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Active Learning for Semi-supervised Structural Health Monitoring

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Key words: structural health monitoring; vibration monitoring; active learning; semi-supervised learning; classification; pattern recognition.

Abstract

A critical issue for structural health monitoring (SHM) strategies based on pattern recognition models is a lack of diagnostic labels to explain the measured data. In an engineering context, these descriptive labels are costly to obtain, and as a result, conventional supervised learning is not feasible. Active learning tools look to solve this issue by selecting a limited number of the most informative observations to query for labels. This work presents the application of cluster-adaptive active learning to measured data from aircraft experiments. These tests successfully illustrate the advantages of utilising active learning tools for SHM, and they present the first application/adaptation of active learning methods to engineering data — a MATLAB package is available via GitHub: `https://github.com/labull/cluster_based_active_learning`.

1 Introduction

Structural health monitoring involves the observation of a structure or mechanical system over time using periodically spaced measurements [1]. These data are usually

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