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AUTOMATED DEFECT CLASSIFICATION FOR MAGEBA-TYPE MODULAR BRIDGE EXPANSION JOINTS VIA DEEP LEARNING

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Abstract

Mageba-type modular expansion joints are high-performance structural components engineered to accommodate large-scale multi-directional movements and rotations in bridge decks. Comprising an intricate assembly of center beams, sealing profiles, and support bars, these joints are subjected to high-frequency dynamic loading and severe environmental exposure. Given their mechanical complexity, traditional manual inspection is labor-intensive and prone to inconsistency. To modernize this workflow, this study proposes a deep learning framework for automated defect classification. The methodology utilizes a specialized dataset over 10,000 inspection images extracted from infrastructure inspection reports. A key contribution involves the normalization of unstructured inspection data into standardized categories specifically tailored for Mageba-type joints. The framework employs Convolutional Neural Networks (CNNs) to map visual features to these predefined defect classes. By functioning as an intelligent screening tool, the model automatically filters routine inspection images and flags potential anomalies for expert review. Preliminary results indicate that this automated approach significantly reduces the manual burden on inspectors while improving the objectivity and scalability of bridge health monitoring. Ultimately, this research provides a data-driven pathway for the digital transformation of maintenance strategies for complex modular bridge components.

Keywords: *Mageba-type Modular Joints, Structural Health Monitoring, Bridge Maintenance*