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RESEARCH BRIEF

UAS Image-Based Point Clouds to 3D BrIM: Deep Semantic Segmentation for 3D as-is Bridge Model Generation

Yelda Turkan, PhD

Background

The mobility of people and goods is highly dependent on the health of a nation's transportation system. However, the U.S. infrastructure has been repeatedly graded in poor condition (ASCE, 2017), and the budget available to either repair or replace these structures is limited (USDOT, 2017). Timely inspection and effective maintenance of bridges is crucial to avoid any issues that may have a negative impact on public mobility. However, current bridge inspection practice inhibits the collection and analysis of information regarding the status of bridges in an efficient and timely manner. This problem is further exacerbated by the large number of bridges in the U.S. and the limited number of inspectors available. A Bridge Information Model (BrIM) is an object-oriented database that enables storing all bridge data, including its 2D drawings and 3D models, material specifications, inspection notes, images and maintenance information. Recent research efforts have focused on implementing BrIM for bridge structural condition assessment, and concluded that it is a suitable concept and technology that can be used to improve the current bridge inspection and management processes (Xu and Turkan, 2018). However, there are several challenges that needs to be overcome for wide adoption of BrIM for bridge inspections and management tasks.

Research Project

The current BrIM development process for existing bridges is labor intensive, time consuming, prone to errors, and state DOTs may not have the resources or personnel time to develop 3D BrIM for all the bridges they maintain and operate. In order to overcome the challenges associated with the development of 3D BrIMs, this research project will develop a novel data collection and analysis framework that enables rapid collection of 3D geometrical information from existing bridges in the form of 3D dense point clouds, and converts them into 3D BrIM in an automated and efficient manner. 3D point clouds will be obtained by applying Structure from Motion (SfM) algorithms to the images collected using an Unmanned Aerial System (UAS). In the next step, these 3D point clouds will be automatically segmented and classified into different structural components using deep learning algorithms. In the final step, the labeled point clouds will be automatically converted to 3D BrIM. Overall, this study will develop a framework that will make it much more convenient and faster to develop and implement 3D BrIM, which can improve the current bridge inspection and management practice significantly in terms of efficiency and safety, thus help improve public mobility.

ABOUT THE AUTHORS

The research team consisted of Yelda Turkan of Oregon State University.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

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FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/uas-image-based-point-clouds-to-3d-brim-deep-semantic-segmentation/