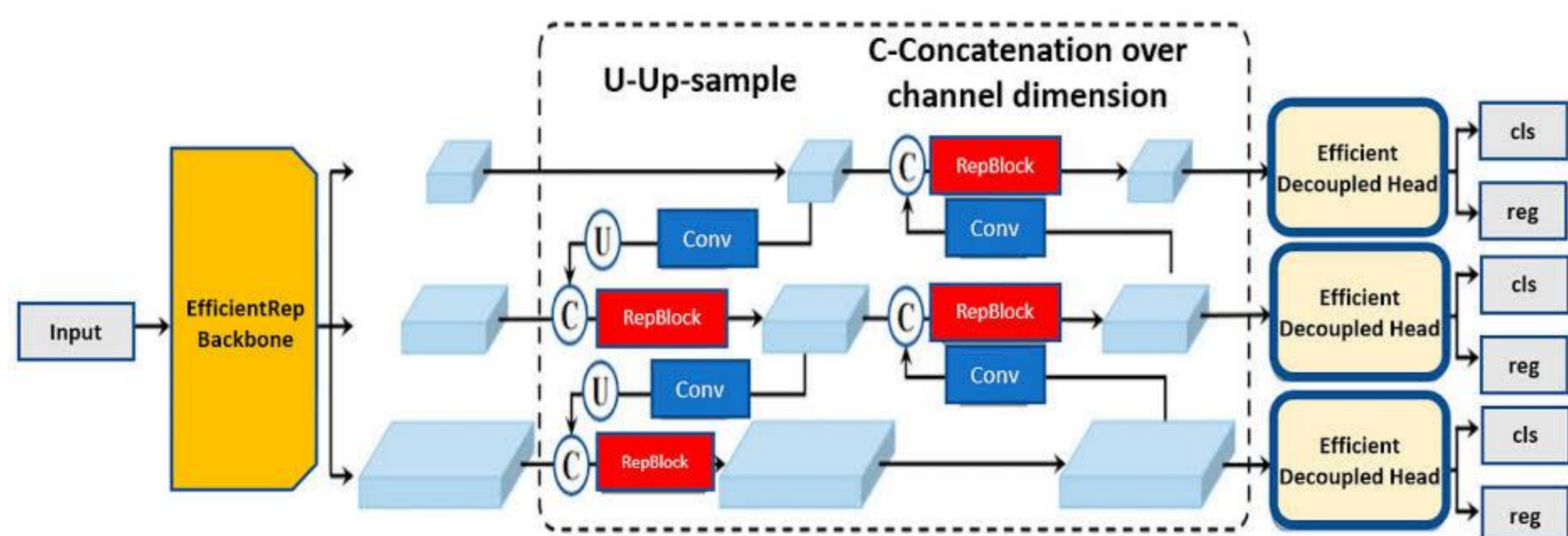


Fig 2: YOLO v8

## Results

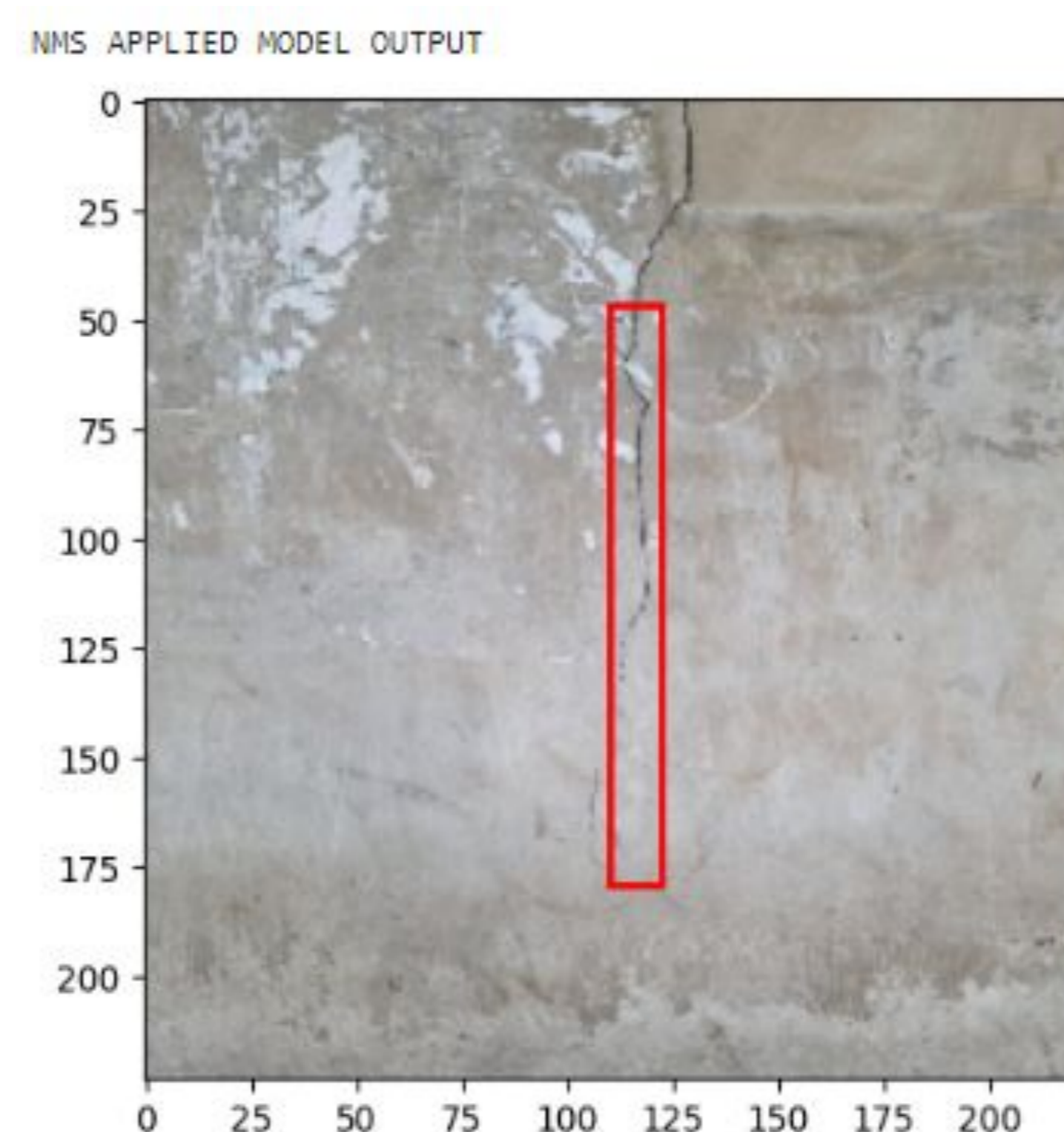


Fig 3: Faster-RCNN Detection



Fig 4: YOLO v8 Detection

## Performance Analysis

Metrics	Faster-RCNN	YOLO v8
Average Precision	0.3	0.37
Average Recall	0.1	0.91
F1-Score	0.15	0.28
Inference time	0.05 s	1.2 s

## Discussion

Our experiments show that CNN models, like YOLOv8 and Faster R-CNN, can effectively identify building defects.

- ❖ **Improving Model Accuracy:** Train models from scratch with sufficient images to enhance feature extraction.
- ❖ **Future Research Baseline:** The dataset and findings can be developed to further improve the application of emerging technologies like AI and IoT in reducing the number of building collapses globally.

## What Next?

- ❖ Implement the Single Shot Detector (SSD) algorithm.
- ❖ Extend data collection beyond the University of Lagos to include other locations.
- ❖ Deploy the best-performing model using IoT sensors for real-time detection.