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(57) Abstract :
Railway track faults are a major concern for railway infrastructure, leading to potential derailments, operational disruptions, and increased maintenance costs. Traditional track inspection methods rely on manual inspections or supervised learning approaches, which require extensive labeled datasets and human intervention, making them costly and time-consuming. This research proposes an unsupervised learning-based railway track fault detection system, which can identify anomalies without the need for labeled data. The system utilizes sensor-based data collection, vibration analysis, and image processing to detect defects such as cracks, misalignments, and structural degradation. Using autoencoders, clustering algorithms (e.g., K-means, DBSCAN), and anomaly detection techniques, the model can effectively classify normal and faulty track conditions in real time. The proposed approach enables automated, scalable, and cost-effective fault detection, reducing reliance on manual inspection while improving railway safety and maintenance efficiency. Experimental results demonstrate that the system achieves high accuracy in detecting faults with minimal false positives, paving the way for AI-driven predictive maintenance in railway infrastructure.

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