Enhanced AI-based PAUT data analysis approach for automatic defect detection

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With the exponential growth of artificial intelligence (AI) applications across different areas, the field of nondestructive testing, especially phased array ultrasonic testing (PAUT), is also experiencing significant changes with applying machine learning (ML) based techniques. The presented approach focuses on the research and development of AI-driven methodologies for PAUT data analysis, including automatic detection, localization, and sizing of defects in welds. Image analysis technique based on Shannon entropy allows us to define defect localization and size definition pretty accurate in PAUT data, but it still faces difficulties in defect type definition and determining the difference between defects and the inherent structure of the weld. This study introduces a combined approach for PAUT data analysis. Here, Shannon entropy-based techniques for the defects localizing and their sizes determining was improved using machine and deep learning methods for refining the results. For this purpose, a dataset of simulated data was collected, which was used as the basis for validating and improving the approach before its testing on real-world data. The use of machine and deep learning (DL) algorithms shows an increase in the accuracy in comparison of using non-AI approach, especially in the task of determining the difference between a defect and the structural specificities of the weld.