

A Deep Learning Approach for Automated Pothole Detection and Road Quality Evaluation

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Abstract: Road surface damages such as potholes and cracks significantly affect transportation safety, vehicle maintenance costs, and travel efficiency. Traditional road inspection methods rely on manual surveys, which are time-consuming, inaccurate, and costly. This paper presents a deep learning-based software framework for automated pothole detection and road quality evaluation using computer vision techniques. The proposed system employs YOLO (You Only Look Once) for real-time object detection and OpenCV for image preprocessing and feature enhancement. A dataset of road images and videos is used to train and validate the model, enabling accurate identification and classification of potholes under varying lighting and weather conditions. The detected potholes are further analysed to determine their severity using shape, area, and texture parameters. The system integrates real-time visualization and reporting tools for effective road maintenance planning. The experimental results demonstrate the efficiency of the proposed AI-based approach in providing fast, reliable, and scalable road condition monitoring without requiring any specialized hardware setup.

Keywords: Artificial Intelligence (AI), Deep Learning, Computer Vision, YOLO, OpenCV, Road Surface Analysis, Pothole Detection, Image Processing, Real-Time Monitoring, Smart Infrastructure

