# AI based bridge health assessment

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## Abstract

Starting from the data extracted from a long-term monitoring system installed on a steel bridge, it has been possible to outline the undamaged behaviour of the structure. The structure under monitoring is a steel suspended arch bridge of long span that has been instrumented with several types of sensors, e.g. triaxial accelerometers, load cells and environmental sensors. The records of the measurements during the first period of structural life and the lack of construction problems ensure the good respect of the structural nominal conditions.

The accelerometric data stored during this period have been used to extrapolate the dynamic characteristics of the bridge: natural frequencies, damping ratios and modal shapes. The use of a specific stochastic subspace technique (SSI-UPCX), allowed to obtain not only the modal parameters but also their uncertainty. In this way, the range of variation of modal parameters, e.g. affected by environmental factors, has been calculated and a minimum and maximum threshold for each parameter has been determined. Consequently, the assessment and control of structural health is updated and linked to these ranges of variation.

In addition, a promising modern approach to tackle the problem is the use of machine learning techniques within the broad field of AI. After the selection/reduction of the parameters that better represent the data, signal detection has been used and the obtained outcomes compared. In the light of both the above approaches, albeit in a different way, it is possible to create a model of the normal operating condition of the structure and consider the deviations from the pattern as an anomaly.

To figure out which method is the most appropriate and effective for this specific case of structural assessment in terms of effort and accuracy, represents a first step and a benchmark for the wider damage and ageing identification problem.