Role of Artificial Intelligence in Sustainable Bridge Design

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Abstract

Sustainable bridge design criteria seek not only to economise the cost, but also to diminish adverse ecological and socio-cultural impacts and works to balance all the three. This multi-criterion decision-making process is often subject to inconsistent opinions of stakeholders. To address the highly complex issue of the sustainable bridge design, Artificial Intelligence (AI) will be the best tool for decision-making process to determine the finest sustainable design by getting the probability of a particular design being chosen. AI can assist this decision-making by offering profound visions on the sustainability aspects in design problems based on available field data, thereby enhancing the quality of the design process, and concurrently served as directives for novice engineers. In this paper, a novel rating system for sustainability assessment of bridge design has been proposed and an AI based model to predict the sustainability rating of bridges has been developed.

Keywords: Sustainability, Sustainable bridge design, Sustainability rating system, Artificial intelligence, Machine learning, Supervised learning.

1 Introduction

The concept of sustainable development happens at the confluence of three constituent parts: social, economic, and environmental [1]. Nowadays, the idea has developed into specific disciplines, such as sustainable engineering, sustainable design and sustainable construction.

Sustainable engineering is rapidly growing in popularity, not only for its limited impact on the environment, but also for the new aestheticism that it has created. The designs of these structures reflect the changing attitudes of the modern period, where people expect buildings, bridges, and spaces to serve more than their singular purpose. Sustainable designs are becoming more prevalent in bridge engineering in particular, where the gap between nature and urban landscaped must be crossed and integrated [2]. Linking the three pillars of sustainability - economic, social, and environmental factors - which have distinct objectives is the main challenge in the sustainable design of bridges. Despite extensive research on economic and environmental considerations, little is known about how social factors affect the