Abstract

Transportation infrastructures are vital to our society. These infrastructures naturally tend to deteriorate over time. A set of activities is then required to manage existing assets in accordance with sound management principles. These activities are usually integrated into systems that manage infrastructures according to technical, social and economic aspects.

This research aims to examine the potential of applying machine learning techniques to current transportation infrastructure management systems. Machine learning is an application of artificial intelligence enabling systems to automatically learn and improve from experience (data), arriving at solutions not explicitly programmed. Powered by algorithms that can learn from data, machine learning leads to efficient and effective systems that improve over time. Over the last few years, the application of machine learning has transformed several industries and could do so for transportation infrastructure as well.

To achieve the research objectives, a set of studies was performed. Each of these studies had a specific objective, the set of which can be expressed as follows: to define combined performance indicators for pavement condition assessment using machine learning; to develop machine learning models for pavement performance prediction; to formulate machine learning solutions to overcome pavement data issues, such as missing data; to integrate machine learning techniques into decision support systems for pavement maintenance management. Together these studies explored the development of machine learning applications for solving some standard pavement management problems, providing insights into the application of machine learning to transportation infrastructure management systems.

The studies successfully demonstrated the potential of machine learning applications for pavement management systems. It showed that machine learning is applicable to various transportation asset management problems, such as condition assessment, performance prediction, and decision support, and that it is able to outperform some of the analytical techniques currently used. Overall, this research work finds that machine learning is a promising tool for transportation infrastructure management systems.

Keywords: Transportation Infrastructure Asset Management; Machine Learning; Prediction Models; Decision Support Systems; Pavement Management Systems.