ID 730

Rail Track Surface Defects Detection Using CNN

RMLV Karunarathna[1#] and B Mayurathan[1]

[1]Department of Computer Science, University of Jaffna, Sri Lanka

[#]lakshithavirajkarunarathna@gmail.com>

Railway transportation plays an important role in global transportation systems, providing efficient and rapid movement of passengers and goods. The safety and reliability of train travel heavily depend on the railway tracks' quality. Rail surface defects present a substantial risk, which can result in accidents and service interruptions. Identifying rail surface defects presents several challenges, particularly in extracting discriminant features for effective defect detection. This task is complex and non-trivial due to the diverse nature of defects and their appearances. Timely identification is crucial to ensure railway operations' safety and continuous functioning. This paper proposes a method using convolutional neural networks (CNNs) to detect defects on rail surfaces. A publicly available dataset containing 1838 images, with 70% allocated for training, 20% for testing, and the remaining for validation, was employed to evaluate the proposed methodology's performance. Rail surface images were improved through various preprocessing methods. This includes resizing the images to compatibility with the CNN model, noise reduction, and pixel value normalization. Data augmentation techniques like rotation, zooming, brightness adjustment, channel shifting, and horizontal flipping wereare used to diversify the dataset by generating additional samples with different perspectives and appearances. Convolutional Neural Networks were employed, utilizing transfer learning techniques such as Mobilenet-V2, VGG-16, SqueezeNet, and Inception-V3 to train the classification model with the addition of channel attention. Several pre-trained models were are evaluated, and the fine-tuned Inception-V3 model demonstrates a classification accuracy of 95.76%. This study contributes to the development of the railway industry, offering cost-effective solutions for detecting defects in railway tracks in earlier stages.

Keywords: *rail defect detection, transfer learning, CNN, channel attention*