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Geometric accuracy of the automated generation of vectors

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Geometric accuracy of the automated generation of vectors

Joachim Höhle

1. Introduction

The specifications of governmental mapping organizations regarding completeness and geometric accuracy must be fulfilled by the applied method. Figure 1 depicts the results of the automated generation of buildings from DSM-based ortho-images. The presented example uses open-source data of a German mapping authority. They are described in (Höhle, 2023), and they were downloaded from their portal¹.

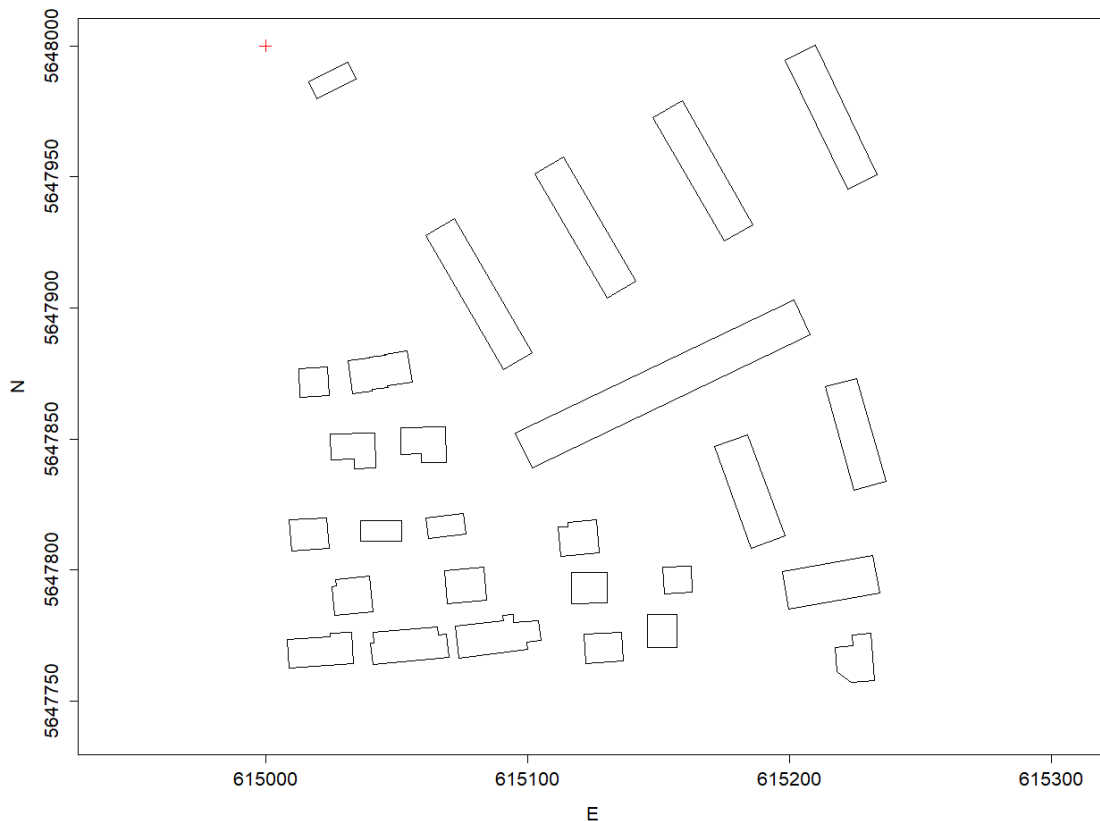


Figure 1. Georeferenced vectors of buildings derived from DSM-based ortho-images by means of automated processing.

Two references are used: The DTK10 and the manual digitized coordinates of the ortho-image. These references are depicted in Figure 2 and 3. The ortho-image is used as source data as well as reference.

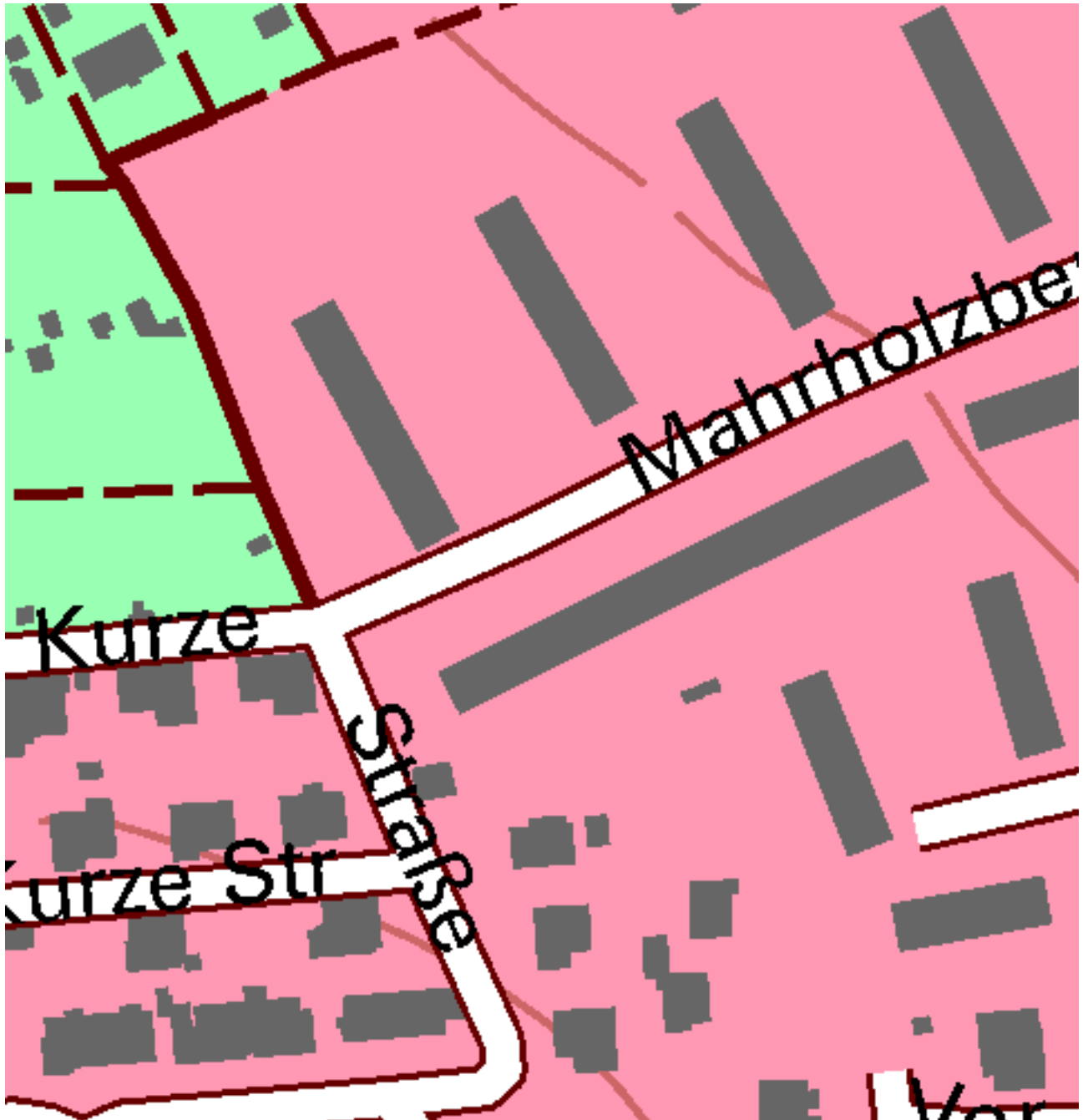


Figure2. Extract of DTK10 covering the test area



Figure 3. Ortho-image of test area.

2. Derivation of the geometric accuracy

The test of the geometric accuracy of the derived buildings requires references of superior accuracy. The applied accuracy measures in the example are the standard deviation and the number of gross errors. Gross errors are defined by $>3\sigma$. All available corners of a selected area shall be tested. Only corresponding corners will be compared.

3. Results

The test of completeness reveals that all buildings the area are mapped. Smaller objects than the specified area of 25m² can be seen in the DTK10. Other buildings are missing because the map has not been updated with regard of the date of the imagery taking for the ortho-image (2022).

Table 1 displays the geometric accuracy of derived corner coordinates.

reference	DTK 10		orthoimage	
coordinate	<i>E</i>	<i>N</i>	<i>E</i>	<i>N</i>
σ [m]	1.0	1.4	1.0	0.8
n_{corner}	102		135	
$n_{\text{gross error}}$	5		4	
n_{na}	16		0	

Table 1. Geometric accuracy of derived corner coordinates.

Gross errors are excluded before the computation of the final standard deviation (σ).

4. Discussion

The generated vectors depend very much on the quality of the automatically derived land cover map. One problem is the difference of the roof area from other building parts (balconies, sunshades, annexes, etc.). Figure 4 is an example of such a misinterpretation by the applied automatic classification.

Not all corners of the derived buildings could be identified in the DTK10. The number of corners is therefore reduced due to 16 non-available corners (n_{na}). The DTK10 is derived by automated generalizing. Its accuracy is quoted with 3m. The geometric accuracy of the derived coordinates of $\sigma_{\text{average}} = 0.9\text{m}$ corresponds to the results with other test materials, e.g. in (Höhle 2021).

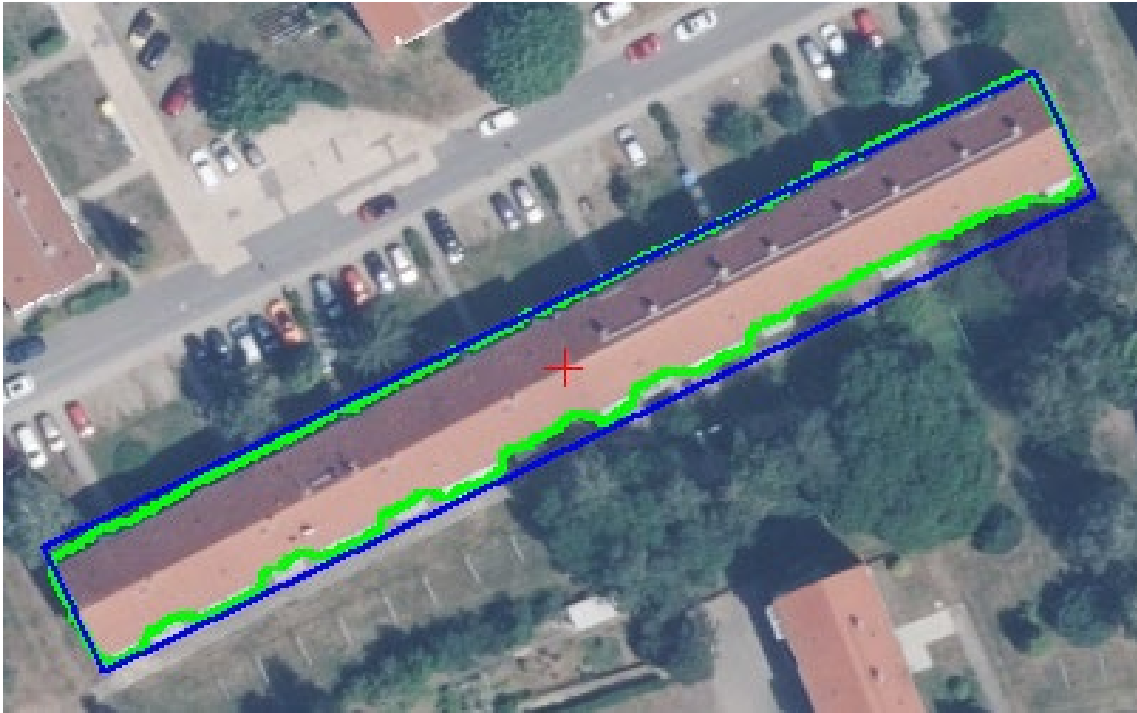


Figure 4. Pixel cluster of building outline (green) and generated vectors (blue) for a long building of four sides

References

Höhle 2021. Automated mapping of buildings through classification of DSM-based ortho-images and cartographic enhancement. International Journal of Applied Earth Volume 95, March 2021, 102237. <https://doi.org/10.1016/j.jag.2020.102237>

Höhle 2023. Blog 9: Automated mapping using artificial intelligence. 7p., [Joachim Höhle \(academia.edu\)](https://www.lvermgeo.sachsen-anhalt.de)

¹<https://www.lvermgeo.sachsen-anhalt.de>

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