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Detecting Corrosion in Steel Canisters using Deep Learning¹ PRESTON ROBINETTE, Presbyterian College, HAYLEY GUY, North Carolina State University, BRYCE KROENCKE, University of California, Davis, JORDAN MILLER, Arizona State University, DANIEL SCHULTZ, University of Tennessee, Knoxville, CATHERINE SCHUMAN, STYLIANOS CHATZIDAKIS, JACOB HIN-KLE, THEODORE PAPAMARKOU, LAURA PULLUM, GUANNAN ZHANG, Oak Ridge National Laboratory — Steel canisters are typically used to store spent fuel from nuclear reactors after the rods have been cooled down in spent fuel pools. The lack of a permanent repository necessitates the use of these canisters for longer periods of time than initially anticipated, resulting in concerns of potential aging. Fast and accurate, nondestructive inspections are therefore needed to ensure the longevity of canister integrity and reduce potential mitigation and remediation costs. High radiation levels, limited access (via small size vents), and space constraints (2-inch overpack-canister gap) make in-situ visual inspections challenging. This necessitates the development of remotely operated systems for real-time detection of defect properties. In order to create an automated system, the project explores, for the first time, the use of convolutional neural networks (CNNs) to accurately detect cracking and pitting in real time. Trained on 22,215 images of 256 x 256 pixel resolution, the preliminary results are promising with achieved accuracies up to 96%. The proposed approach could significantly increase the speed of inspections, minimize inspection costs, and minimize radiation doses to personnel.

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