ABSTRACT

Cracks in concrete are among the early indicators of structural damage that can compromise building safety if not detected promptly. Traditional crack inspection is often performed manually by experts through visual observation, which is subjective, time-consuming, and inefficient for large-scale applications. To address this issue, this study develops a concrete crack classification model based on digital images using deep learning with the InceptionV3 architecture. The model was built using a transfer learning approach by fine-tuning selected layers and adding a custom classification head tailored to the task. The dataset consists of labeled images of concrete surfaces cracked (Positive) and non-cracked (Negative) which were preprocessed through resizing and normalization. Model training involved grid search optimization of hyperparameters such as learning rate, batch size, and dropout rate. The best-performing model achieved a validation accuracy of 98.82% and a test accuracy of 98.69%, with precision, recall, and F1-score values of 98.66%. The model demonstrated excellent performance even under varying lighting and surface textures, and was successfully deployed as a web-based application using Streamlit for real-time inference. This research is expected to contribute to the development of faster, more accurate, and automated infrastructure inspection systems.

Keywords : Concrete crack classification, Convolutional Neural Network, InceptionV3, transfer learning, *hyperparameter* tuning, web application.

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