FILTERING OF LIDAR DATA

ADVANCED DTM GENERATION FROM LIDAR DATA
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The introduction of laser scanning has triggered off a revolution in topographic terrain capturing, especially in the generation of digital terrain models (DTM).

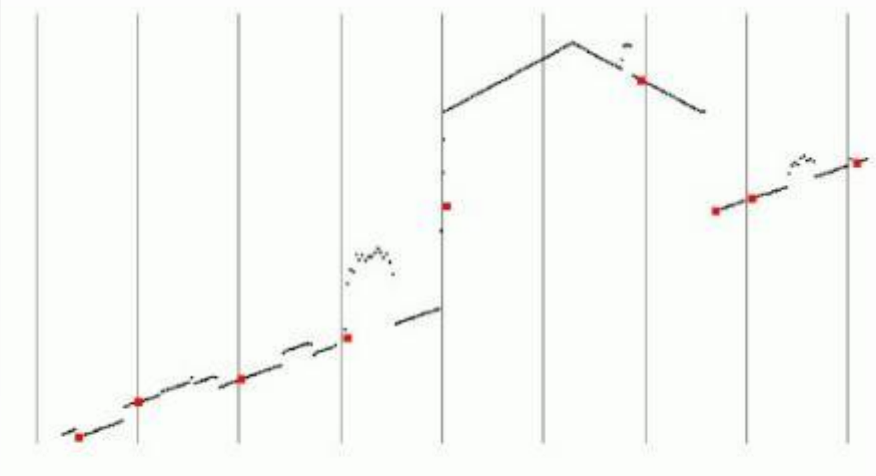
In this article refined methods for the restitution of airborne LIDAR data are presented which have been developed at the Institute of Photogrammetry and Remote Sensing (Institut f¨ur Photogrammetrie und Fernerkundung, I.P.F.) at Vienna University of Technology.

Three parts of the article:

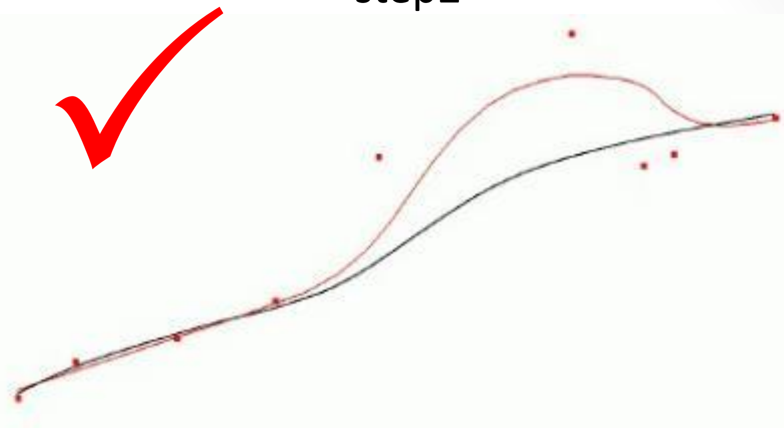
- a technique for the calibration of laser scanner data is introduced.
- Filtering of LIDAR Data and interpolation of the terrain surface
- Derivation of structure line

workflow

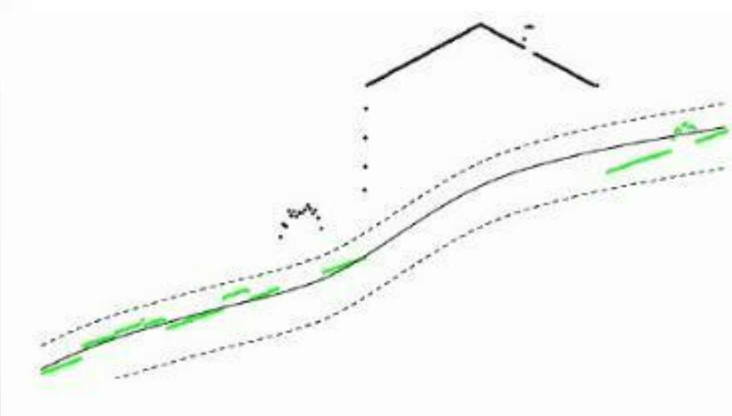
step1



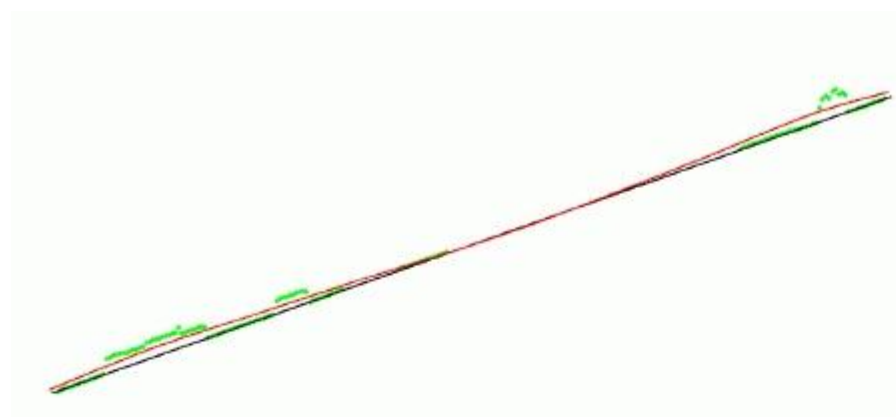
step2



step3



step4

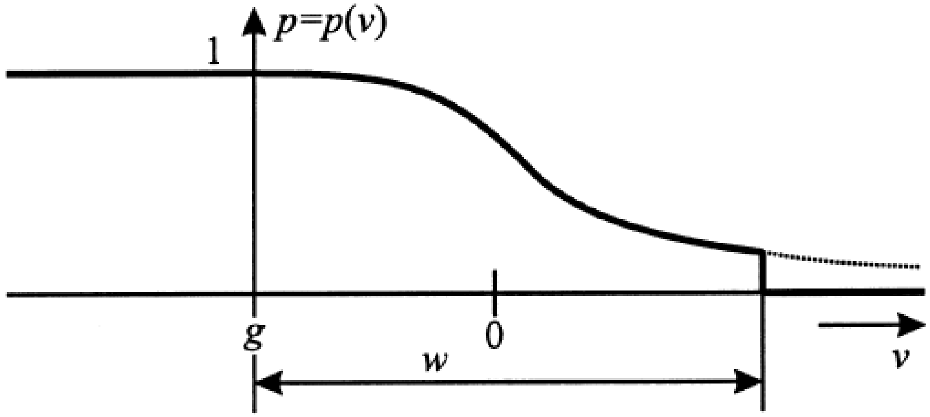


Filtering[Kraus and Pfeifer, 1998]

The algorithm is based on linear prediction (Kraus and Mikhail, 1972) with an individual accuracy for each measurement.

weight function for robust estimation

$$p_i = \begin{cases} 1 & v_i \leq g \\ \dfrac{1}{1 + (a(v_i - g)^b)} & g < v_i \leq g + w \\ 0 & g + w < v_i \end{cases}$$



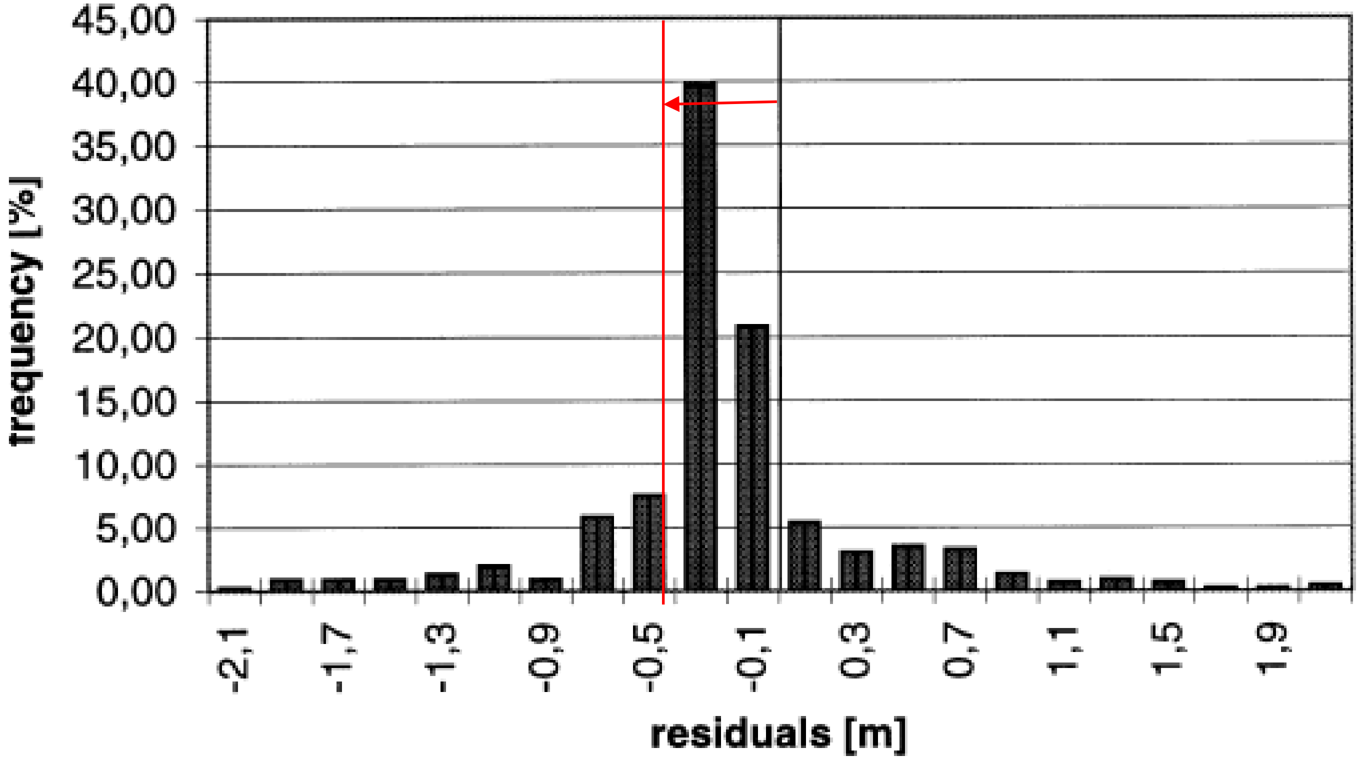
The parameters *a* and *b* determine the steepness of the weight function.

a=1
b=4

The value for g can be computed with a histogram of the residuals

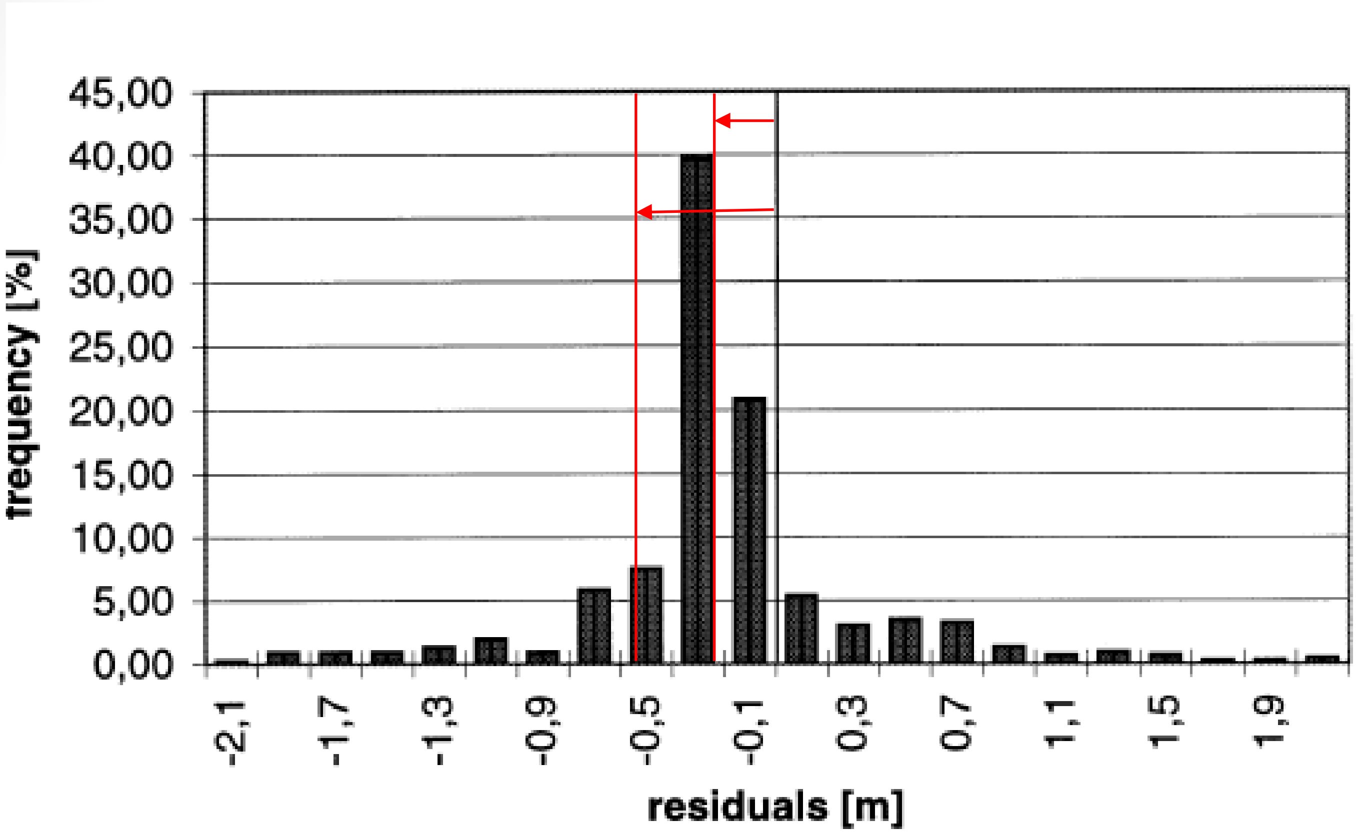
We implemented **three** different methods to determine g:

1-The first method uses the expected accuracy of the terrain points $\boldsymbol{\sigma}_T$.



Drawback: If there are the big negative blunders, this method does not work.

2- The second method is more robust in presence of such blunders.

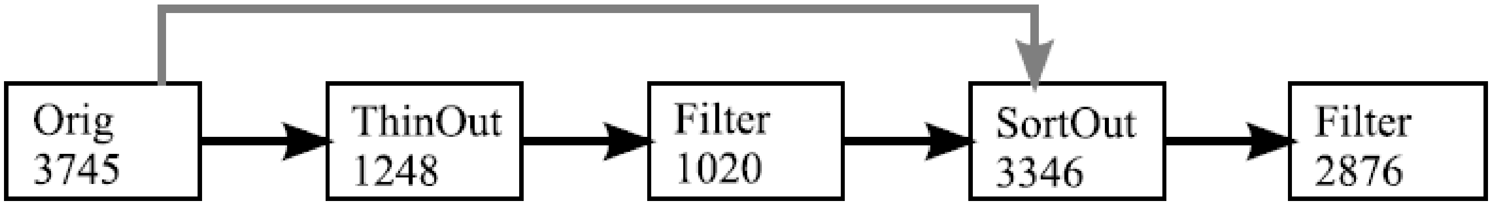


A minimum indicates an accumulation of residuals(Pfeifer et al., 1998) and, therefore, an accumulation of terrain points.

3- For the third method, a rough estimation of the penetration rate is required. If it is estimated that there are 40% terrain points, the value of g is at the position where the first 20% of the residuals are found.

- Now, the weights *pi* can be used for the next computation (iteration) of the surface. Points with large negative residuals have maximum weights and they attract the computed surface, whereas points with medium residuals have smaller weights and less influence on the computed surface. Points with residuals to the right of g+w are eliminated.

Flowchart



[Pfeifer et al., 2001] Derivation of digital terrain models in the SCOP++ environment.

Thanks for your attention

Advices & questions are always welcomed!