



DOCUMENT

Use of algorithms on big DEM's

Better utilization of national detailed elevation models

Workshop summary

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Summary

Nation wide generation of height data is still an ongoing task within most European national mapping agencies. Using the national elevation databases for large scale feature extraction and analysis are being carried out by various mapping agencies. IGN Spain have developed workflows for large scale automatic river network extraction and powerline/obstacle mapping from their LiDAR datasets. Automatic feature registration benefits highly from additional information such as return intensity and the acquisition of multispectral LiDAR and coregistration with hyperspectral imagery. A pure pointcloud based analysis approach are computational challenging and the research on a more efficient mathematical representation, such as spline, will potentially make the analysis more computer efficient.

Workshop recommendations

- Investigate models and methods for normalizing the intensity values and produce a more homogenous reflectance map.
- Testing what density is optimal for LOD1, LOD2 and LOD3 city modeling.

Invitation/Call for papers

Dear Colleagues,

On April 4th and 5th EuroSDR will organize a workshop discussing:

“Use of algorithms on big DEM’s - better utilization of national detailed elevation models”

The workshop will be arranged as a noon to noon meeting at the County Governor’s office in Tønsberg, Norway.

We welcome speakers from industry, academia and government.

Possible topics (not in prioritized order): Discuss **use of algorithms on big DEM’s**, in the following applications:

1. Automatic detection of waterbodies in LiDAR
2. Improvement of hydro network
3. Mapping of poles and powerlines
4. Obstacles for aviation – International view ICAO
5. DEM from image matching – Multispectral Analysis
6. Copernicus – Creating DTM’s on hydrography
7. Cloud computing (AWS) – Automatic corrections in preparation of DTM’s
8. DEM Analysis using Machine or deep Learning Algorithms
9. New data acquisition techniques and their processing (multispectral ALS, single- photon lidar)

More ideas/topics could come up and are welcomed.

Please submit an abstract before February 8th to: jon.arne.trollvik@kartverket.no

More information and registration will soon be available at the EuroSDR homepages:

<http://www.eurosdnet.net/workshops/use-algorithms-big-dem%E2%80%99s>

With kind regards and on behalf of commission 3 EuroSDR.

Program committee

The following organizing committee will compose the final program:

- Adam Andrzejewski, GUGIK Poland
- Jesús María Garrido Sáenz de Tejada, IGN Spain
- Christian Malmquist, Kartverket Norway
- Julián Delgado Hernández, IGN Spain
- Juha Hyypä, FGI Finland
- Håkon Dåsnes, Kartverket Norway,
- Jon Arne Trollvik, Kartverket Norway

Program



Workshop:



Use of algorithms on big DEM's

April 4th and 5th 2018, Tønsberg, Norway

Program

Title	Use of algorithms on big DEM's
Objective	Share experiences and knowledge gained when using different algorithms on height data. Identify common challenges, identify fields of possible cooperation and research
Venue	Premises of the County Governor of Vestfold, Statens park Bygg I, Anton Jenssens gate 4, 3125 Tønsberg
Dates	April 4 th and 5 th 2018
Day 1 (April 4th)	
12:00	Lunch and registration
13:00	Welcome address, objectives and an introduction to EuroSDR Jon Arne Trollvik, Norwegian Mapping Authority (NMA) (No)
Session 1: Key notes	
13:15	<i>iQmulus - A High-volume Fusion and Analysis Platform for Geospatial Point Clouds.</i> Tor Dokken, SINTEF (No)
14:00	<i>Introduction to Point Cloud Processing</i> Xinlian Liang, FGI (Fi)
14:45	Coffee break
Session 2: New sensors	
15:05	<i>LiDAR data capture with sensor SPL100 in the Region of Navarra</i> Victor Garcia, Tracasa (Sp)
15:35	<i>New possibilities with multispectral and hyperspectral point clouds</i> Dagrun Aarsten, Terratec AS (No)
Session 3: Water detection	
16:05	<i>Detection of Waterbodies from Dense Point Clouds</i> Christian Malmquist and Jon Moe, NMA (No)
16:35	<i>Automatic river network extraction from LiDAR data</i> Jesus Maria Garrido Saenz de Tejada, IGN (Sp)
Session 4: Break out	
17:05	<i>Introduction to break out / Coffee break</i>
17:15	<i>Break out discussion</i>
18:00	Closure of meeting day 1
20:00	Get-together dinner <i>at Restaurant Kverneriet, Rambergveien 15, 3115 Tønsberg (at the harbor)</i>

Day 2 (April 5th)	
09:00	Introduction day 2
09:05	Wrap up of discussions day 1
Session 5: Bathy LiDAR	
9:20	<i>Large scale Bathymetric LiDAR for shallow water,</i> Jon Moe and Boele Kuipers, NMA (No)
Session 6: Feature extraction	
09:50	<i>Feature extraction potential in the Norwegian national detailed elevation model</i> Arkadiusz Szadkowski Terratec AS (No)
10:20	Coffee break
10:35	<i>Detection of power lines and obstacles for aviation using national LiDAR data</i> Jesus Maria Garrido Saenz de Tejada, IGN (Sp)
Session 7: Break out	
11:05	<i>Introduction to break out</i> (Topics to be decided end of day 1)
11.10	<i>Break out discussion</i>
11:45	Wrap up discussions from break out
Session 8: Closing session	
12:00	Recommendations for further work
12:10	Closure of meeting
12:15	Lunch

List of participants

Last name	First name	Company	Country
Aarsten	Dagrun	Terratec AS	Norway
Akmentīņa	Karina	LGIA	Latvia
Andrzejewski	Adam	Head Office of Geodesy and Cartography	Poland
Arief	Hasan Asyari	NMBU	Norway
Bjørklund	Per Anders	Norwegian Mapping Authority	Norway
Boustedt	Simon	Lantmäteriet	Sweden
Bunæs	Marit	Norwegian Mapping Authority	Norway
Dokken	Tor	SINTEF Digital	Norway
Gandor	Florian	Swisstopo	Switzerland
Garcia	Victor	Tracasa	Spain
Garrido Saenz de Tejada	Jesus Maria	Instituto Geografico Nacional	Spain
Gruno	Anti	Estonian LandBoard	Estonia
Grünthal	Erkko	Estonian Land Board	Estonia
Hast	Isak	Lantmäteriet	Sweden
Sundby	Henning	Norwegian Mapping Authority - Hydrographic Service	Norway
Holter	Andreas	TerraTec AS	Norway
Klingenberg	Torgeir Ferdinand	Norwegian Mapping Authority	Norway
Korsnes	Andreas	Norwegian Mapping Authority	Norway
Liang	Xinlian	Finnish Geospatial Research Institute	Finland
Malmquist	Christian	Norwegian Mapping Authority	Norway
Moe	Jon	The Norwegian Mapping Authority	Norway
Nilsson	Erik	Lantmäteriet	Sweden
Norin	Maria	Lantmäteriet	Sweden
Nygren	Michelle	University of Gothenburg	Sweden
Oveland	Ivar	NMBU	Norway
Petersons	Peteris	Latvian Geospatial information agency	Latvia
Ptak	Agnieszka	MGGP Aero	Poland
Rasmussen	Johnny Koust	COWI	Denmark
Szadkowski	Arkadiusz	TerraTec AS	Norway
Trollvik	Jon Arne	Norwegian Mapping Authority	Norway
TOTAL	30		

Photos

Photos: Per Anders Bjørklund



Workshop participants



Tor Dokken, Sintef (No)



Xinlian Liang, FGI (Fi)



Victor Garcia, Tracasa (Sp)



Dagrun Aarsten, Terratec (No)



Christian Malmquist, NMA (No)



Jon Moe, NMA (No)



Jesus Maria Garrido Saenz de Tejada, IGN (Sp)



Arkadiusz Szadkowski Terratec AS (No) (Photo: J.A.Trollvik)

Break out session

Break out session was arranged at the end of both days with topics relevant to the presentations. The participants were divided into 4 groups and the discussion was presented in plenum.

Break out day 1.

Topics

- Spline Representation of Large Pointclouds
- Point Cloud Processing
- Single Photon LiDAR
- Multi/Hyperspectral Pointclouds
 - For what applications do you see the need of multi/hyperspectral pointclouds.
- Detection of Waterbodies
 - What tools/methods are suitable for NDWI segmentation? Given challenges such as shadows, different acquisition dates, acquisition sensors, etc.
- Automatic River Network Extraction
 - Is your hydro network coherence with DTM?
If yes, how do you do it?

Summarized Group Answers – Day 1

- Spline Representation of Large Pointclouds
 - B-spline representations are compact and computer efficient and are potentially efficient in analytical use of the DTM. B-splines are smoother than TIN representations.
 - B-splines used together with remaining outliers can possible assist in data segmentation and data quality control.
- Point Cloud Processing
 - A good introduction to Point cloud processing.
 - Intensity calibration is important for analytical use.
 - Machine learning / deep learning will probably be important in the future.
- Single Photon LiDAR
 - Interesting technique giving efficient flightplans (higher acquisition altitude, and higher flightspeed).
 - Noisy data raw data making the post-processing challenging.
 - Uncertainty about accuracy.
 - SPL can be considered a new techonogy and methods for noise reduction will probably improve in the future.
- Multi/Hyperspectral Pointclouds
 - *For what applications do you see the need of multi/hyperspectral pointclouds.*
 - Highly interesting dataset with possible applications outside the normal terrain modelling focus.
 - Endless possibilities when it comes to the extraction of "hidden" information

Topics Day 2

- Large scale Bathymetric LiDAR for shallow water
 - *How do you do qc on patchy data like what you get from green laser under water?*
 - *How do you define what is wet points, and when in the process?*
(outside/inside coastline, above below z0, wet at flight -> tidal variations?)
- Feature Extraction Potential in the NMA Detailed Elevation Model
 - *Intensity raster as "Panchromatic True-Ortho", what is the status for that project in your country?*
 - *Is scaling of intensity values in order to balance separate flight session harmful for forestry?*
 - *What interpolation methods are best for rasterization/gridding of laser point cloud, please share your experience?*
 - *Your experience with high altitude data collection and large laser beam footprint?*
Have anyone identified any limits for own applications.
- Detection of power lines and obstacles for aviation using national LiDAR data
 - *What is the best flight configuration (LiDAR system, scan pattern, density..) to detect power lines?*
 - *What is the status for obstacle mapping in your country?*

Summarized Group Answers – Day 2

- Large scale Bathymetric LiDAR for shallow water
 - *How do you do qc on patchy data like what you get from green laser under water?*
 - Large scale Bathymetric for shallow water QC/QA is very manual process due to at this time no dedicated software applications for automatic. Dialog with software developers/providers is needed, to add new functionality for LIDAR processing of Bathy data.
 - *How do you define what is wet points, and when in the process?*
(outside/inside coastline, above below z0, wet at flight -> tidal variations?)
 - Important to define these parameters during the tender process.
- Feature Extraction Potential in the NMA Detailed Elevation Model
 - *Intensity raster as "Panchromatic True-Ortho", what is the status for that project in your country?*
 - Interesting, suited for certain types of objects
 - Need focus on intensities during data acquisition / QC
 - Intensity image is very underestimated sub product, as it represents true-orthophoto terrain is very good input for simple mono mapping and information extraction.
 - *Is scaling of intensity values in order to balance separate flight session harmful for forestry?*
 - Scaling intensity is harmful for forestry, especially for applications that depend for absolute intensity. For intensity raster production it is

recommended to use a copy of the data for manipulation.

- *What interpolation methods are best for rasterization/gridding of laser point cloud, please share your experience?*
 - Regarding the interpolation methods, either for grading of DTM or generation of intensity images. Interpolation method must be tested locally for the data set and optimized. Recommended methods are weighted distance, linear interpolation and nearest neighbor.
- *Your experience with high altitude data collection and large laser beam footprint? Have anyone identified any limits for own applications.*
 - Limits for powerlines and obstacle mapping.
 - Discussion footprint in steep slopes
- Detection of power lines and obstacles for aviation using national LiDAR data
 - *What is the best flight configuration (LiDAR system, scan pattern, density...) to detect power lines?*
 - Regarding the laser footprint size from high altitude flights, it is recommended to avoid footprint that has bigger significant bigger size then resulting DTM grid.
 - It is most important to correctly classified powerlines and often bring them back from noise class, 4-5pts/m² if using the National Data projects and minimum 20pts/m² for specific powerlines orientated projects.
 - Minimum 5pt (denser is better), for pure wire detection an elliptical scanner is preferred, however a rotating mirror scanner gives the most even distribution when flightlines are not planned along the wires.
 - *What is the status for obstacle mapping in your country?*
 - Ongoing in most countries. Challenge to clarify data model to be used and balance with expectations from aviation authorities
 - For obstacle detection it is best to use high field of view LIDAR system/data with cross pattern flight lines to make sure we get the highest return.