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Conclusion	Óbuda University, Alba Regia Technical Faculty, Institute of Geoinformatics
	2023.06.06.

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Laser scanners and point clouds

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- There are more laser scanning (LiDAR) technologies
 - Terrestrial Laser Scanning (TLS)
 - Mobile Laser Scanning
 - Airborne LiDAR survey
- The result of the laser scanning survey is a point cloud
 - a lot of points (millions, or even billions)
 - these points provide a detailed image of the terrain

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LiDAR data processing

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- The point cloud contains a lot of poins from many (natural or artifical) objects of the terrain
- One of the most important object is the terrain surface
- Small proportion of the points located in the terrain surface

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The Disc Fitting method, illustrated in 2D





The Sector Based Linear Regression, in any (three or more dimension)





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Parameters of the method

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The Disc Fitting method is an local, 3 dimensional (2 independent and 1 dependent coordinates) case of the Sector Based Linear Regression. The method has two important parameters:

- *R*: the radius of the loacal area (the radius of the fitted disc)
- *q*: the quantile of the linear regression (this proportion of the points located under the fitted disc)

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The impact of the *R* and *q* parameters

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The purpose of the analysis

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- Measure the elevation of terrain in some test points, geodetic accuracy
- These points are the reference points of the analysis
- Calculate the elevation from LiDAR data by different methods (Disc Fitting with various *R* and *q* paramters, and other reference methods)
- Compare the results with the reference
- Calculate statistics from the differences (in each method)

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• Compare the statistics of different methods



The test area 195 points in about 25 hectares





Mean differences in various paramters





Distributions in some paramters



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Point Cloud thickness

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- The difference of the elevations with two different *q* value. (For example *q_{high}* = 0.9 and *q_{low}* = 0.1 with *R* = 4.0*m* in both cases.)
- The thin and thic areas (for example the thickness is greater or less than 40*cm*) may be studies separately.



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Mean differences in thin and thick areas



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thin



thick

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Distributions in thin and thick areas

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the method

Point cloud thickness



thin

thick

1.00 0.75

0.50

0.25

0.00 -0.25 -0.50 -0.75 -1.00 R=8.0 q=0.027

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Machine learning possibilities

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- The elevations (and slopes) are the data of the input layer of a neural network
- The real elevation (surveyed in the teaching data, estimated other) is the data in the output layer

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• I do not have enouht test data for the teaching (yet).



Conclusion

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- The Disc Fitting methos is a promising method for LiDAR data processing
- The fine tuning of the method needs more research and more test data. (More point from more test areas.)



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Thank you for the attention!

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