AI-Driven Corrosion Detection in Coastal Cars: A Comparative Study using YOLOV8n, Efficientnet, and VGG16

R. Saliya Prasandike* and P.H.P. Nuwan Laksiri

Department of Information and Communication Technology, Faculty of Technology, University of Ruhuna, Sri Lanka

* *mrsprasandika@gmail.com*

Abstract

Corrosion of cars is one of the major factors that affect the operational and resale value of a used car in Sri Lanka. Identification of coastal corrosion among many types of corrosion by visual observation has become a major challenge in the automobile market. This research aims to evaluate the accuracy of three selected Deep Learning Models (DLM) named YOLOv8n, EfficientNetB7, and VGG16 in the aforesaid identification process. An expert-verified dataset of 1444 images shows the corrosion in both inland (I) and coastal (C) cars. Furthermore, the dataset included vehicle-specific metadata such as distance to the beachside, drive hours in coastal areas per day, and car age to enhance classification accuracy. The training process of EfficientNetB7 and VGG16 was executed on 20 epochs, while YOLOv8n required 50 epochs, all using an Adam optimizer with varying learning rates. The models combined image analysis with metadata through concatenation and ensemble techniques to classify the corrosion as either coastal or inland. The results revealed that the Efficient Net B7 model reached the highest accuracy (84.08%). Moreover, the VGG16 model achieved a moderate accuracy (73.79%), while YOLOV8n had the lowest accuracy at 67.59%, primarily due to its architecture being optimized for object detection rather than image classification. The study concluded that classifying car corrosion based on its region can be achieved by the Efficient Net B7 model due to its architecture which is designed to optimize the network's depth, width, and resolution simultaneously. Also, Its' Neural Architecture Search (NAS) and model scaling led to higher performance than the others. However, the DLM selection and fine-tuning are crucial for addressing such a complex classification. Additionally, future work should focus on upgrading the architecture of EfficientNetB7 into a lightweight version and implementing a user-friendly mobile application for coastal corrosion detection.

Keywords: *Automobile Market, Coastal Car Corrosion, Deep Learning Models, EfficientNetB7, Neural Architecture Search*