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### Unsupervised Deep Learning-Based Crack Detection in Full-Scale Stamped Products for Applications in Automotive Industry

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#### Abstract

Automated crack inspection for stamped panels is crucial for industrial manufacturing. While supervised learning methods are commonly used for quality assessments, they often require a substantial amount of labeled data, which can be challenging to obtain in a well-tuned production line. In contrast, unsupervised learning, which leverages only defect-free samples for training, presents a more practical alternative for real-world deployment. This study aims to develop a robust learning framework that enables unsupervised crack detection and facilitates cross-panel generalization across diverse stamped panel types. Three key techniques are developed to address challenges in real-world manufacturing: (a) an unsupervised crack detection framework for crack-prone regions; (b) an extension of the framework to full-panel inspection under complex real industrial conditions; (c) a training strategy that enables rapid adaptation for crack inspection in newly unseen panels.

[사용언어: 영어]