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Convolutional Neural Network-Based Image Quality Assessment for UAV-Captured Structural Inspection Images

Gi-Hun Gwon[1)], Jinhwan Lee[2)], In-Ho Kim[3)] and *Hyung-Jo Jung[4)]

[1), 2), 4)] *Department of Civil Engineering, KAIST, Daejeon 305-600, Korea*
[3)] *Department of Civil Engineering, Kunsan National University, 558 Daehak-ro, Gunsan-si, Jeollabuk-do, Korea*
[4)] *hjung@kaist.ac.kr*

ABSTRACT

The maintenance and diagnosis of structures, including bridges, can greatly benefit from the analysis of digital images captured by unmanned aerial vehicles (UAVs). However, issues such as UAV movement, inspection environment, and camera parameters can result in low-quality images, making it challenging to accurately assess the structural condition through digital image processing. To address this, it is crucial to develop an appropriate method for evaluating image quality while considering the potential degradation factors in structural inspection images. A novel approach is proposed in this study to assess image quality using a convolutional neural network (CNN). Various factors that can lead to degradation of the quality of inspection images captured during structural assessments are considered. The first stage of the proposed method focuses on obtaining consistent image quality by mitigating the impact of degradation factors. This is achieved through adjustments in camera parameters to minimize image degradation, ensuring a standardized level of quality across the acquired images. Next, the proposed method distinguishes between low- and high-quality images based on the devised image acquisition method. This step enables the classification of the inspection dataset into different quality categories. In the second stage, a CNN-based image quality classifier model is employed to train the dataset and classify images based on their quality. Experimental validation of the proposed method demonstrates that the results align closely with subjective quality classification performed by the Human Visual System (HVS). This indicates that the proposed IQA method can accurately classify inspection images. Furthermore, the method offers the advantage of shorter processing time, allowing for more efficient analysis of large datasets.

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1) Ph.D student
2) Ph.D
3),4) Professor

REFERENCES

H. Tang, N. Joshi, and A. Kapoor. (2011), “Learning a blind measure of perceptual image quality,” in IEEE conference on computer vision and pattern recognition, Colorado Springs, CO, USA, 305-312.

A. Mittal, A. K. Moorthy, and A. C. Bovik. (2012), “No-reference image quality assessment in the spatial domain,” IEEE Transactions on image processing., **21**(12), 4695-4708.

L. Duque, J. Seo, and J. Wacker. (2018), “Bridge deterioration quantification protocol using UAV,” Journal of Bridge Engineering., **23**(10), 04018080.

L. Wu, J. Z. Cheng, S. Li, B. Lei, T. Tang, and D. Ni. (2017), “FUIQA: fetal ultrasound image quality assessment with deep convolutional networks,” IEEE transactions on cybernetics., **47**(5), 1336-1349.

H. J. Jung. (2019), “Bridge Inspection and condition assessment using Unmanned Aerial Vehicles (UAVs): Major challenges and solutions from a practical perspective,” Smart Structures and Systems, An International Journal., **24**(5), 669-681.

N. Venkatanath, D. Praneeth, M. C. Bh, S. S. Channappayya, and S. S. Medasani. (2015), “Blind image quality evaluation using perception based features,” in 2015 Twenty First National Conference on Communications (NCC), Mumbai, India, 1-6.

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