A convolution neural network model for automatic signal analysis in eddy current testing with noise effect

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This paper proposes an automated, systematic inversion model by the convolution neural network (CNN) for eddy current testing (ECT) signals with noise. Defect detection and location is one of the fundamental issues in the nondestructive evaluation of tubes and plates. However, noise, for example, lift-off, always complicates the signal analysis process and reduces the efficiency of defect detection and location. CNN is ideally suited to this problem since it can learn and classify features automatically. In this work, an AISI 316 specimen with different depth slits is used to evaluate the accuracy of detection and location by a CNN model. The slit signals with/without noise (probe lift-off and probe tilting) are collected by both experiment and simulation. During scanning process, the scanning distance is set as 60 mm, and the probe passes through the slits in different locations and different angles in a two dimensional scanning mechanism. The probe collects defect signals at a random angle and random path. No-slit signals with/without noise are obtained as reference data. The absolute value signals and coordinates of slits are used as input data and target data respectively to train the CNN. The corresponding target data of no-slit signals is set as 0 rather than coordinates, which means there are not slits signals in input signals. According to the validation results, a trained CNN shows a high accuracy of detection and location functions, even with the noise effect.