The 2022 World Congress on
The 2022 Structures Congress (Structures22)
16-19, August, 2022, GECE, Seoul, Korea

Road Roughness Assessment Using Synthetic Images based on Deep Convolutional Neural Network

YoungJae Lee[1)] and Robin Eunju Kim [2)]*

[1), 2)] *Department of Civil and Environmental Engineering, Hanyang University, Seoul 04763, South Korea* *robinekim@hanyang.ac.kr

ABSTRACT

Computer vision (CV) technologies have shown potentials in offering solutions for non-contact sensor-based monitoring of a civil infrastructure with enhanced efficiency. In particular, the computer vision-based deep learning (CV-DL) is receiving attentions for providing human-like perception. To facilitate such aim, database tailored for the monitoring target is critical, while often challenging to ensure integrated and balanced labelled dataset in real practice. Recently, dataset with synthetic images is being adopted to resolve the imbalanced data and also to accommodate environmental variations, which otherwise expensive when collected in real world images. Although CV-DL has actively been applying on pavement assessment for defect detection, the International Roughness Index (IRI), an indicator that quantitatively provides the extent of pavement roughness, has not been performed using CV-DL technologies. This is because labelling road image with precisely measured IRI is difficult, and the collected images are affected by the external environment such as sunlight than by other defects such as crack. Thus, in this study, a CV-DL framework is proposed to demonstrate the potentials of using synthetic images for evaluating pavement roughness. To achieve the goal, 3-dimensional road profile is reconstructed from the field-measured IRI. Then the road profiles are rendered and captured using 3ds max with V-Ray accommodating external environment such as sunlight direction variations. Finally, the created dataset consists of 9,600 synthetic images. Then, two Convolutional Neural Networks models are developed to classify the road grades and to predict IRI. As a result, the proposed models achieved 99% accuracy for road grade classification and R-squared over 0.99 for IRI prediction. From the outcome of the study, the dataset using synthetic images can provide potentials for an advanced evaluation of pavement condition.

REFERENCES

Spencer Jr, B. F., Hoskere, V., & Narazaki, Y. (2019). “Advances in computer vision-based civil infrastructure inspection and monitoring”, *Engineering*, 5(2), 199-222.

[1)] Graduate Student
[2)] Professor