GWF

GEOSPATIAL WORLD FORUM

RIEGL’s AI quest

to AI or not AI?

Christian Sevcik
Manager, Strategic Partner Alliances

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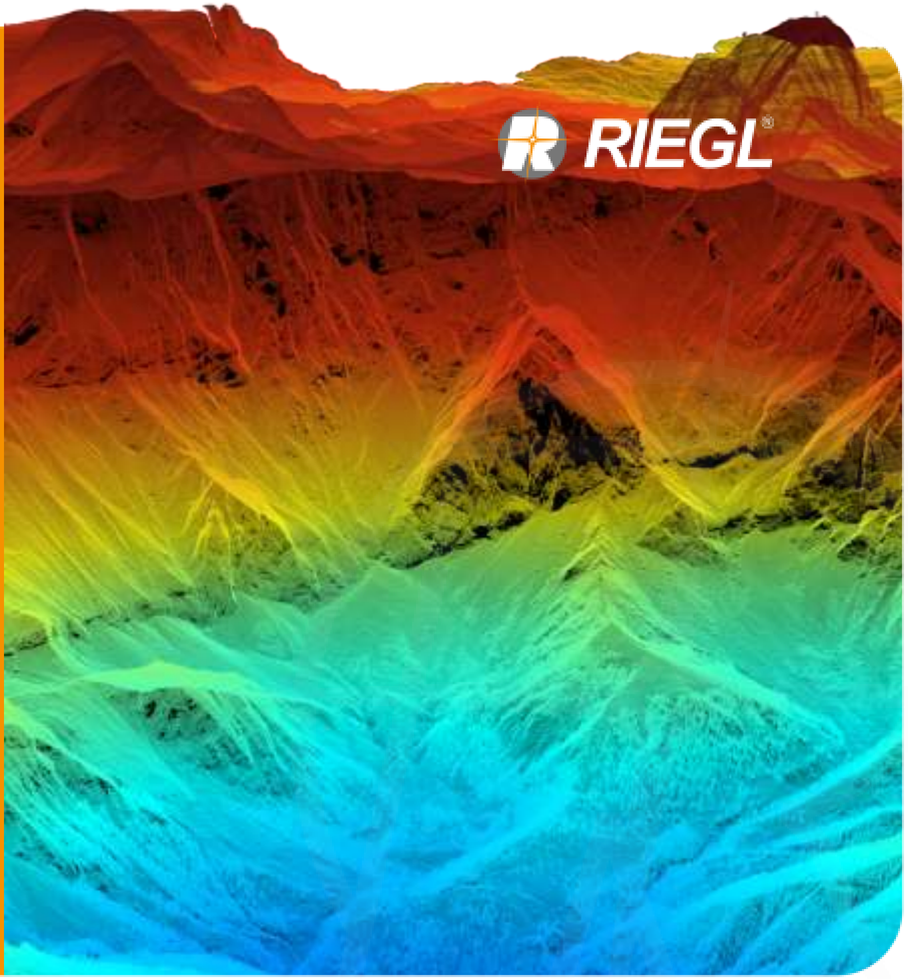

RIEGL Deep Learning Suite

Libraries

RiDLImages
DeepLearning models

Face detection
License plate detection

RiDLPointClouds
DeepLearning models

ALS classification urban
Tieobject detector
Tree detector

RiDLWaveforms
DeepLearning models

Waveform decomposition

RiDLCore
Python Foundation

OpenCV
PyTorch
TensorFlow
RetinaFace
Python
pillow
...and many more

RiPROCESS

RiSCAN PRO

The DeepLearning networks, installed by the *RIEGL* Deep Learning Suite bundle, are accessed via Functions from within RiSCAN PRO and RiPROCESS.

Face blurring

ML approach

e.g RetinaNet

Several pretrained models available. Although re-training is required to adopt to characteristics of imagery.

Conventional approach

image processing techniques

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Tree segmentation

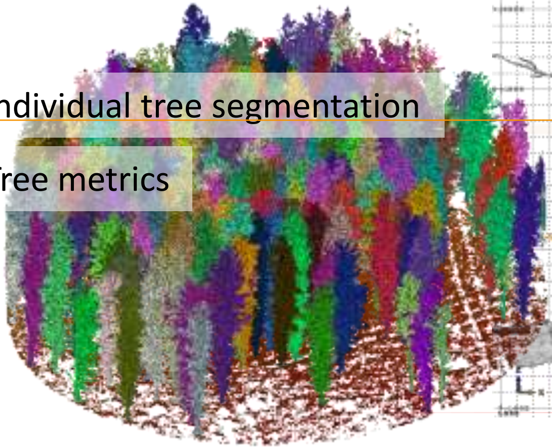
Machine learning

Good performance with properly trained model.

Tree stem detection

Failed due to amount of data. Pointcloud of an entire tree / slice of significant size could not be handled efficiently.

1. Ground classification

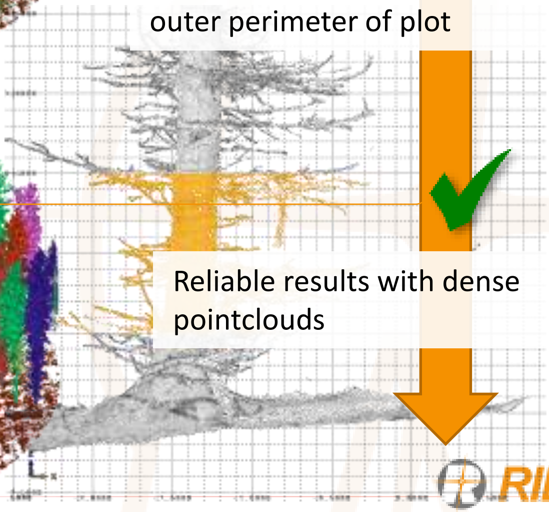


2. Individual tree segmentation

3. Tree metrics

Geometric method

Ground classification performs well, even with sparse ground returns on outer perimeter of plot



Reliable results with dense pointclouds

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Pointcloud classification

Machine learning

e.g SparseConvNet

+ Easy to use

Pretrained model is up & running in a few clicks

scales with graphics card

More graphics power – better performance

– Dependency on training data

Poor performance on datasets not similar to those used for training.

Pointcloud classification

Geometric method

e.g neighborhood analysis, PCA, segmentation

Flexible usage

By adjusting processing parameters, differnt datasets can be classified

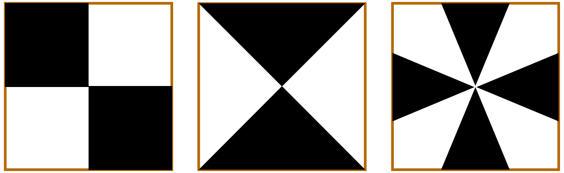
Expert knowledge

Proper parameter tweaking requires thorough understanding of used algorithms

Tieobjects

Tieobjects are used to identify the same objects in different datasets. Minimizing the spatial distance of corresponding tieobjects by means of adjustment routines provides co-registered datasets.

Examples of artificial tieobjects: wedge targets



Examples of natural tieobjects: poles

Task

Identify tieobjects in pointclouds and imagery.

- Pointcloud to pointcloud registration
- Pointcloud to imagery: camera alignment mandatory for pointcloud coloring

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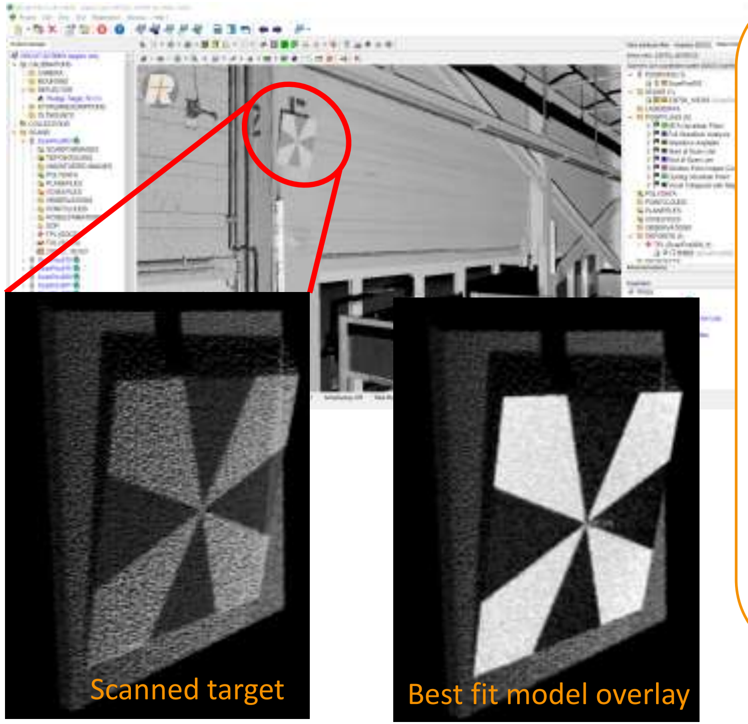
Tieobjects



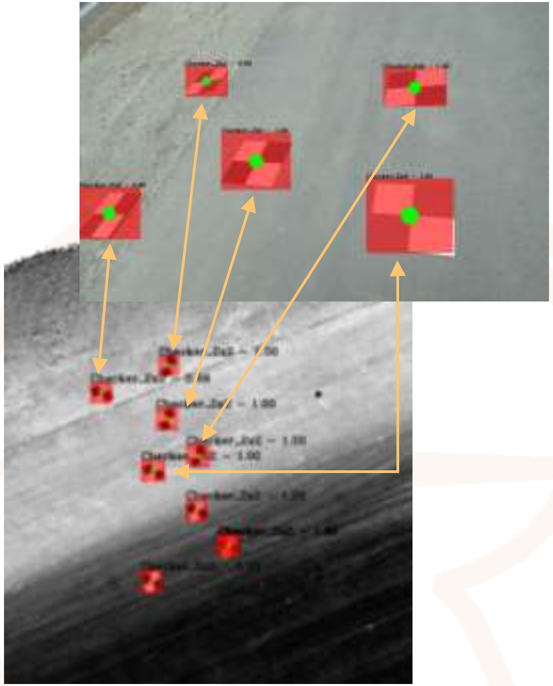
Machine learning

- Identify target candidates

&

Geometric method

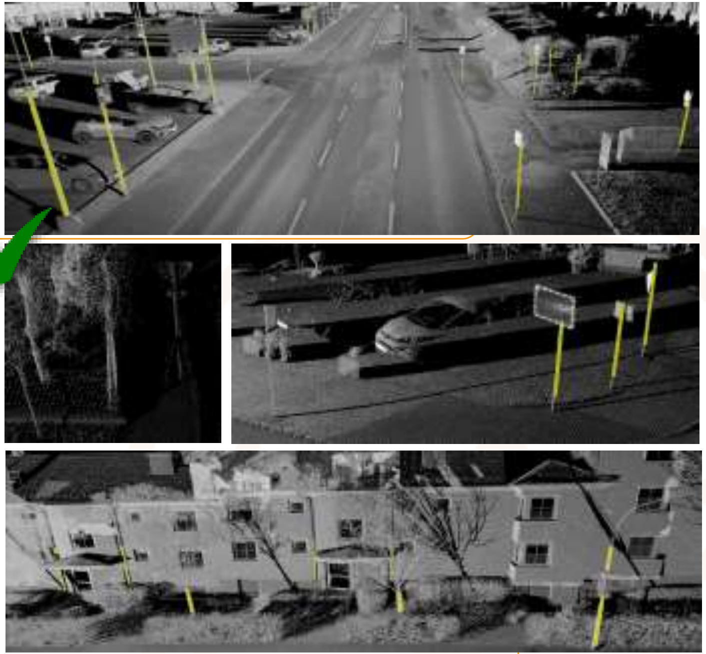
- Match target models
- Match corresponding targets



Tieobjects

Deep learning

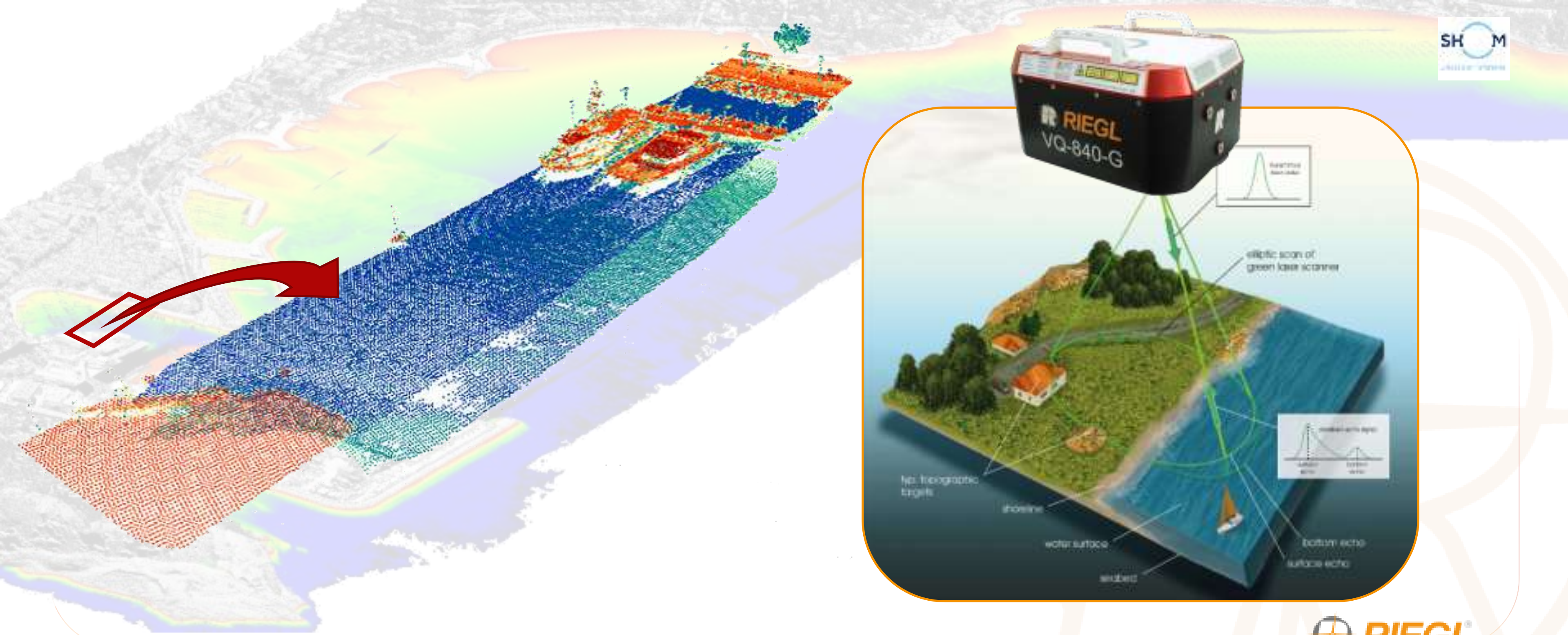
Geometric method



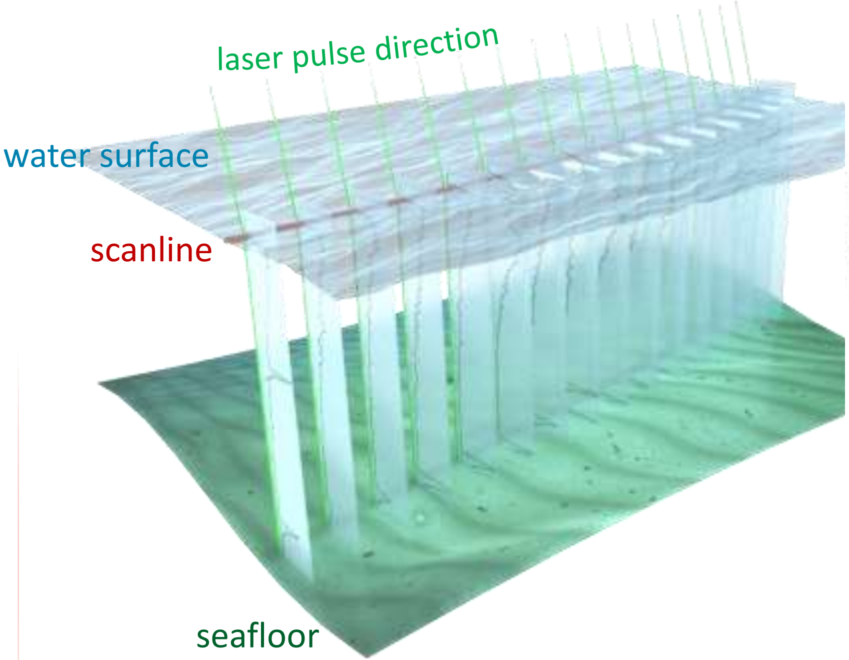
Detection rate

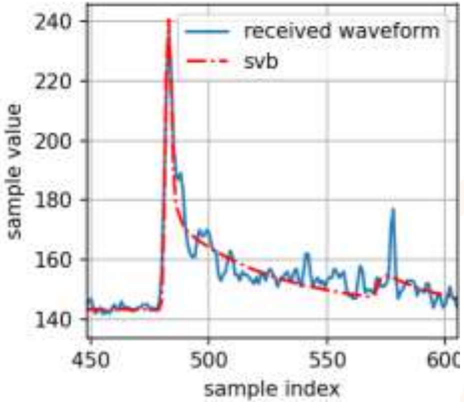
Runtime: 1.5x of Geometric approach

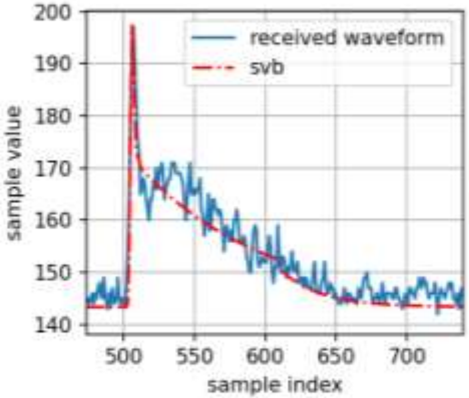
Bathymetric waveform extraction



Bathymetric waveform extraction





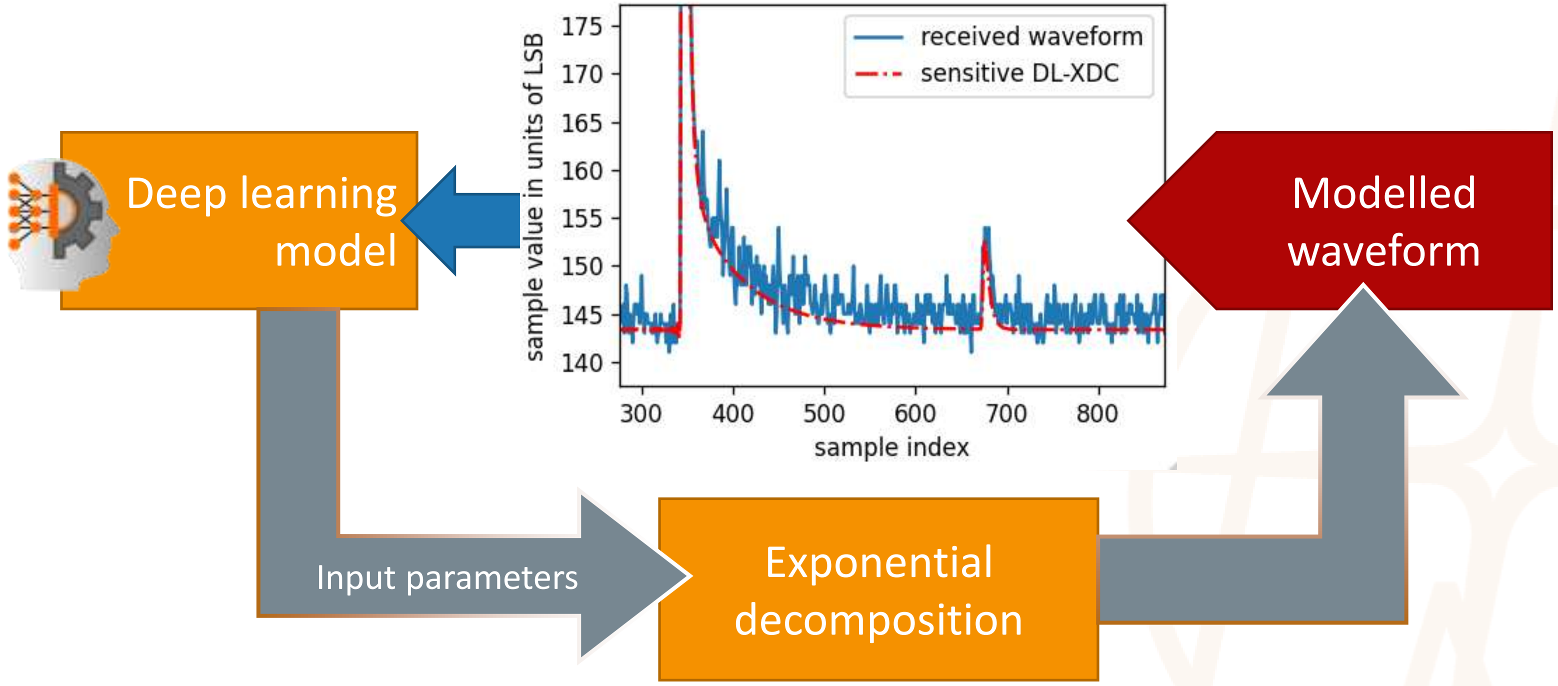


Task

Best fit modelled waveform to received waveform

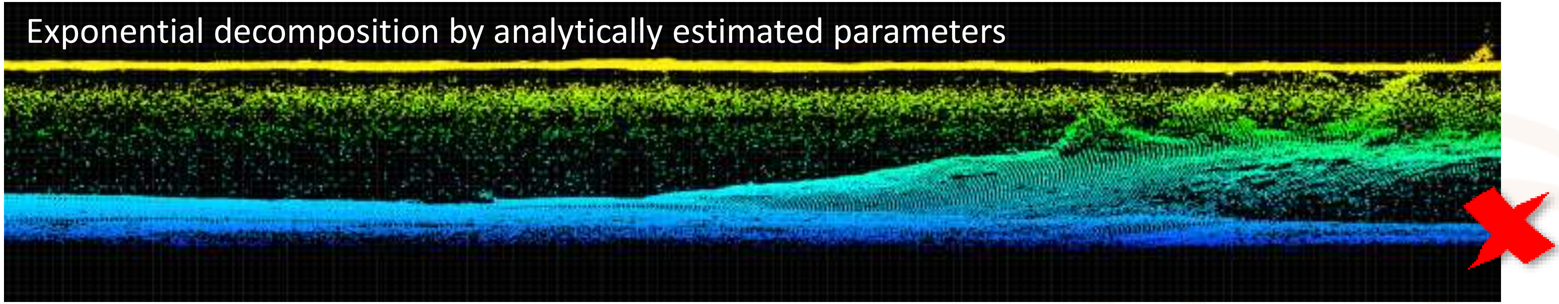
Bathymetric waveform extraction

Deep learning assisted exponential waveform decomposition

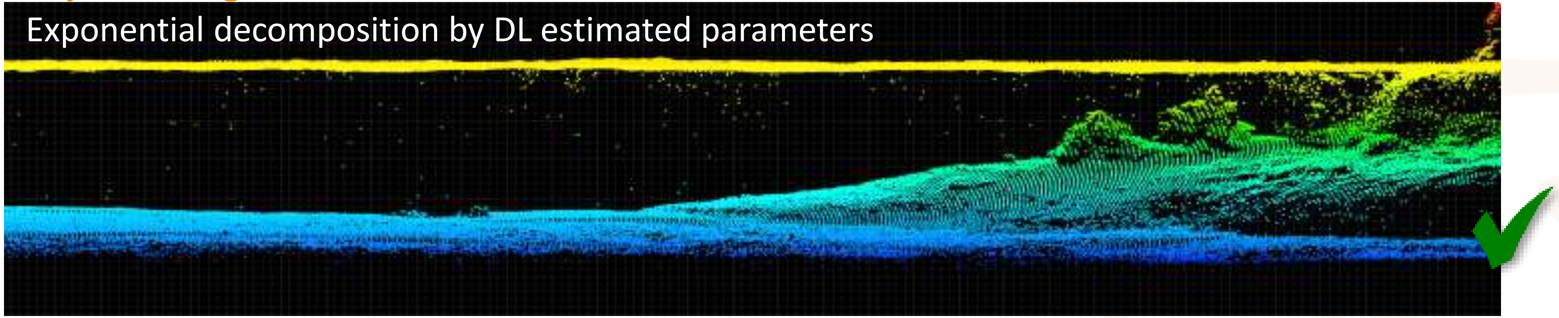


Bathymetric waveform extraction

Conventional approach



Deep learning



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Findings

Machine learning / Deep learning

- ✓ Very powerful for repetitive tasks on mass data of similar characteristics
- ✓ Superior to conventional techniques when data is overlayed with some sort of noise
- ✓ Scales well with better hardware
- ○ Quality of the results heavily rely on the training data
- ○ Massive computational efforts

Geometric / Conventional approach

- ✓ Superior in well described tasks, with rich data available
- ✓ Not necessarily slower than ML / DL
- ✓ Easier adoption for data variations
- ○ Prone to sparse data or noise

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Thank you

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