

A Deep learning Framework for Cultural Heritage Damage Detection for Preservation; Based on the case of Heunginjimun and Yeongnamnu in South Korea

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In general, there are many restrictions on investigations for safety inspection due to the uniqueness of cultural heritages. Methods such as visual inspection and non-destructive inspection, which are mainly used as inspection methods, are regularly carried out, but there are limitations on time and cost. This is insufficient to identify and respond quickly when an abnormal symptom appears in cultural heritage. As a basic study of system development for rapid abnormal detection of architectural, cultural properties through Deep Learning, this paper organized a Deep Learning framework for detecting tilt in buildings for the roof of Heunginjimun Gate (Korea Treasure No. 1) and Yeongnamnu Pavilion (Korea Treasure No. 147). A framework was developed using a Convolutional Neural Network (CNN). As a result of an application, EfficientnetB0 and EfficientnetB2 models showed excellent accuracy in detecting the tilt of the roof of Heunginjimun with an average accuracy of 99.66% and 99.69%, respectively. In addition, EfficientnetB0, EfficientnetB2, and Shufflenet_v2 models showed excellent accuracy in detecting tilt of the roof of Yeongnamnu with 98.81%, 99.80%, and 98.48% accuracy. Additionally, the Grad-CAM experiment was conducted as a basis for whether the model made the proper judgment to confirm the criteria for determining abnormal detection according to the results of each model. These findings quickly detect abnormalities occurring in cultural heritages from the perspective of cultural heritage management and preservation, enabling rapid response, and are valuable for research on artificial intelligence technology related to cultural heritages.

Keyword— Conventional Neural Network, Cultural Heritage, Grad-CAM, Preservation



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