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Comparative Analysis of Automatic Methods for Road Infrastructure Elements Extraction from Point Cloud

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Need for Road Infrastructure Objects Extraction

- In order to better manage the environment, built objects and assess their possible deformations, the collection of 3D spatial data is becoming increasingly important.

- DGM, DTM, navigation maps, traffic management..

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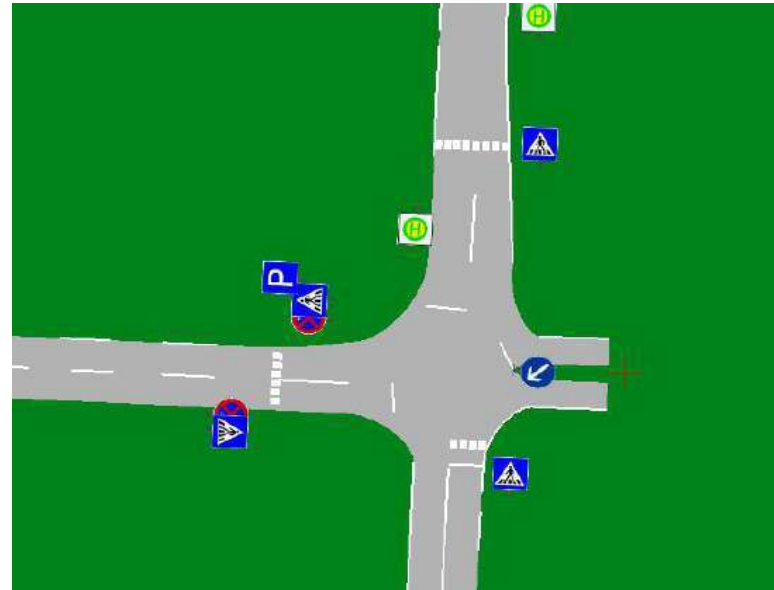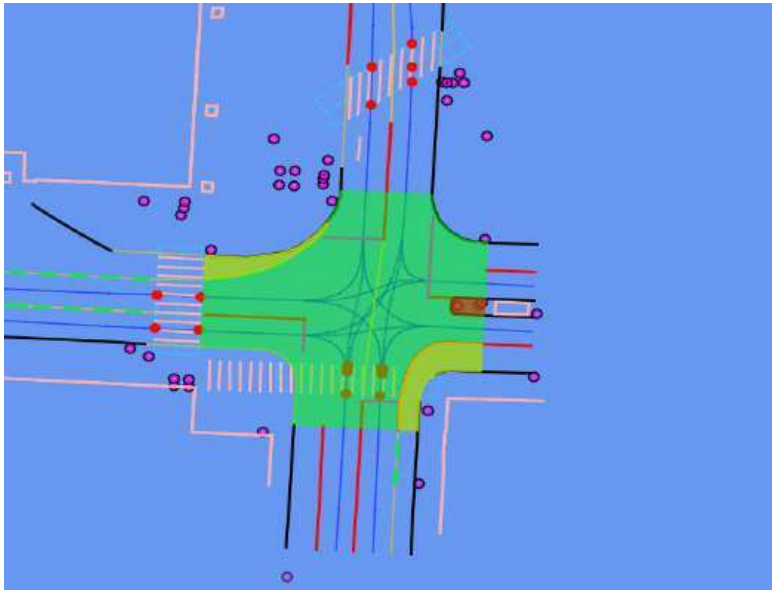
LiDAR Usage in Road Infrastructure Objects Extraction

- Active method

- Georeferenced data

- Greater accuracy, precision and density

- High spatial and temporal resolution

- Multiple reflection registration
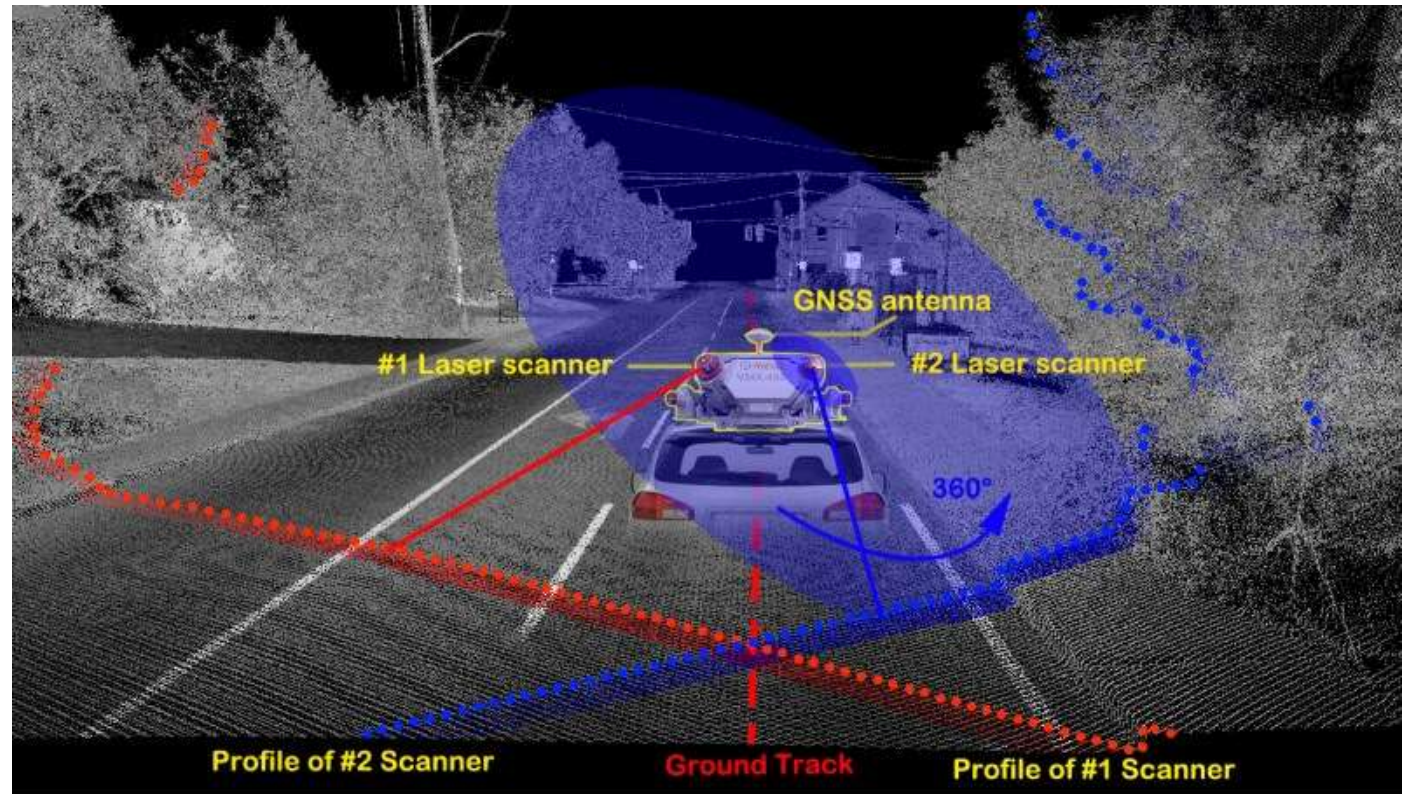
Objects Extraction Solutions

- C++ code

	Total number	Recognized number
Ground	1	1
Wall	1	1
Window	11	7
Roof	3	3
Door	5	5
Protrusion	3	3
Intrusion	0	0

- Ground, wall, roof, door and protrusion are all very well recognized, while only 7 of 11 window features are correctly recognized. This difference in recognition rate is mainly due to the different segmentation quality.
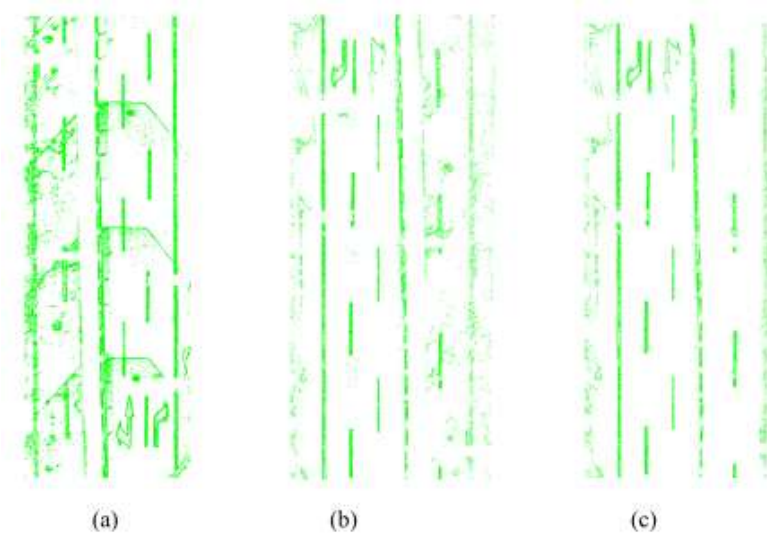
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Objects Extraction Solutions

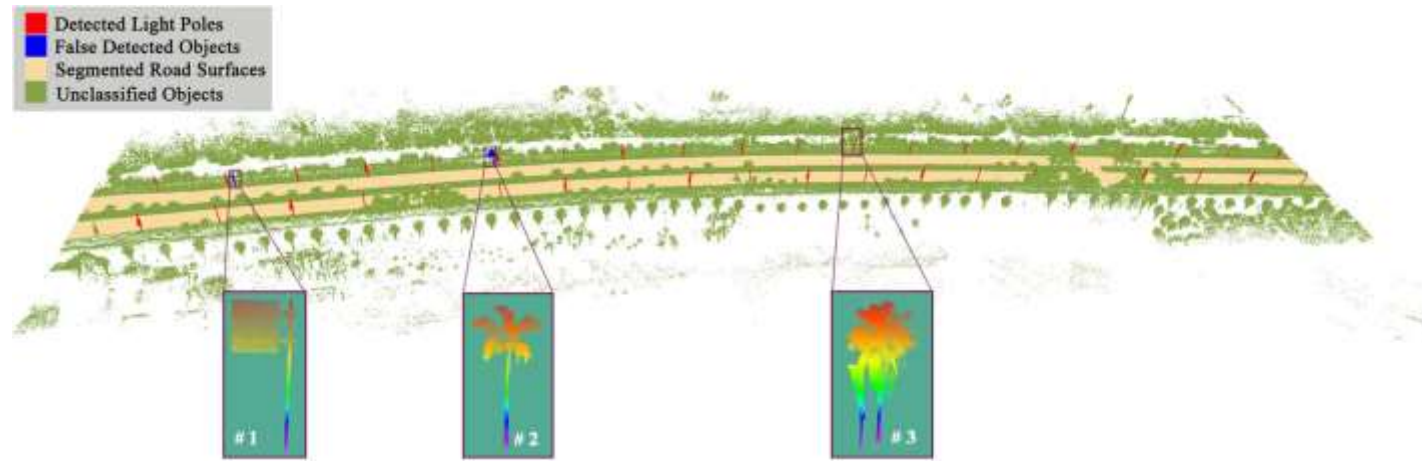| Areas	Plan metric accuracy [m]	Height error [m]
VH 1	1.05	0.41
VH 2	0.74	0.37
VH 3	0.89	0.27
Average	**0.89**	**0.35**

- For all areas, there were many under-segmentation cases where small roof structures could not be separately extracted, but might be merged with the neighboring large planes. Some low height roof structures were missed.

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Road Marking Extraction Solutions

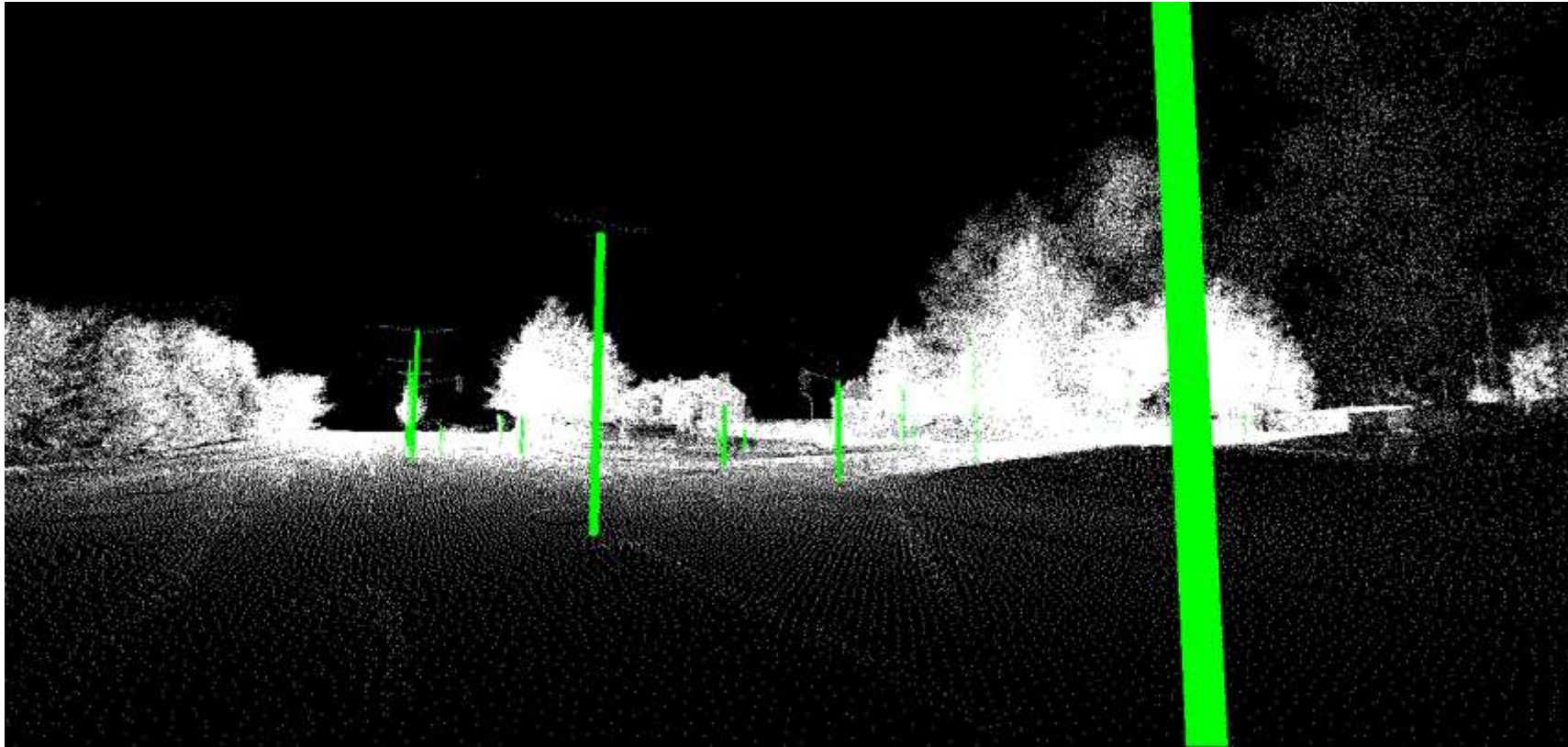

(a)   (b)   (c)

- Extraction results using: (a) adjacent point cloud gray level differential; (b) point cloud intensity value and intensity difference; (c) dynamic grid point cloud density filtering .

- The results indicated that both correctness and completeness were higher than 90%.

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Street Light Poles Extraction Solutions

- Road and non-road surface segmentation
- This methodology has a lot of advantages, such as true positives rate and quality of final result. Anyway, there is still space for further development, regarding detection of other pole-like objects on street, such as masts, traffic lights and signals.

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Street Light Poles Extraction Solutions

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Conclusion

In the past two decades, LiDAR technology has rapidly developed and been used to acquire geospatial information for a variety of applications: urban planning, environmental impact assessment, cultural heritage documentation, intelligent transportation systems, and disaster management. This system provides an efficient solution for capturing spatial data in a fast, efficient and highly reproducible way. Thus, accurately extracting objects from mobile LiDAR point cloud has attracted more and more attention in different branches.

Nowadays, there are a lot of methodologies for obtaining objects of interest. The focus is on improving existing methodologies regarding speed, quality, precision and level of details. A key issue is to identify geometric features (for example, the boundary of a building) automatically. Compared with the capturing of mobile LiDAR data, which is straightforward, the processing of these data urgently requires powerful and effective solutions for purposes such as emergency mapping, feature extraction, data fusion, and 3-D reconstruction. That is why the need for detailed 3-D information about buildings continues to increase steadily.

Thank You for Your attention!

Questions

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