EMERGING TOPICS IN 3D GIS

EDITORIAL

This section of Transactions in GIS "Emerging topics in 3D GIS" represents a collection of approaches to acquire, analyse, and utilise 3D geospatial and Building Information Modelling (BIM) data. The issue aims at providing an insight in the latest developments and applications in advanced 3D data and technologies, encompassing topics from 3D city models acquisition and processing to BIM and 3D spatial data analysis. A part of this special issue arises from the 3D GeoInfo 2019 Conference and the 2th BIM/GIS Integration Workshop organised in Singapore (Stouffs *et al.*, 2019a,b). The authors were given an opportunity to extend their research papers published in the proceedings of the event, but this issue was also open to other researchers working on the state of the art of the topics covered by the event.

This special issue consists of eleven papers that represent the latest emerging topics in 3D GIS and cover a number of important aspects of 3D spatial data science and BIM. This issue opens with the paper "Area and volume computation of longitude–latitude grids and three-dimensional meshes" by Kelly and Šavrič (2021). The paper presents relevant geodetic considerations for longitude-latitude grid and three-dimensional mesh analyses and demonstrates the effects of neglecting these aspects on global and regional data analyses using GIS. Using ecological marine units (EMUs), the paper compiles and compares calculations of grid cell surface area and mesh element volume on spherical and ellipsoid Earth models, confirming that ellipsoidal equations yield the best results.

The second paper "Web-based real-time visualization of large-scale weather radar data using 3D tiles", by Lu *et al.* (2021), argues that existing weather studies are mostly confined to 2D and proposes a web-based real-time 3D visualization framework for large-scale weather radar data using 3D Tiles. The researchers develop a prototype Meteo3D presenting a nation-wide implementation of the framework.

Dehbi *et al.* (2021b) concentrate on advancing the automatic acquisition of 3D building models, by focusing on improving the reconstruction of dormers. The paper presents a novel approach that classifies and reconstructs roofs and their structures based on designed statistical features derived from probability density functions. The presented approach identifies even rather small dormers, and it contributes to the increase of detail of 3D building models.

In the work focused on indoor of buildings, Hu *et al.* (2021) underline the importance of semantic information of indoor features. The researchers develop an approach to infer room usage information, and use two techniques: random forest and relational graph convolutional networks. The experiments are conducted on floor plans of university research buildings.

Dehbi *et al.* (2021a) propose a novel method for the 3D reconstruction of LoD2 buildings from LiDAR data using an active sampling strategy. Following machine learning approaches and using prior knowledge represented by density distributions, the method overcomes the pitfalls of RANSAC-based approaches and validates promising hypotheses.

Eriksson *et al.* (2021) assert the importance of version management in 3D geoinformation, as one of the prerequisites for a digital information flow in the planning

and building process. Their paper defines requirements of version management and it evaluates different versioning methods, focusing on geodata buildings in the 3D cadastre process. One of the takeaways of the work is that there is a trade-off between number of functionalities and complexity in version management.

In "Automatic filtering and 2D modelling of airborne laser scanning building point cloud", Tarsha Kurdi *et al.* (2021) suggest a new approach for automatic building roof modelling exclusively using Lidar data, firstly, filtering the building point cloud to detect the points of roof class and, secondly, modelling the roof by detecting and classifying the roof plane boundaries and analyzing their junction relationships. Quantifying correctness and completeness of both steps demonstrates the high efficiency of the approach.

Nikoohemat *et al.* (2021) present a formal grammars approach to check the semantic, geometric, and topological consistency of a reconstructed 3D model of indoors. This method is independent of the level of detail and the reconstruction method. The approach is formulated such that it can be integrated into industrial-level model checkers.

In the ninth article of this special issue, Asghari *et al.* (2021) address the challenges involved in checking the closure of diverse 3D legal spaces represented by 3D geospatial models in cadastre. The work employs several techniques to examine the closure of diverse 3D cadastral objects. A notable characteristic of their work is that the implementation has been released publicly as open-source code.

Lucks *et al.* (2021) present a novel approach for improving trajectory estimation using 3D city models and kinematic point clouds, by matching the recorded point cloud with the semantic city model using a point-to-plane iterative closest point method. The applicability of the method is demonstrated on an inner-city data set recorded with a mobile mapping system.

Finally, the article "A modular graph transformation rule set for IFC–to–CityGML conversion" by Tauscher *et al.* (2021) presents research on novel techniques to facilitate the exchange of data between two architectural and geospatial formats. They develop a modular framework for IFC–to–CityGML transformation rules, and demonstrate the implementation with a range of input datasets.

In summary, we believe that this special issue demonstrates the versatility of research on the topic of 3D GIS and that it presents a snapshot of current research activities in the field. We hope that this special issue will be useful to many readers of Transactions in GIS, and that the journal will continue attracting submissions describing cutting edge work in the domain of 3D city modelling and BIM.

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Filip Biljecki[1], Rudi Stouffs[1], Mohsen Kalantari[2]
[1]National University of Singapore, Singapore
[2]University of Melbourne, Australia

ORCID
Filip Biljecki https://orcid.org/0000-0002-6229-7749
Rudi Stouffs https://orcid.org/0000-0002-4200-5833
Mohsen Kalantari https://orcid.org/0000-0002-6650-5218

Correspondence
Filip Biljecki, Department of Architecture and Department of Real Estate, National University of Singapore, 4 Architecture Drive, Singapore 117566
Email: filip@nus.edu.sg

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