# Defect identification of phased array ultrasonic testing using artificial intelligence

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In ultrasonic testing, highly skilled operator identifies defects from noises derived from weld area or object shape itself and measures size of defects from ultrasonic data. This analysis depends heavily on technique of operator and it is important to pass these techniques down to inexperienced operators. Considering the future manpower shortage, reducing workload of operator is also important to improve efficiency in ultrasonic testing. To solve these problems, we applied artificial intelligence to phased array ultrasonic testing (PAUT) images and developed automated analysis system. We use convolutional neural network (CNN) which is useful for image classification by searching for spatial features from two-dimensional array. PAUT images acquired from the specimen with stress corrosion cracking were labeled by whether it contains defect or not based on classification by the operator. These labeled images were fed into CNN, and then optimized model for classifying images into two classes was generated. Using this optimized model, echoes from such as shallow defect in conjunction with surface and branched tip with weak echo could be recognized as a defect instantly, although it is required enormous amount of time to identify defects even by highly-skilled operator. Moreover, to utilize limited data effectively, we applied data augmentation technique clipping original images into smaller pieces by changing clip area. As a result, we succeeded in reducing defect-overlooking rate to 9.7% that was 18.7% without data augmentation.