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| Title | Towards Safer Cities: AI-Powered Infrastructure Fault Detection Based on YOLOv11 | | |
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| Published Journal Name | Future Internet | | |
| Type of Publication | Article | | |
| Volume | 17 | Issue | 5 |
| Publisher | MDPI Future Internet | | |
| Publication Date | 22 April 2025 | | |
| ISSN | ISSN: 1999-5903 | | |
| DOI | doi.org/10.3390/fi17050187 | | |
| URL | https://www.mdpi.com/1999-5903/17/5/187 | | |
| Other Related Info. |  | | |
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| Abstract |  |
| The current infrastructure is crucial to metropolitan improvement. Natural factors, aging, and overuse cause these structures to deteriorate, introducing dangers to public well-being. Timely detection of infrastructure failures requires an effective solution. A YOLOv11-based deep learning model has been proposed which analyzes infrastructure and detects faults in civil architecture. The focus of this study is on an image-based approach to infrastructure assessment, which is an alternative to manual visual inspections. Despite not explicitly modeling infrastructure deterioration, the proposed method is designed to automate defect identification based on visual cues. A customized dataset was created with 9116 images collected from various platforms. The dataset was pre-processed, i.e., annotated, and after pre-processing, the proposed model was trained. After training, our proposed model finds defects with greater precision and speed than conventional defect detection techniques. It achieves high performance with precision, recall, F1 score, and mAP in 100 epochs, and is therefore reliable for applications in civil engineering and urban infrastructure monitoring. Finally, the detection results show that the proposed YOLOv11 model works better than other baseline algorithms (YOLOv8, YOLOv9, and YOLOv10) and is more accurate at finding infrastructure problems in real-world scenarios. | |