An AI-based Image Qualification System for Radiographic Testing Film with Wire-type Image Quality Indicators

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Image quality assessment in radiography non-destructive testing (NDT) is crucial to secure reliable and coherent quality inspection. The Wire-type Image Quality Indicators (IQIs), which are used as reference standards to evaluate film image quality by verifying with the visible extent vision from qualified inspectors, are commonly used in advance of defect assessment. However, the image qualification process by inspectors may suffer from fluctuated assessment from inspectors who have different workmanship and human error via time-consuming work. Consequentially, it may lead to degrade quality of product with losing time and cost efficiency. In this study, we propose a novel AI-based system that automates the image quality assessment process with wire-type IQIs. This system aims to overcome the limitations associated with human-based evaluations. By leveraging image processing techniques and deep learning model with domain knowledge provided by high-level inspectors, our system enables automatic and objective assessment of image quality for radiography non-destructive testing. The process of assessment is performed following three steps. The first step is searching for the Region of Interest (ROI) which is automatically identified IQIs area in the radiographic image. The second step is wire detection which utilizes techniques such as contrast enhancement, edge enhancement, line detection, and object detection using deep learning to accurately identify the length and the number of wires present in the IQI regions. The final step is to decide the image quality level to proceed with defect inspection or retake radiographic films based on AI prediction and inspector's final check. The proposed system was validated with the actual radiographic images from welding parts of metal tubes and pipes by comparing with the results from qualified inspectors. The system as a cooperator with inspectors can be employed to enhance total quality with low resources by automation and knowledge propagation via AI model as a concentration of the inspector's high workmanship know-how.