3D Augmented Urban Space Modeling from Unstructured Point Clouds

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ABASTRACT:

Today, we are living in cities, which face many challenging issues. It is estimated that over 50% of the world's population now lives in urban areas and this will rise to 70% by 2050. On the other hand, there is no secret that most of the urban infrastructure in civilized countries is aging and failing and that funding has been insufficient to repair and replace it. These challenges will bring a tremendous impact on the sustainability of urban infrastructure assets (building, transportation, utility, etc). In this regard, today's engineers face the formidable challenge of modernizing the urban infrastructure that supports the competitiveness of cities which account for nearly 90% of global population growth, 80% of wealth creation, and 60% of total energy consumption. One of primary research interests in Geomatics Engineering is to reconstruct "as-built" infrastructure models, approximating the existing infrastructure conditions modelled with semantically rich primitives. Having such accurate model representation allows us to efficiently conduct high-precision risk analysis, inventory update and management. However, like many other vision tasks, automatically generating large-scale "as-built" models still remain unresolved research problems. Thus, today's practice used for the infrastructure management heavily relies on human-centric, error-prone and time consuming process. This presentation will introduce the latest research activities conducted through my research programs, studying image understanding and model reconstruction of outdoor and indoor building spaces, railways and utility networks using dense point clouds. Also, I will present the augmentation of the 3D models to urban information and communication technology (ICT) for providing real time decision support and spatial awareness. These augmented 3D models serve as important model-centric interfaces, blurring discrete boundaries between virtual and physical urban space, which could result in unprecedented opportunities for efficiently monitoring and managing infrastructures.

Gunho Sohn is an Associate Professor at the Department of Earth and Space Science and Engineering, and a former undergraduate program director in Geomatics Engineering program at York University. His research interests are in the area of photogrammetry, computer vision and machine learning. Current researches are focused on graphical modeling, object recognition, vision-based navigation and 3D reconstruction for large-scale urban space and infrastructure modeling. As a recipient of York's research leaders award in 2016, Dr. Sohn is co-leading several research programs including the NSERC CREATE Data Analytics and Visualization (DAV), ORF Research Excellent Programs in BRAIN (Big Data Research, Analytics, and Information Networks) Alliance and ISSUM (Intelligent Systems for Sustainable Urban Mobility), and ORF Infrastructure in ADERSIM (Advanced Disaster Emergency Response and Simulation). He is also co-leading ISPRS's international benchmark on 3D scene analysis and modeling. Dr. Sohn is a co-founder of Industrial SkyWorks, which became the first night-time drone operating service provider in US for building envelope inspection in 2016.