

Digitalization of bridge inventory via automated generation of BIM models

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Abstract

The construction of building information modeling (BIM) models for infrastructure is becoming increasingly prevalent, as it facilitates current asset management practices. Existing bridges are particularly challenging to model due to their complex geometry and missing information. Given the recent advancements in 3D surveying and artificial intelligence, new possibilities emerge for the generation of BIM models. This paper presents a novel, modular framework for an automated construction of as-is bridge BIM models from point clouds of existing bridges. Bridge element datasets were provided to train neural network. Trained neural network can identify bridge elements, which are further processed using geometric algorithms into surface and solid bridge elements. This result can be additionally enriched with information from existing databases. The final BIM models are exported in the standardized, open Industry Foundation Classes (IFC) format.

Keywords: bridge inventory; point cloud; artificial intelligence (AI); deep learning (DL); building information modeling (BIM); digital twin (DT); Industry Foundation Classes (IFC).

1 Introduction

1.1 Motivation

According to the “Master Plan BIM Federal Highways (Masterplan BIM Bundesfernstraßen)” of the German Federal Ministry for Digital and Transport [1], since 2021 new construction projects have to be planned and built using digital building models. These digital building models are to be

further used to manage infrastructure operation and maintenance phases more effectively.

The benefit of the digitalization in the operation and maintenance lifecycle phases can however only be fully exploited when BIM (building information modelling) [2] models are available for the majority of the existing infrastructure assets. Depending on the quality and completeness of existing 2D plans and information in infrastructure databases, the manual digitalization of 2D plans can be time-consuming, costly or only feasible to a