BINYU LEI

4 Architecture Drive, National University of Singapore, Singapore
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RESEARCH INTEREST

Digital twins, 3D GIS, graph neural networks, crowdsourcing data, open government data, urban planning, socio-economic development, geospatial analysis, data visualisation

EDUCATION

National University of Singapore, Singapore — Aug 2021 - Present
PhD Researcher, Urban Analytics Lab

School of Design, University of Melbourne, Melbourne, Australia — Jul 2017 - Jul 2019
Master of Urban Planning

East China Normal University, Shanghai, China — Sep 2013 - Jun 2017
Bachelor of Science in Human Geography and Regional Planning (Hons)

RESEARCH EXPERIENCE

Urban Analytics Lab, Singapore — Aug 2021 - Present
PhD Researcher

- 3D City Index: developed a framework to evaluate 3D city models; implemented the approach to evaluate 3D data from different dimensions; provided an understanding of the state of 3D GIS
- Digital twins: conducted a systematic review of documented challenges in the literature; designed an expert survey contributed by a panel of domain experts; aggregated and analysed results by using R; identified challenges to digital twins combining technical and non-technical perspectives
- Urban sidewalk: helped with experiments set up and participants' recruitment; assisted with computer vision tasks by leveraging street view imagery for outdoor comfort studies
- Crowdsourcing data: evaluated the availability and suitability of volunteered geospatial information in different urban scenarios (e.g. OpenStreetMap data, Mapillary street view imagery, social media data); explored the mechanism to realise semantic richness in urban digital twins
- Urban deprivation: retrieved social sensing data and building footprints in London; assisted with correlation analysis between street view imagery and socio-demographical profile
- Street classification: leveraged the results of street image segmentations to cluster street network

School of Design, University of Melbourne, Melbourne, Australia — Feb 2019 - Jul 2019
Member of Healthy Cities 2050 Research Studio

- As a research student joined the "Healthy Cities 2050 Plan for Clayton" project, focusing on walking and cycling priority zones to build the suburb as part of a healthy future Melbourne
- Completed "Walking and Cycling Clayton 2050 Strategic Plan", including reviewed literature on cases of healthy communities with measures to encourage walking/cycling; assessed planning schemes, transport planning, and cycling policies; and visualised connectivity of active transport from Clayton Station using QGIS; presented the final report to public sectors and local companies at the planning meeting

PUBLICATIONS

- Lei, B., Stouffs, R., & Biljecki, F. (2022). Assessing and benchmarking 3D city models. *International Journal of Geographical Information Science*, *37*(4), 788-809.
- Lei, B., Janssen, P., Stoter, J., & Biljecki, F. (2023). Challenges of urban digital twins: A systematic

review and a Delphi expert survey. *Automation in Construction*, *147*, 104716.

- Liu, P., Zhao, T., Luo, J., Lei, B., Frei, M., Miller, C., & Biljecki, F. (2023). Towards Human-centric Digital Twins: Leveraging Computer Vision and Graph Models to Predict Outdoor Comfort. *Sustainable Cities and Society*, *93*, 104480.
- Lei, B., Su, Y., & Biljecki, F. (2023, September). Humans As Sensors in Urban Digital Twins. In *International 3D GeoInfo Conference* (pp. 693-706). Cham: Springer Nature Switzerland.
- Wang, S., Huang, X., Liu, P., Zhang, M., Biljecki, F., Hu, T., ... & Bao, S. (2024). Mapping the landscape and roadmap of geospatial artificial intelligence (GeoAI) in quantitative human geography: An extensive systematic review. *International Journal of Applied Earth Observation and Geoinformation*, *128*, 103734.
- Lei, B., Liang, X., & Biljecki, F. (2024). Integrating human perception in 3D city models and urban digital twins. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *10*, 211-218.
- Lei, B., Liu, P., Milojevic-Dupont, N., & Biljecki, F. (2024). Predicting building characteristics at urban scale using graph neural networks and street-level context. *Computers, Environment and Urban Systems*, *111*, 102129.

CONFERENCES AND EVENTS

The 19th International 3DGeoInfo Conference 2023 **Jul 2024**

Speaker, talk title: Integrating Human Perception in 3D City Models and Urban Digital Twins, University of Vigo, Spain

The 128th Open Geospatial Consortium Meeting (OGC) **Mar 2024**

Speaker, Talk title: Humans as Sensors in Urban Digital Twins, Virtual Event, TU Delft

The 18th International 3DGeoInfo Conference 2023 **Sep 2023**

Speaker, talk title: Humans as Sensors in Urban Digital Twins, Technical University of Munich, Germany (Best Paper Award)

London Data Week **Jul 2023**

Keynote, talk title: Understanding Urban Data and Digital Twins in Cities, Centre for Urban Science and Progress, the King's College London, Virtual Event

The 124th Open Geospatial Consortium Meeting (OGC) **Oct 2022**

Speaker, Talk title: Understanding Challenges to Urban Digital Twins, Lifelong Learning Institute, Singapore

NUS-SUTD PhD Symposium in Architecture **May 2022**

Speaker, Talk title: Understanding 3D City Models and Digital Twins, National University of Singapore

The 122nd Open Geospatial Consortium Meeting (OGC) **Mar 2022**

Speaker, Talk title: Assessing and Benchmarking 3D City Models, Virtual Event

PEER REVIEW EXPERIENCE

International Journal of Geographical Information Science, Automation in Construction, Energy & Buildings, Resources, Conservation & Recycling, Building Simulation

OTHER ACTIVITIES

- Membership: Member of Open Geospatial Consortium; Member of Planning Institute of Australia (Associate); Member of China Land Science Society