Design of a bridge digital twin system for Intelligent operation and maintenance based on machine vision

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Abstract

Under the background of the transformation and upgrading of bridge maintenance management, aiming at the problems of weak processing capacity, low management efficiency and intelligent degree of the bridge operation and maintenance process, this paper proposes a digital twin system solution of bridge intelligent operation and maintenance based on machine vision. Then framework of the bridge digital twin system for Intelligent operation and maintenance is proposed, followed by the realization methods based on machine vision. Finally, a case application of the concrete simply supported girder bridge is given.

Keywords: bridge; operation and maintenance; system; machine vision; digital twin

1   Introduction

By the end of 2021, China has built 961,100 highway bridges with a total mileage of 73,800 km. Typically, the successful construction of representative bridges such as Sutong Yangtze River Bridge, Nansha Bridge, Lupu Bridge, and Hong Kong-Zhuhai-Macao Bridge indicates that China has reached the international leading level in bridge design theory, construction technology and bridge construction equipment. At the same time, with the increase of service life of bridges and the deterioration of service environment, maintaining the structural durability and safety of in-service bridges, and ensuring and extending the service life of bridges has become one of the main problems faced by bridge engineers[1]. Monitoring and testing the performance of bridges in service, and making scientific evaluation and maintenance decisions, has become a research hotspot in the world[2]. The traditional operation and maintenance system has problems such as poor real-time monitoring or detection, difficult condition evaluation, high management cost. Therefore, it is necessary to study a management system with a new service model. Digital twin provides a fresh idea to this challenge, which describes the whole life cycle trajectory of