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Object and defect detection in additive manufacturing using deep learning algorithms

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Abstract-

Additive manufacturing (AM) allows the construction of customized objects from the 3D printing of pre-modeled objects. Defects may occur during the printing process that impact user satisfaction. The inspection procedure is usually performed by a human; however, such a task is often characterized by slowness and a high likelihood of errors. Therefore, it is important to automatically inspect 3D-printed objects to overcome the limitations of manual visual inspection, contributing to efficiency, reliability, and worker health. It is possible to automatically inspect objects through deep learning models. In this case, the model detects the object and its defects with a lower probability of error. However, in the literature, approaches often propose one single model to perform all the detection tasks, which makes the model more complex and less scalable. This work proposes a process for detecting defective objects and their defect level based on the division of tasks between deep learning models to support decision-making strategies in AM. The proposed process allows new models to be added to find new information about objects. The selected models are: faster region-based convolutional neural network (FASTER RCNN), convolutional neural network (CNN), and MobileNet. To evaluate the models, a real-world dataset was built with additively manufactured parts for maintenance in elevators. Based on the experiments, it was observed that the proposed process not only improves detection effectiveness but also contributes to the acquisition of new information. This improvement is achieved by the innovative and modular approach that separates tasks for each model.

Index Terms- Object defection; Additive manufacturing; Deep learning; CNN; Defect detection; Defects

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