Artificial intelligence algorithms applied to heat exchanger tubes for improved data analysis

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Globally, the nondestructive testing (NDT) industry is facing a growing shortage of workers in the field of heat exchanger tube inspection, especially certified level 2 analysts capable of analyzing the acquired data. With the regular addition of new technologies and the transition to array probe configuration, the complexity of the task and the volume of data continues to grow. More than ever, the industry needs tools to simplify data interpretation, increase analyst efficiency while maintaining a consistent and repeatable level of confidence. Assisted analysis for tube testing with electromagnetic technique has been around for several years. However, most solutions described in the literature or commercially available have been developed for steam generator tube inspection using eddy current technique. Traditional detection method based on phase angle, amplitude thresholding and probe position in the tube become quickly limited when the test conditions are not well controlled (uneven pulling speed, incomplete tube scan, no encoder position) or when the information about the tube bundle is incomplete (unknown detailed landmark table, re-tube section). These test conditions are very common outside the nuclear industry and they contribute to reducing the efficiency and reliability of data interpretation. Moreover, very few solutions can support other electromagnetic technique such as RFT, NFT and Array probes. This paper explores the feasibility of employing artificial intelligence (AI) technique, such as deep learning, to improve various tasks of the tube inspection process such as landmark localization without detailed prior knowledge of the bundle configuration and support to the classification of critical tube to be reviewed by an analyst. Typical implementation results will be presented for ECT and RFT inspection technique.