# AI-based Transportation System (“SALAMTAK”)

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## Abstract

In recent years, with the rapid development of the economy, road construction has entered a phase of coexistence between construction and maintenance. Even road maintenance has become a major aspect of road construction. The government invests a lot of money in road maintenance every year. Therefore, it is very important to detect road problems, including cracks and potholes, in order to reduce maintenance costs. This study aims to address the issues of poor real-time performance and low accuracy in traditional road problem detection. By leveraging the advantages of deep learning networks in target detection, a method based on YOLOv8 and YOLOv5 has been designed for road problem detection. The method utilizes annotated images from a training set consisting of approximately 15,000 images. Finally, the YOLOv8 model has demonstrated exceptional performance, achieving an impressive 74.8 mAP, surpassing the results obtained by YOLOv5, which achieved a still commendable 71.9 mAP. Additionally, the speed of road problem detection has been improved compared to traditional identification methods.

## Introduction

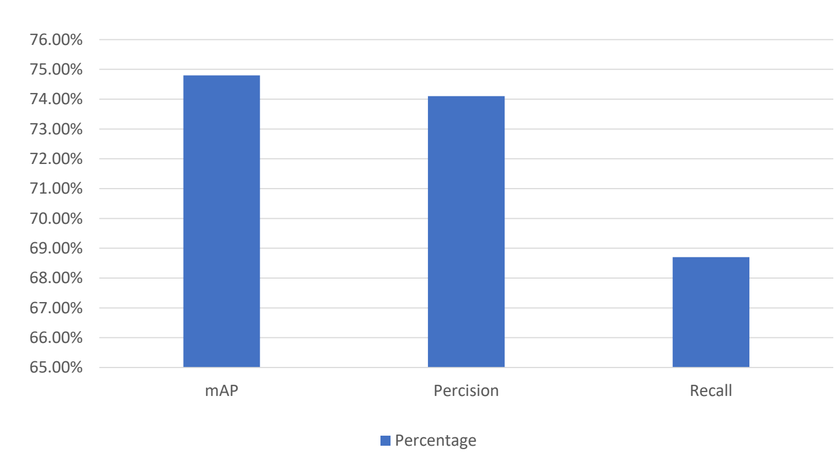
Developing a robust crack and pothole detection system for roads is of paramount importance due to the risks they pose to safety and the economic implications involved. By proactively identifying these hazards, accidents can be minimized, lives can be saved, and maintenance costs can be reduced. Implementing advanced technologies such as computer vision and sensors automates the detection process, streamlining infrastructure maintenance. The aggregated data obtained can inform transportation planning, optimizing resource allocation and enhancing overall connectivity. Investing in this project will revolutionize road maintenance, ensuring safer and more efficient transportation networks for all.

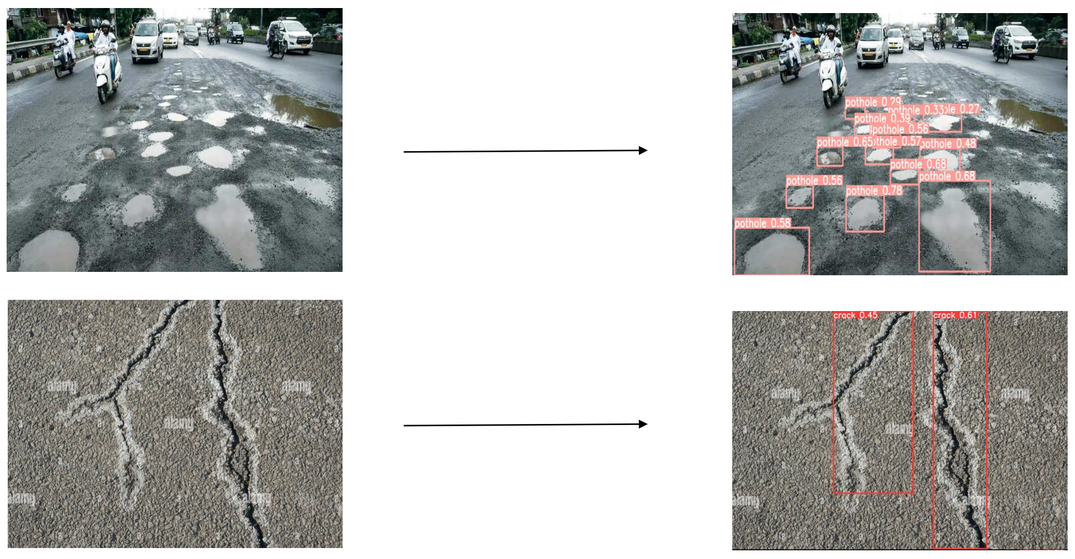
## Methods

This project focuses on using the YOLO version 8 object detection algorithm for AI-based crack and pothole detection on roads. The YOLO algorithm divides images into a grid and predicts bounding boxes and class probabilities for anomalies. The process involves data collection, annotation, preprocessing, network architecture, model training, inference, and post-processing. Evaluation metrics are used to assess the performance, and the results indicate the model's accuracy and generalization capabilities. By integrating YOLO, the system enables efficient and accurate detection, empowering authorities to address road hazards promptly for safer transportation infrastructure.

## Results

Our YOLO v8 model has demonstrated exceptional performance, achieving a remarkable 74.8 mAP in the detection of images containing cracks and potholes. This signifies the superior accuracy and precision of our YOLO v8 model in identifying and localizing these specific anomalies.




## Conclusion

In this evaluation, YOLO v8 and YOLO v5 were compared on a dataset of 5,622 images collected from two sources focusing on cracks and potholes. The dataset was augmented using the Roboflow platform, resulting in a total of 15,846 images. YOLO v8 outperformed YOLO v5 with a higher mean average precision (mAP) of 74.8 compared to 71.9. YOLO v8 also showed improved detection of cracks and potholes, capturing instances that were missed by YOLO v5. A desktop application was developed using the Tkinter library, providing real-time detection and analysis capabilities for both saved photos and videos.

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