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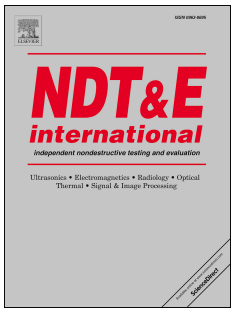

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Confidence Metric for Signal Classification in Non Destructive Evaluation

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Abstract

Quantitative assessment of the reliability of defect classification is critical in non-destructive evaluation (NDE) applications. Particularly in automated data analysis systems, such a measure enables the system to monitor its own performance and automatically flag indications where operator intervention is required. Apart from inherent ambiguity of non-discriminative features and inadequate training samples, noisy measurement is a primary reason underlying the classifier's unreliable decisions. In this paper, we have developed a framework to incorporate the major sources of classification errors into a single quantitative measure. By bootstrapping and weighting Bayes posterior probability with estimated noise distribution, effect of noise in NDE measurements is embedded in the resultant confidence measure. The effectiveness of the proposed method is first demonstrated on synthetic dataset from an eddy current simulation model. It is then used to analyse confidence of classifying experimental data from eddy current inspection of defects in steam generator tubes.

Keywords: Bayes posterior probability, Bootstrapping, Eddy Current Testing, Reliability, Classification

1. Introduction

In recent years, automated signal classification (ASC) systems have gained popularity in non-destructive evaluation (NDE) applications in order to rapidly interpret large volume of data obtained from various inspections [1] [2]. Often, expensive remedial measures are involved after detection of anomalies and hence there is a need for high accuracy in performance of ASC systems. In a non-destructive inspection, potentially harmful anomalies are expected to be detected with greater certainty than the benign discontinuities. This notion of metric attached to the classification decision of an ASC system affords a confidence measure in the classification results. Estimation of confidence is beneficial since an ASC system with such capability will automatically flag indications for which operator intervention is required. Thus, defects identified with low confidence

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