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Leveraging image processing for very thin crack detection using deep learning

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ABSTRACT

In this study, we propose a novel approach leveraging image processing techniques to the conventional deep learning-based crack detection approach for very thin crack detection and quantification at field. The training data for the segmentation deep learning model is first prepared by labeling the inside of the crack elaborately. The proposed approach dilates the labeled area using a structuring element so that the features of the thin cracks are not missed during model training. Then, the dilated crack area detected by the model trained by dilated data is then eroded using the same structuring element. This makes preprocessing unnecessary, which can greatly reduce quantification errors. The performance of the proposed approach was evaluated on images taken from a concrete wall with very thin cracks. Cascade Mask R-CNN was used as a deep segmentation model for crack detection. The detected cracks using models trained with and without dilation were compared using length-based F1-score. The model trained with dilation resulted in 0.906 on average, which is 0.270 higher than 0.636 of the model trained without dilation. Crack quantification was carried out by applying the erosion with the same structuring element with dilation. The proposed approach quantified crack widths at 10 points with the average error of 0.018mm, while the conventional quantification approach using preprocessing resulted in the average error of 0.084 (Kim and Cho, 2019).

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REFERENCES

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