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How to Properly Plan the Reduction in the LiDAR Big Dataset?

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Problem

There are **many methods of data collection**, which leads to a **big dataset**.

Such datasets are difficult or sometimes **impossible to rational use**. Therefore, in **the stage of pre-processing** the big dataset is reduced without losing data necessary for the proper implementation of objective study.

The process of reducing the big dataset will allow efficient, less time consuming and labor intensive processing.

Depending on the purpose of data processing and project requirements the reduction of big dataset **must be properly planned**. It involves (1) selecting the appropriate method of reducing big dataset, (2) choosing the appropriate tools, (3) criteria and (4) parameters.

The reduction with Optimum Dataset method

Within reduction methods, which provide the optimal solution there is the **Optimum Dataset method (OptD)** proposed by Błaszczak-Bak (2016).

The OptD method allows for obtaining a representative sample of the original dataset as an optimal set of LiDAR.

1. The necessary information is not lost.
2. Application of the OptD method in preparation of the data for DTM construction is more accurate and less time-consuming.
3. Reducing the time and cost of LiDAR point cloud processing, what in turn enables to conduct efficient analyses of acquired information resource.

The OptD method

OptD method can be conducted in two variants:
(1) OptD method with single objective optimization called OptD-single,
(2) OptD method with multi objective optimization called OptD-multi.

If OptD-single method is chosen, then a set which strictly fulfilling one condition is sought. If there is a decision on processing using OptD-multi, then in result several sets will be obtained, among which the best one should be selected.

Two options in the processing

Planning to use of the OptD method for data from airborne laser scanning (ALS) for generating a DTM can be carried out in two variants.

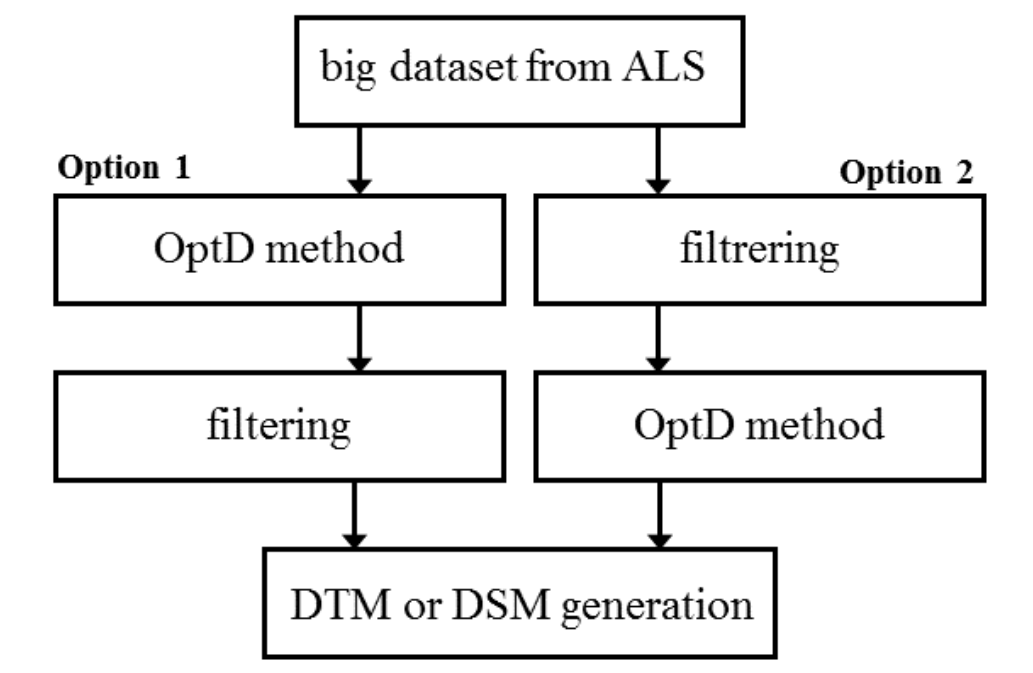
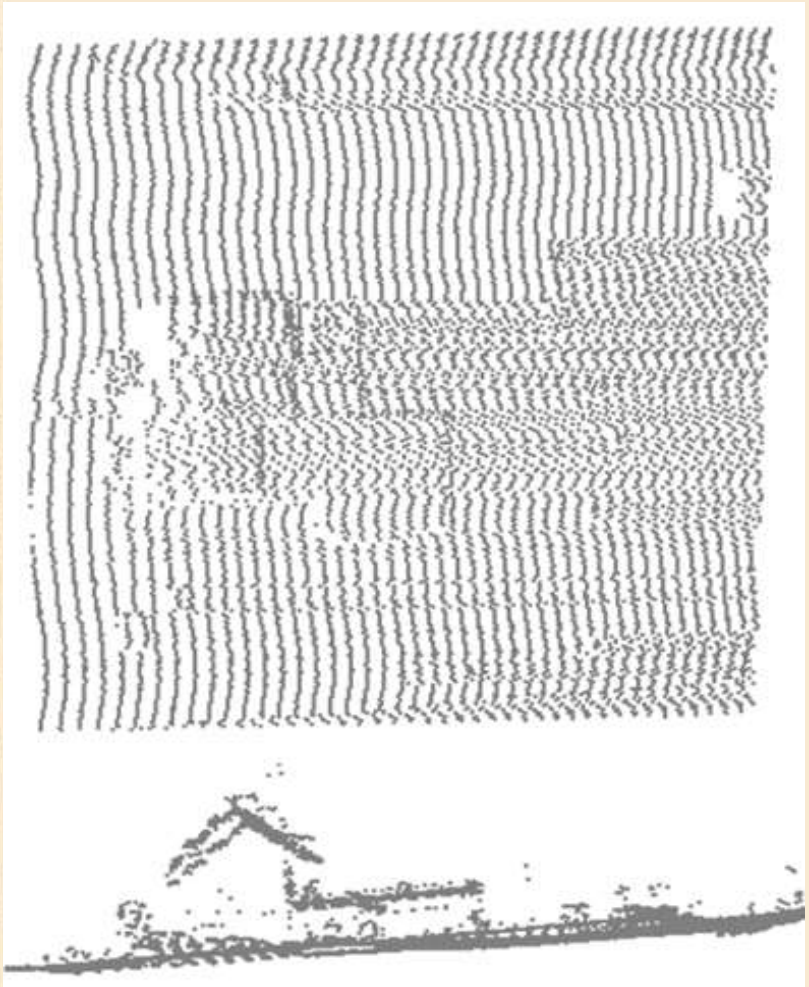


Figure 4. The order in the processing of big dataset from ALS (source: own study)

Materials of the research



The study area is a section of the national road No. 16, Sielska Street in Olsztyn, located in Warmia-Mazury. Airborne laser scanning was made by Visimind Ltd. Fragment of this measurement was selected for tests. Selected test area was called **Object** and it contains 12781 points.

Figure 5. Test area Object (original dataset) (source: own study in CloudCompare v.2.6.0)

Option1: OptD method-filtering

The topographic surface dataset for Object was called **TSset1**. The number of points in this set is 10414. The application of the OptD-multi method resulted in obtaining the optimum solution, which contained **OptDset1** with 8121 number of points (22% of points were removed).

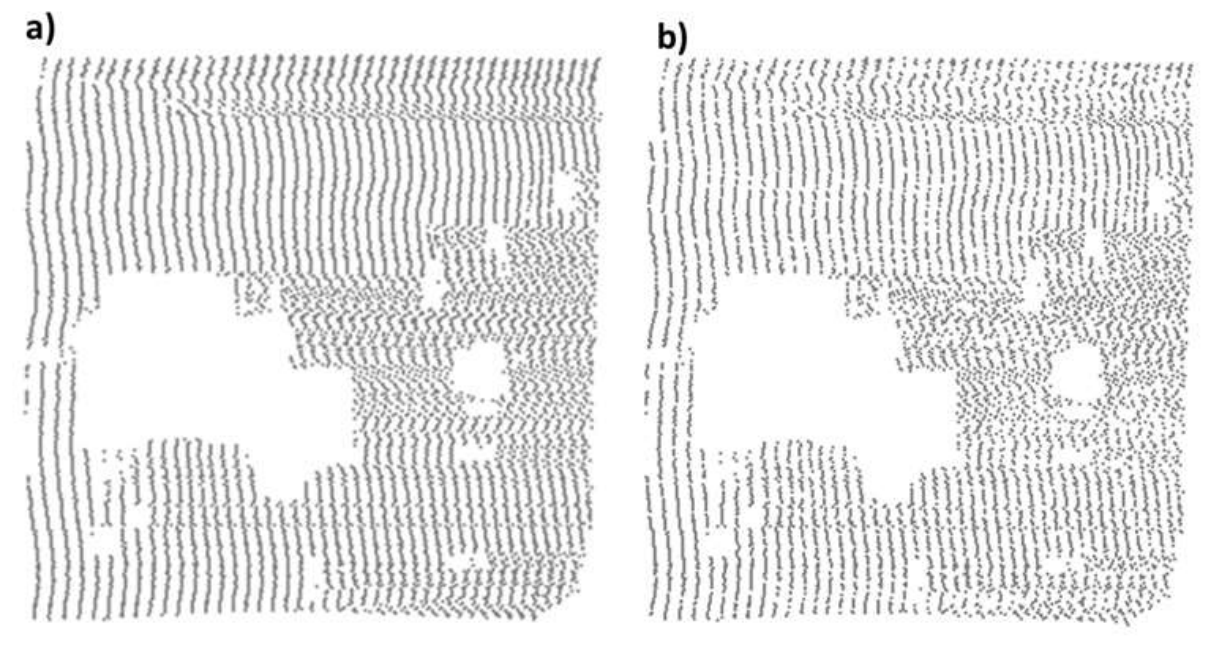


Figure 6. a) dataset after filtration (**TSset1)**
b) **TSset1** after the OptD-multi method application **(OptDset1)**

Option2: filtering - OptD-method

As a results of the OptD-multi method there is a one set of data which is called **OptDset2**. The number of points in this set is 9808. The application of adaptive TIN model selected the dataset with points which represented the topography: **TSset2**. The TSset2 consists of 8005 points.

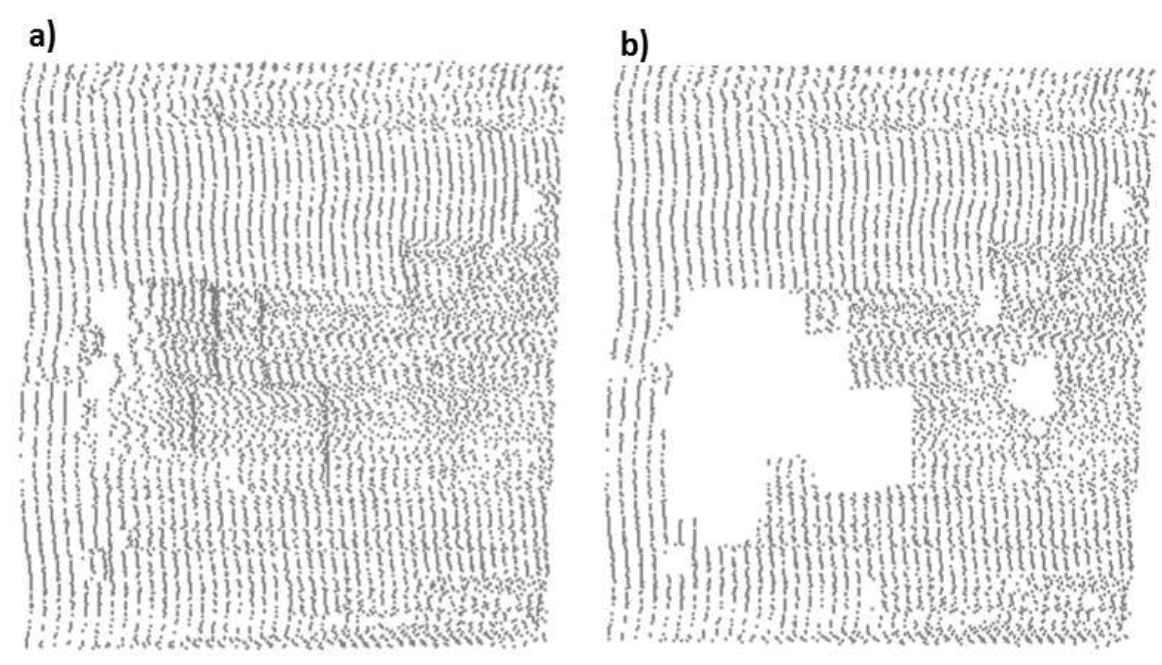


Figure 7. a) dataset after OptD-multi method application **(OptDset2)** b) **OptDset2** after filtration (**TSset2**)

Results

Parameters:	**Option 1**	**Option 2**
Total number of points in Objects	**12781**	**12781**
Number of terrain points in **TSset**	**10414**	**8005**
Number of terrain points in **OptDset**	**8121**	**9808**

DTMs generation

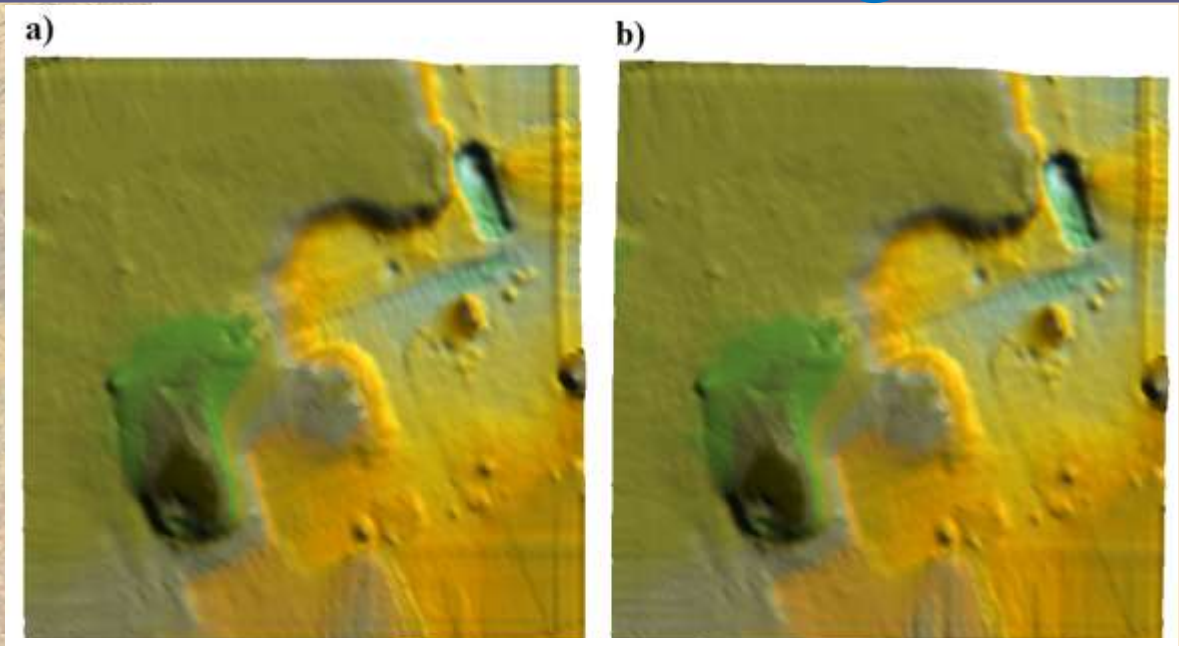


Figure 8. DTMs
a) from all points of **TSset1**,
b) from points of **OptDset1**

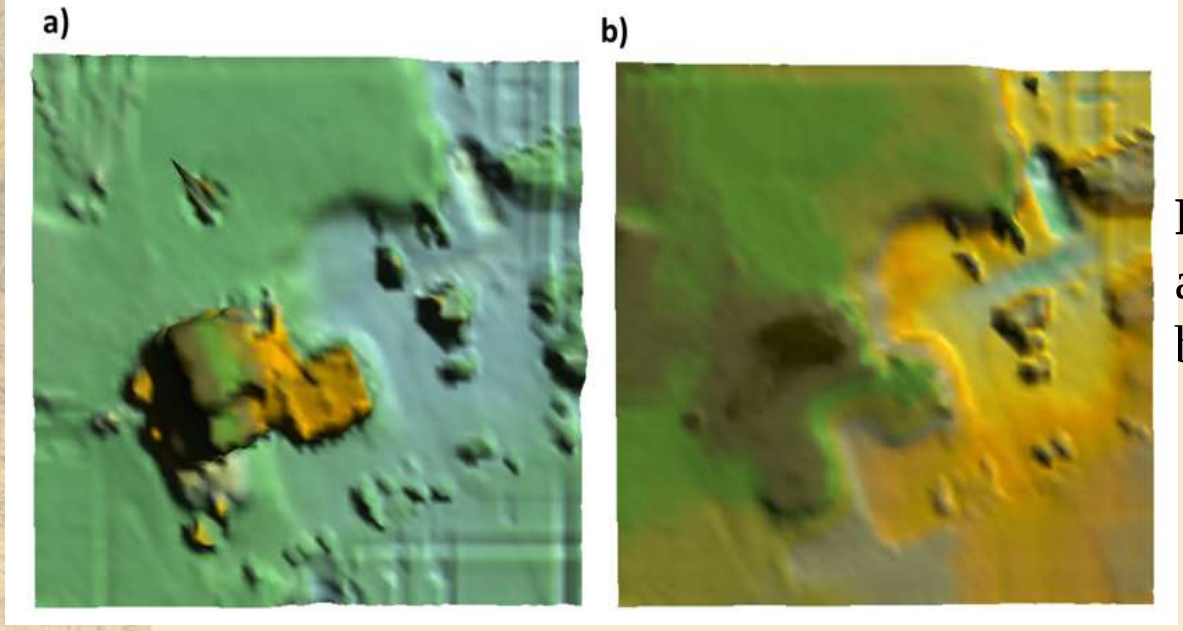


Figure 9. DTMs
a) from all points of **OptDsetD2**,
b) from points of **TSset2**

Conclusions

Based on the analysis, following general conclusions can be stated:

1. The OptD method is a simple in application method for data reduction, which takes into account optimization criteria.
2. The result of the implementation of the OptD method is an optimal dataset that can be used to generate DTM.
3. The OptD method fulfills all the expectations of reducing the number of points in dataset without losing data necessary for the proper DTM generation.
4. Option 1 gives the better solution then option 2.

Thank you for your attention

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