Drive-By Damage Detection In Bridges Using Mel-Frequency Cepstral Coefficients And Machine Learning

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Drive-by damage detection for bridges has caught much attention in the last decades. A salient advantage of this method is that only a few sensors are instrumented on the passing vehicle instead of monitoring systems on the bridge itself. Damage detection considering the bridge's frequencies extracted from the vehicle's vibration data was a promising way confirmed by scholars worldwide. However, the current research is typically concerned with the low-order frequency-domain responses of the bridge. Responses under high-order frequencies that may contain bridge damage information are ignored. To detect the bridge's damage accurately, all frequency-domain responses of the passing vehicle are considered in this work. Firstly, the vehicle's frequency-domain responses are utilized as input features to train machine learning models to predict the bridge is damaged or not. Then, the efficiency of training is improved by projecting the Hertz scale frequency responses into the Mel scale to reduce the dimensions of inputs, in which the Mel-frequency Cepstral Coefficients (MFCCs) are used to feed machine learning models. To verify the effectiveness of the proposed method, an I-shaped simply supported beam and a model car are employed in the lab. The results demonstrate the promise of the proposed method. Finally, this work's limitations and future development directions are also discussed.