An Automatic Classification Tool for Non-destructive Testing for use in Structural Maintenance

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Abstract: *New non-destructive testing methods based on ultrasonic waves involve analysing a large amount of time series of data to classify the structural state of the system being evaluated. In North America, thousands of civil infrastructures have to be replaced to maintain the networks in good working order. Detecting faulty structures from good ones is a time consuming, error prone, and costly activity. Although, modern acoustic signal based tools are now available for such work, analysing the data automatically using computational tools is an ongoing research. We have designed a decision support system with classification ability for non-destructive testing of materials for defect classification and characterisation. The classification is performed using artificial intelligence (back propagation neural network and adaptive neuro-fuzzy inference system) and statistical techniques (k-nearest neighbor and linear discriminate analysis). The research involves identifying appropriate features for defect characterisation as there are a large number of possibilities. From the classification results, we found that k-NN gave the highest accuracy of 94% in identification of a defect and 81% in determining the size of the defect. The classification results establish the applicability of simplified methods such as k-NN in defect characterisation.*

Keywords: *Non-destructive testing, feature extraction, clustering, classification, neural networks, data mining*