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PREDICTION TECHNIQUE FOR HISTORICAL HERITAGE PRESERVATION BASED ON IOT

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ABSTRACT

The value of historical heritage for every country's identity and people emerges the importance of heritage preservation. Surface cracks are one of the major defects in the building infrastructure, which is the main indicator of the building's durability and potential structural damage. The success of Machine Learning (ML), Deep Learning (DL), and the Internet of Things (IoT) paved the way for spotting and continuous tracking of structural damage by building intelligent damages detection systems. Therefore, this thesis presents a novel prediction framework for historical heritage preservation based on IoT, which is tackling the problem of crack detection, severity recognition, and crack segmentation.

The proposed framework comprises two main components, namely, (1) crack detection and crack severity recognition, (2) crack segmentation. The first component is trained and validated by utilizing 10 representative UCI datasets and 4 datasets of crack images. The obtained experimental results showed that the proposed system achieved an accuracy, F-measure, and features reduction rate of 96.86%, 96.22%, and 68%, respectively for crack detection in historical buildings. The obtained experimental results showed that using VGG16 learned features outperformed using the fused hand-crafted features by 18.44% increase in accuracy for crack severity recognition. Moreover, the second component called the pixel-level crack detection achieved Dice score of 75.5% and mean Intersection over Union (mIoU) of 80.9%.