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Hyperspectral Imaging Inspection of Nuclear Assets through Leaded Glass Windows

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Inspection of nuclear assets and structures is fundamental towards security in the nuclear industry, where the use of sensor technologies can play a key role in the early detection of corrosion, leaks, degradation, defects or other anomalies, reducing nuclear threat and enhancing safety. However, deploying and operating sensors within the nuclear industry presents significant barriers. One particularly challenging scenario arises when assets and structures are enclosed within protective rooms for safety, with leaded glass windows to allow visual inspection. In such cases, many sensors struggle to capture data effectively from outside due to the partial transparency of these windows, which obstructs their vision, resulting in the need to access the rooms, with increased costs and safety implications. The objective of this project was to evaluate the case in which hyperspectral imaging (HSI), a promising technology being progressively introduced in the industry, is captured through a leaded glass window. A real sample of this type of window, provided by the National Nuclear Laboratory (NNL), was used in the experiments to gain a deeper understanding of how this leaded glass impacts the sensor data. Experiments evaluated the effect of this window on the captured HSI data in three different spectral ranges (visible, infrared and ultraviolet), and explored how artificial intelligence can address this challenge through data recovery techniques.

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