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The program package ‘buildenh_v1.3’

The new version is the result of continuous development. The version 1.3 is stored as repository and can be accessed by the address https://github.com and the repository’s name ‘JoaHoe/buildenh_v1.3’. The previous versions (1.1., 1.2) are now obsolete and will be removed from the site.

Changes and improvements in the new version

The mayor improvement is the introduction of alternative adjustment method for all objects containing orthogonal lines only. The object types (‘extr_wd’, ‘4_long’ and ‘100_all’) are now calculated using condition equations. This means that the adjustment is not anymore separated for the unknowns (angle θ, distance ρ). The processing is now more stable and faster. Furthermore, the documentation of the programs has been extended by comments in the scripts and by an article describing the package in detail. A detailed description how to download the program package from GitHub is also attached.

Result of enhancement of the classification

The result of the enhancement is depicted in Figure 1. The area is densely built up and several buildings have a complex form. The automated enhancement of the 37 buildings included some generalization. Some errors occurred in the shadowed areas.

Figure 1: Orthoimage together with the derived polygons.

Degree of automation

The processing of the enhancement is interactive because some decisions must be made by the user. They consider the selection of a reference line, the type of object and of the method for the determination of the lines-sequence. The graphic display of the intermediate results or proposals derived by a decision tree will

help the user. Supporting scripts can be used to detect all lines correctly. For example, the orientation of the reference line can be derived from the ridge of the house which is normally clearly visible in the orthoimage. Lines parallel or orthogonal to the reference line can be identified by measuring one pixel only. The answers to a few other questions, e.g., minimum size of line, partition of the object, are typed-in by a number or a single letter (Y/N). For learning a processing mode “demo” is included where proper answers are proposed. Furthermore, a table with the answers for all objects of one orthoimage is contained in the documentation of the software package.

Geometric accuracy

The checking of the geometric accuracy has been carried out by a sample of check points which are randomly selected. Their reference coordinates are determined by reading the position of the selected building corner in the enlarged orthoimage. The results of geometric accuracy test of enhancement of land cover map #2 (derived from orthoimage #1) with n=37 checkpoints are given in pixels (pel) and meter (m). One point exceeded 3σ and was excluded from the calculation of the standard deviation (σ).

σ_x=15.7pel (1.4m), σ_y=9.6pel (0.9m), n_{corner}=36, $n_{gross\ error}$=1, $\sigma_{x,y}=0.5(\sigma_x+\sigma_y)$=12.6pel (1.15m)

This test with a sample of check points indicates that improvements in the geometric accuracy are not achieved, which is not very surprising. The geometric accuracy is very much influenced by errors in the input data. The used orthoimage and land cover map were the same as in the previous test using the version 1.2 of the software package ‘buildenh’. The former result ($\sigma_{x,y}$=0.85m) was obtained from n_{corner}=153 check points (Höhle, 2021). One gross error has been removed before the calculation of the accuracy measure. The cause of the rather poor result is in the input data (original aerial image, DSM, nDSM) and in the applied classification. The original aerial image contains long and dark shadows which caused difficulties in the derivation of the DSM using correlation of image pairs. The generation of the orthoimage and of the normalized DSM suffered then from the poor quality of the aerial images. The reduction in the sample size may also have some impact.

Figure 2: Checkpoints used in geometric accuracy test

References

Höhle, J., 2021. Automated mapping of buildings through classification of DSM-based ortho-images and cartographic enhancement. International Journal of Applied Earth Observations and Geoinformation 95 (2021) 102237. https://doi.org/10.1016/j.jag.2020.102237.