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# Assessment of resistance spot welding quality based on ultrasonic testing and tree-based techniques

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## Highlights

- CART models are used to classify ultrasonic oscillograms obtained from RSW joints.
- CART models offer high interpretability at an acceptable error performance.
- Random forests diminish the misclassification rate but reduce interpretability.
- Random forest's agreement allows operators to focus just on the most difficult cases.

## Abstract

Classification And Regression Tree (CART) and Random Forest techniques were proposed as pattern recognition tools for classification of ultrasonic oscillograms of Resistance Spot Welding (RSW) joints. The results showed that CART models produced an acceptable error rate with high interpretability. These features may be used to understand and control the decision processes, instruct other human operators, compare margins of safety or modify them depending on the criticality of the industrial process. Compared with CART trees, random forests reduced the error rate at the cost of decreasing decision interpretability. The use of the agreement of the forest was proposed as a measure to reduce the workload of human operators, who would only have to focus on the analysis of ultrasonic oscillograms that are difficult to interpret.

Keywords: Resistance Spot Welding; Non-Destructive Ultrasonic Testing; Random Forest Technique; CART Trees; Classification; Quality Control

## 1 Introduction

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