

A Novel Unsupervised Deep Learning Method Using A Convolutional Auto-Encoder To Detect Structural Damage

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Even though many image- or video-based deep learning methods for structural damage detection have been developed in recent years, they can only detect the damage at the surface of structural components. Data-driven methods are able to detect both external and internal damage by identifying the difference between the features extracted from structures before and after damage. A novel data-driven unsupervised deep learning method is proposed in this study to detect structural damage. The major novelty of this method is that only the acceleration data for undamaged structural scenarios are used to train a convolutional auto-encoder, and these training data can be reconstructed with extremely low losses of data reconstruction. The testing data from different damaged scenarios of that structure show different relatively high levels of reconstruction loss. The experimental study showed a 91.3% detection accuracy for a fabricated steel bridge model with bolt loosening at structural joints.