Abstract

Title: Deep Learning-Based Pothole Detection and Obstacle Identification on Roads with Smart Vision

Road maintenance is a critical aspect of urban infrastructure management, with potholes posing significant hazards to vehicle safety and driver comfort. Traditional methods of pothole detection are often labour-intensive, time-consuming, and prone to human error. To address these challenges, we present a novel solution for road pothole detection leveraging deep learning techniques. This project employs the YOLOv8 architecture, a state-of-the-art object detection model known for its high speed and accuracy.

Our system is developed using Python, with a frontend composed of HTML, CSS, and JavaScript, and is deployed using the Flask web framework. The detection algorithm was trained on a dataset of 780 images, achieving an overall accuracy of 71%. The detection system is versatile, offering three modes of operation: image-based detection, video-based detection, and real-time detection using a webcam.

The image-based mode allows users to upload static images, which are then analyzed for pothole presence. The video-based mode processes video files, enabling continuous monitoring of road conditions. The webcam mode provides real-time detection, making it suitable for integration into vehicle systems or roadside monitoring stations. Each mode leverages the YOLOv8 model to quickly and accurately identify potholes, providing valuable data for timely road maintenance interventions.

This project demonstrates the feasibility of deploying deep learning models for infrastructure monitoring, showcasing significant potential for improving road safety and maintenance efficiency.

In Summary, this project addresses the critical issue of road pothole detection using a deep learning approach. Developed with Python and a frontend comprising HTML, CSS, and JavaScript, the system is deployed via the Flask web framework. It employs the YOLOv8 architecture for object detection, trained on a dataset of 780 images, achieving an accuracy of 71%. The detection system operates in three modes: analyzing images, processing videos, and real-time detection using a webcam. These capabilities make it suitable for various applications, including vehicle systems and roadside monitoring. The project demonstrates significant potential for enhancing road safety and maintenance efficiency through advanced deep learning techniques.