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Autonomous Robotic Damage Inspection

A DRL-based inspection agent that halves inspection time while improving defect detection accuracy versus raster scans.

Inspecting structures for damage has historically been a labor-intensive and dangerous task for human workers. On top of this, conventional inspection methods can be prone to human error that can lead to unnoticed failures. Because methods for robotic inspection typically use pre-defined paths, additional viewpoints are not obtained for occluded areas or areas with sub-optimal lighting. In response to these challenges, researchers at Purdue University have developed an artificial intelligence framework based on advanced deep reinforcement learning to enable robots to choose the best course of action to identify defects and minimize uncertainty. This is achieved through formulating the problem as a Partially Observable Markov Decision Process (POMDP). The use of computer vision and deep-reinforcement learning enables higher detection accuracy than conventional image scanning. This technology has applications in the inspection of structures and large infrastructure, such as nuclear facilities or bridges.

Advantages

-Reduces inspection time by 2x

-Improved accuracy over conventional raster scanning techniques

-Active perception

Applications

-Civil Engineering

-Safety Inspections

-Robotic Inspection

-Computer Vision

-Autonomous infrastructure damage detection

Technology Validation:

Technology ID
2024-JAHA-70539

Category
Infrastructure & Construction/Structural Health Monitoring
Artificial Intelligence & Machine Learning/AI-Integrated Imaging Systems & Industrial Vision and Inspection

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This technology has been validated through a photo-realistic simulation environment, where it was shown that Purdue's approach shows a 15% improvement in intersection over union (IoU) accuracy compared to raster scanning while taking 2x less time.

TRL: 6

Intellectual Property:

Provisional-Patent, 2024-06-05, United States | Utility Patent, 2025-06-05, United States