(SEC) SINGAPORE-ETH CENTRE 新加坡－ETH 研究中心

(FCL) FUTURE CITIES LABORATORY 未来城市实验室

A Sliding Window Method For Detecting Corners Of Openings From Terrestrial LiDAR Data

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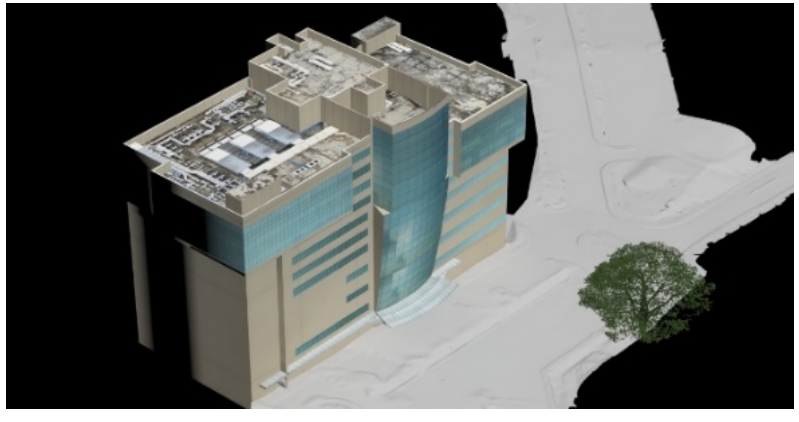
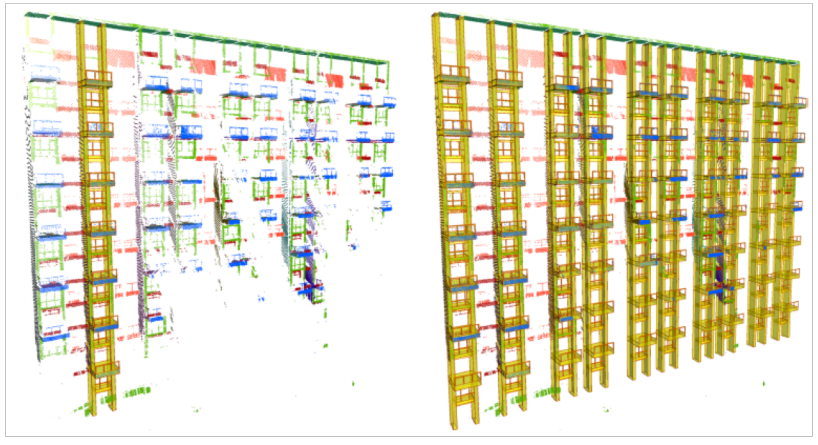
Outline

- Background
  - Towards LoD3 modeling
- Methodology
  - Sliding window search
  - Change detection for façade elements
  - Corner point intersection
- Experiments
  - Terrestrial LiDAR data
- Discussion
- Conclusion and future work

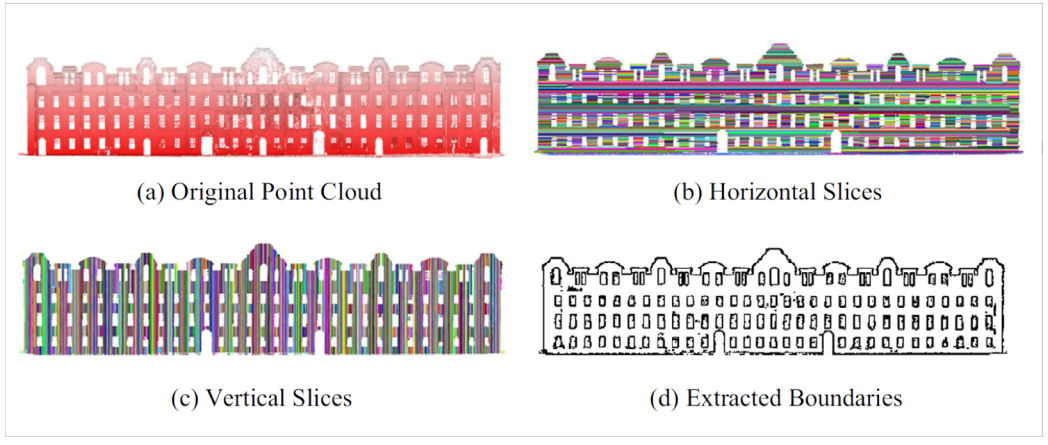
Virtual Singapore - generate and maintain LoD3 3D city models



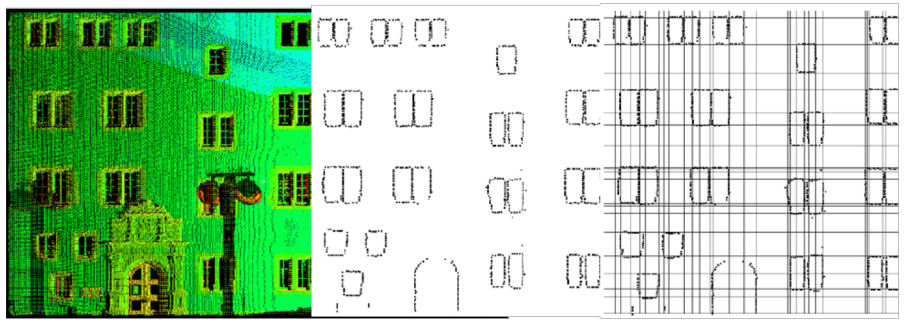
Literature review



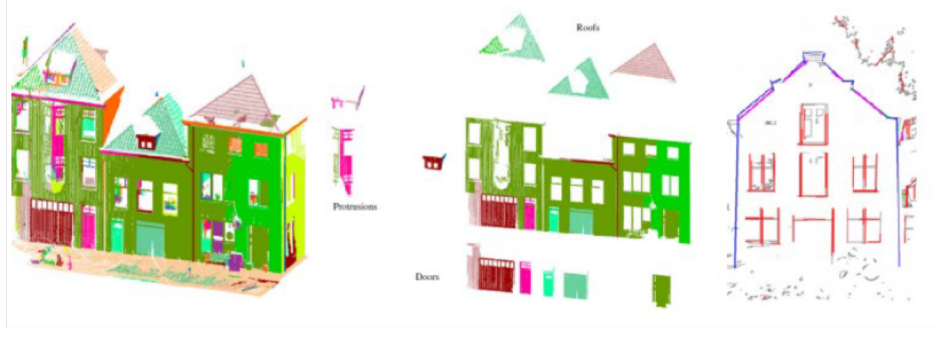
L. Nan et al., 2010



S.M.Iman Zolanvari, D.F. Laefer, 2016

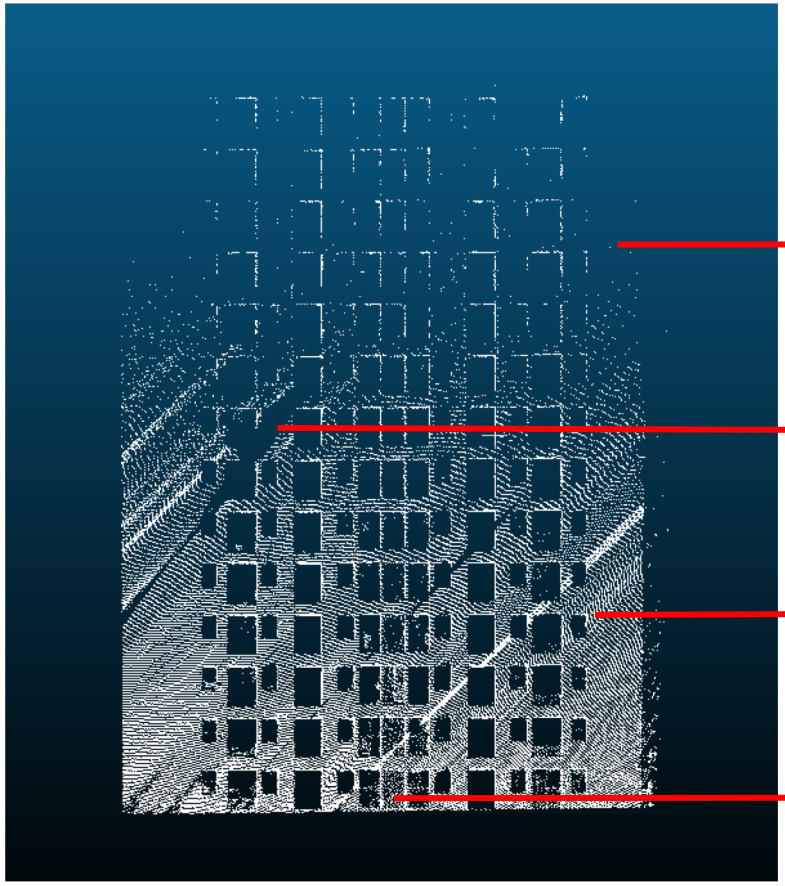


S.Becker, N.Haala, 2007



Shi Pu, et al., 2009

Motivation - Detecting openings from point clouds towards LoD3 modelling



Challenges of MLS data:

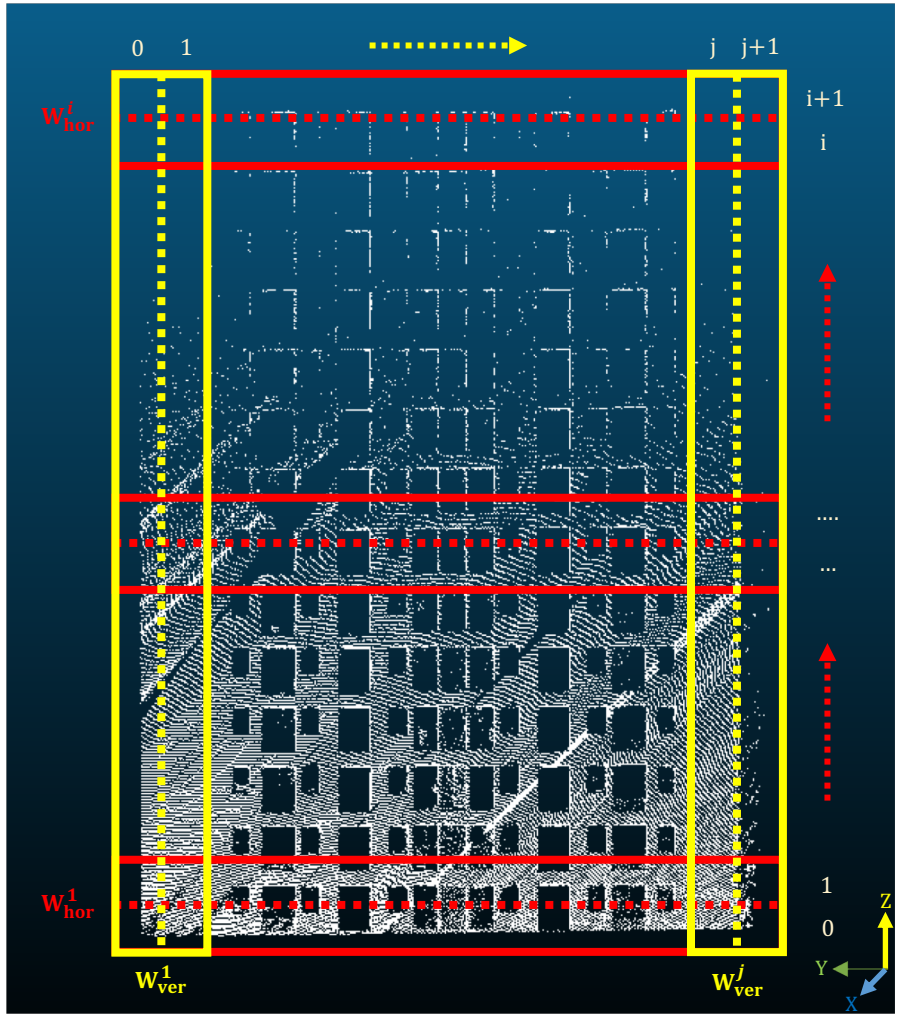
Inhomogeneous and low point density

Occlusion

Primitives

Outliers

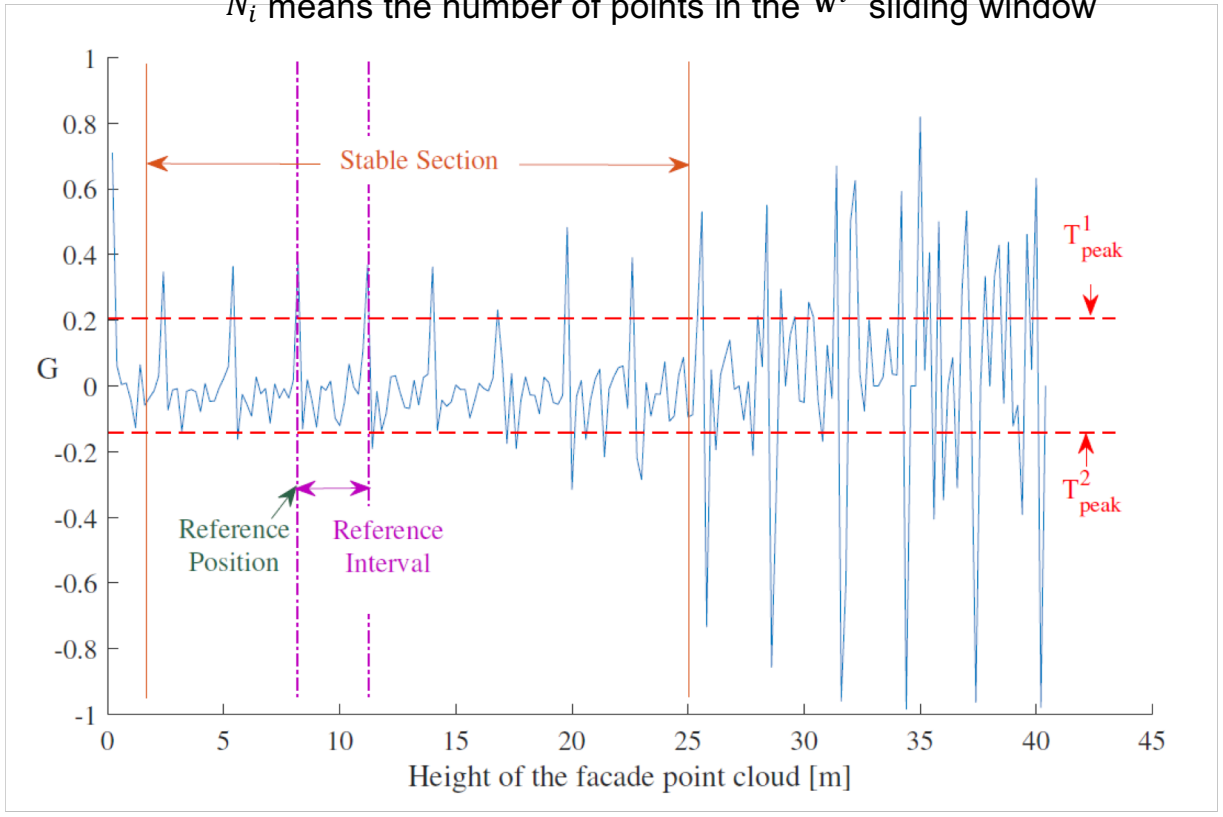
Methodology- A sliding window method



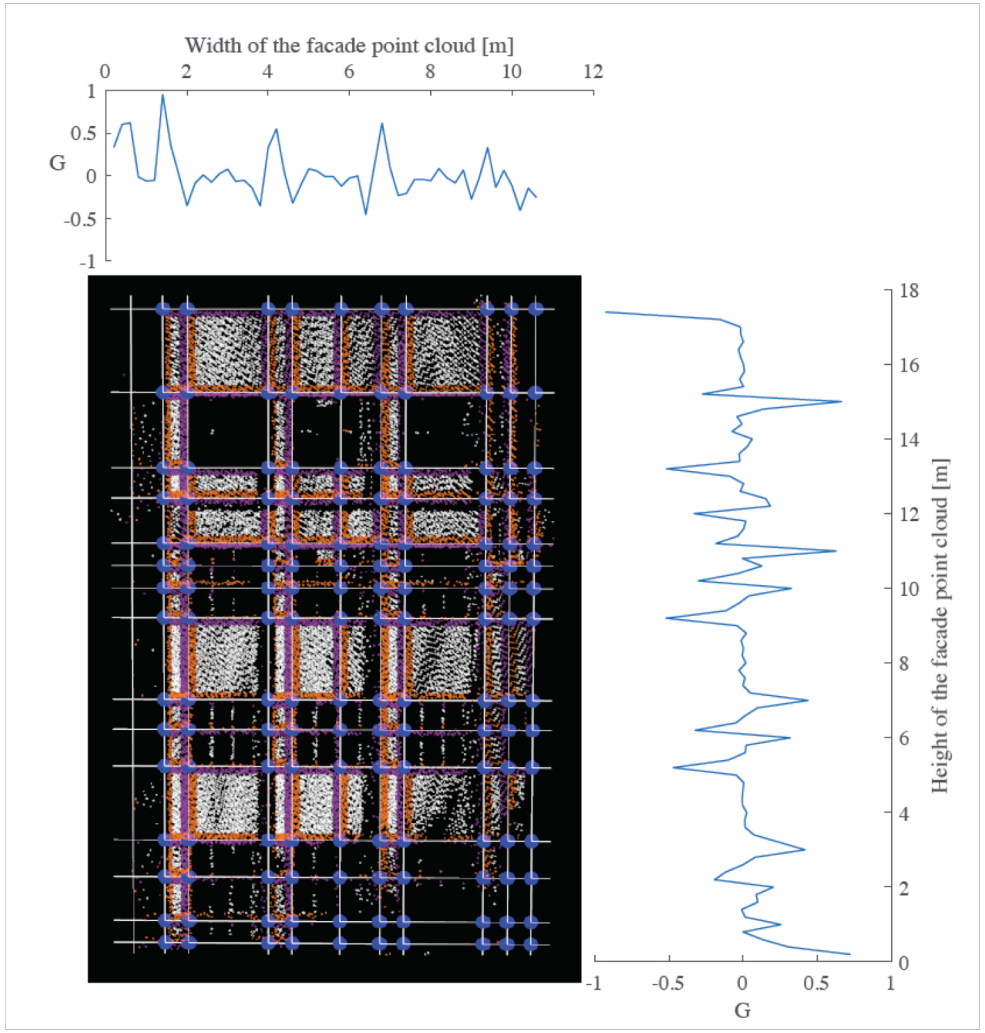
Gradient in sliding window

$$G = \frac{N_{i+1} - N_i}{N_i + N_{i+1}} \rightarrow \begin{cases} 1 & N_i \ll N_{i+1} \\ 0 & N_i \approx N_{i+1} \\ -1 & N_i \gg N_{i+1} \end{cases}$$

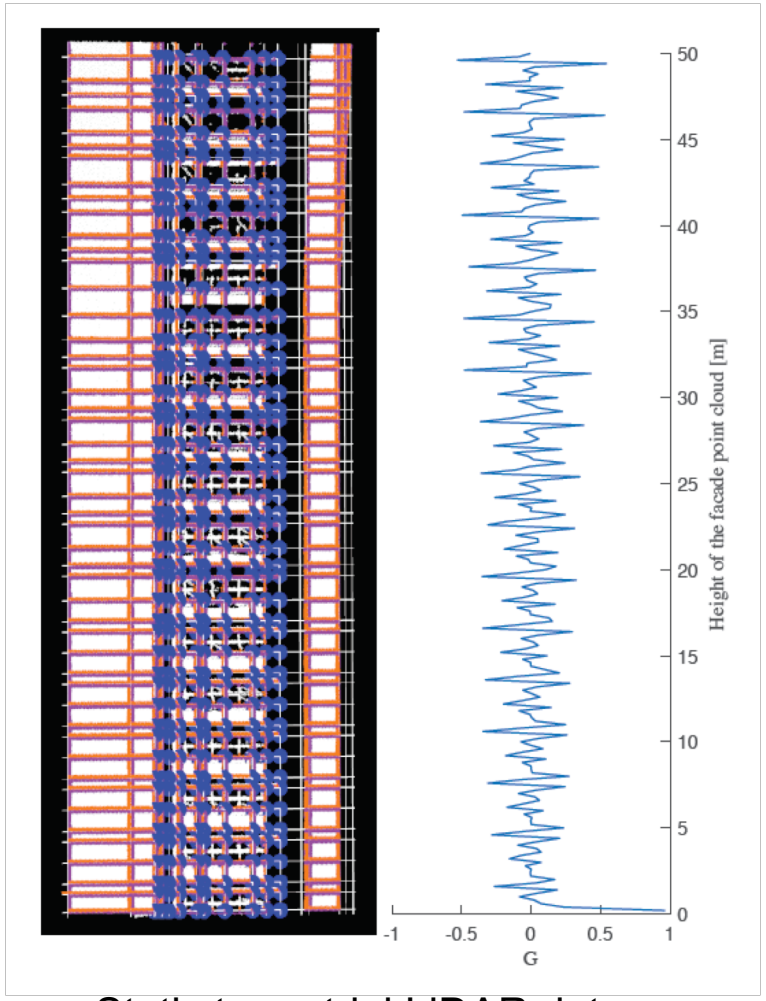
N_i means the number of points in the $\mathbf{w}^i$ sliding window



Experiment – terrestrial LiDAR data

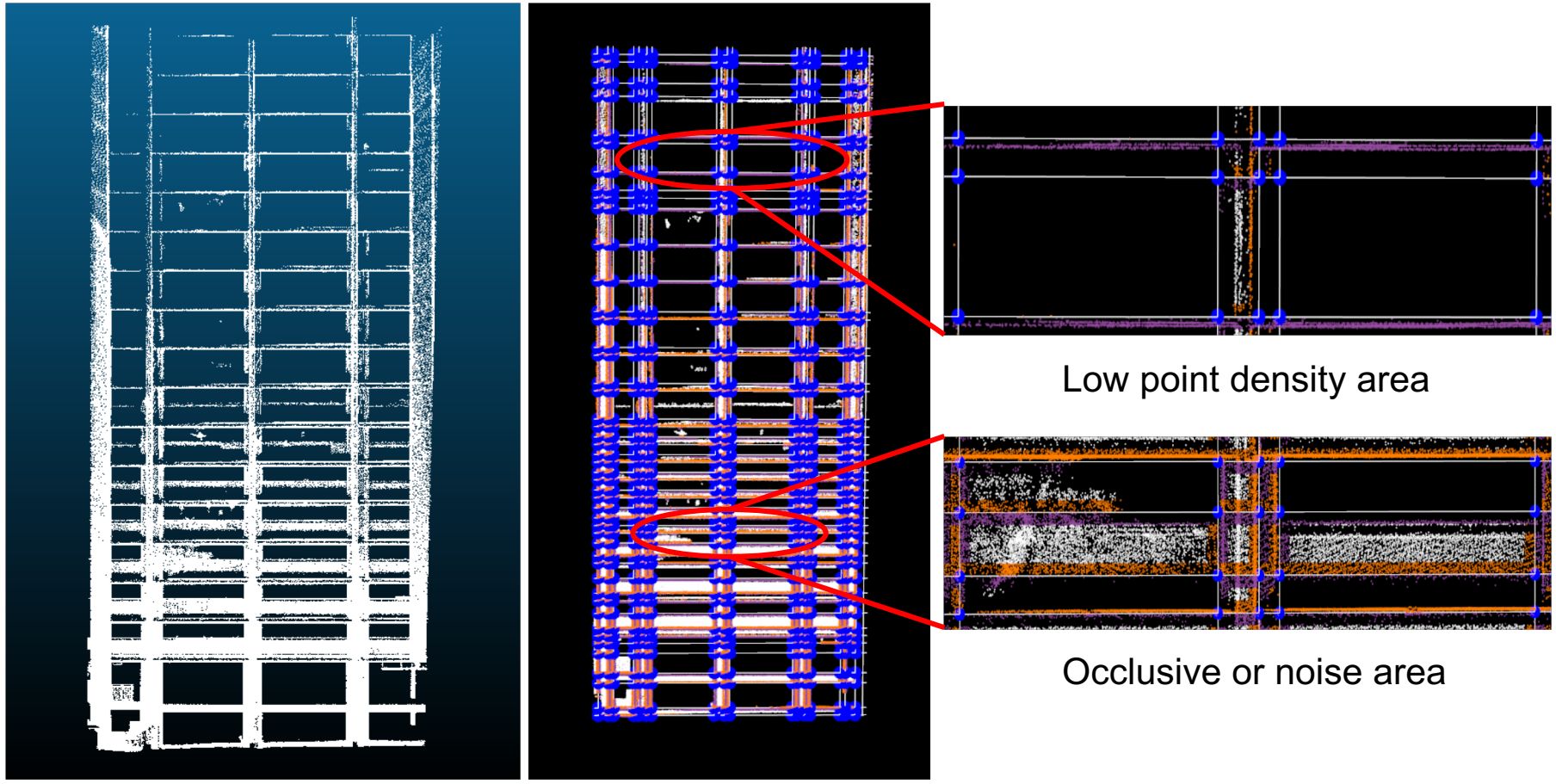


Mobile LiDAR data



Static terrestrial LiDAR data

Experiment – Mobile LiDAR data



Discussion

Challenges \ Methods	Data-driven	Rules-driven	User-driven
Noise point			
Low point density			
Occlusion / data incomplete			
Irregular repetitive			

 : The method is moderately robust to the corresponding challenge.

➢ **Noise effect and complex façade structures still be the main challenges**

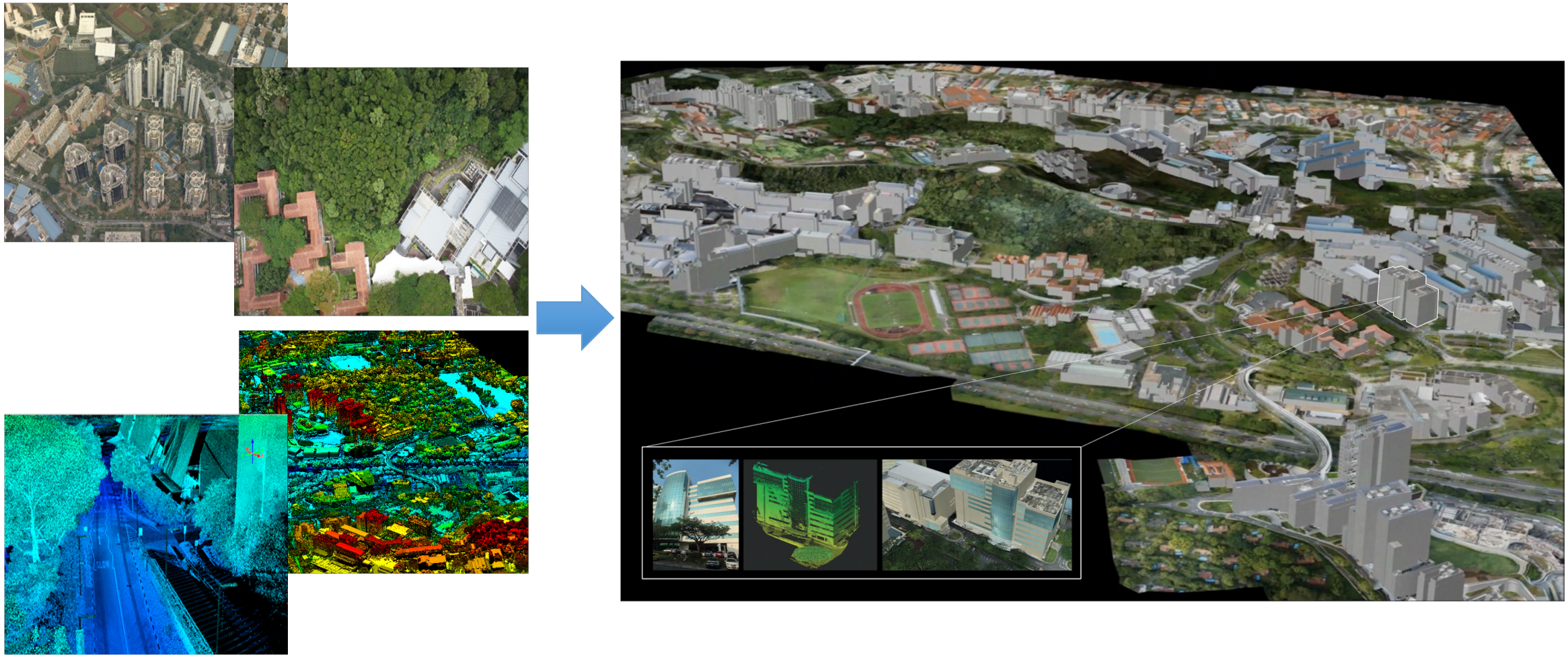
Conclusion

- ✓ Data-driven
- ✓ Locate corners of openings from (static & mobile) terrestrial LiDAR data
- ✓ Recovers corner points in partly missing data areas

Future work

- ➢ Extend to façade elements classification and modelling
- ➢ Assist feature extraction and semantic labelling from multi-source data

Virtual Singapore – Modelling, Labelling, Editing



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