Virtual Laser Scanning using

HELIOS++
3DGEO HEIDELBERG

Applications in Machine Learning and Forestry

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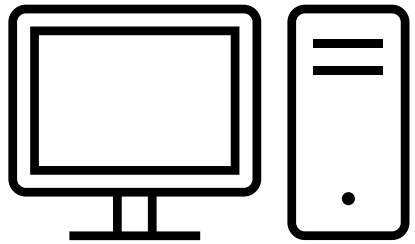
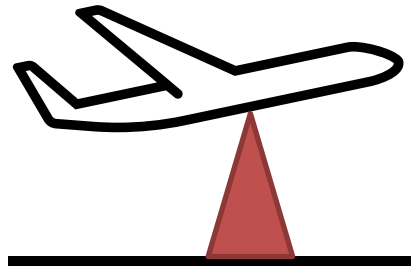
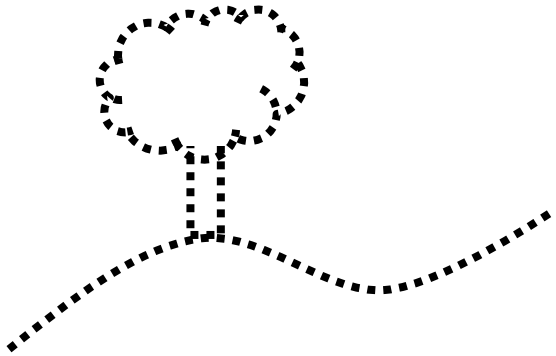
What is Virtual Laser Scanning?

- A **scientific method** for 3D remote sensing
- Allows to create LiDAR point clouds from models
  - Sensor model
  - Platform model
  - Scene model
- Reasons for VLS:
  - Cost of equipment, time
  - Investigation of different settings (planning tool)
  - Reference data generation
  - Teaching
  - …

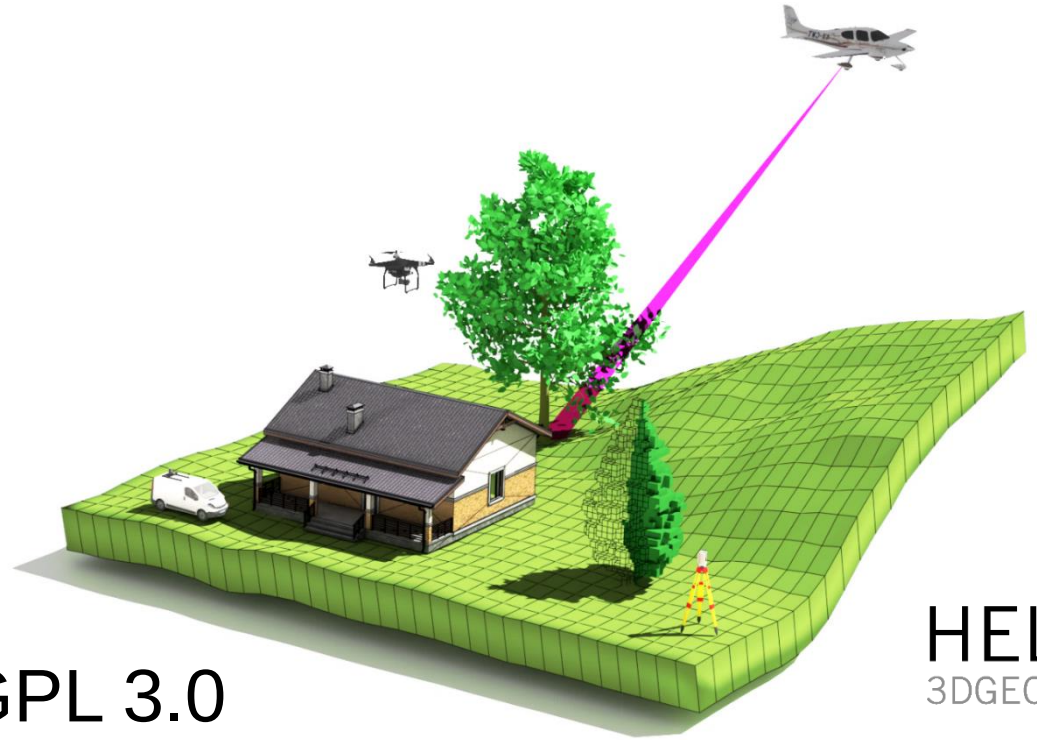






HELIOS++ for Virtual Laser Scanning

- Heidelberg LiDAR Operations Simulator
- Implemented in C++
  - run via command line or Python
  - Jupyter Notebooks showcases
  - QGIS Plugin AEOS
- Modular concept
- Beam divergence modelling
- Full waveform export
- Open Source: GPL 3.0 and LGPL 3.0



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https://github.com/3dgeo-heidelberg/helios

Application 1: Machine Learning

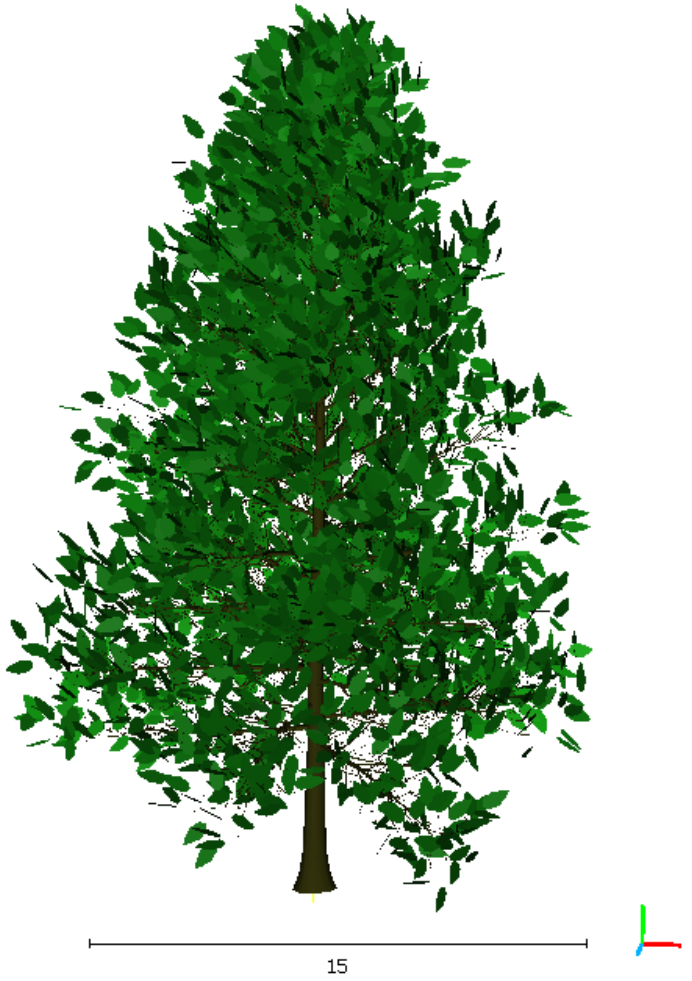
- ML, especially Deep Learning is data-hungry
- With VLS, perfectly annotated data can be generated
- 3D representation must resemble real data sets
  - Models from real LiDAR data
  - Procedural generation
  - Extraction from proxy data (OSM buildings, …)

Application 2: Forestry

- Increased model complexity
- Procedurally generated trees:
  Software from computer graphics

- Occlusions and multiple returns

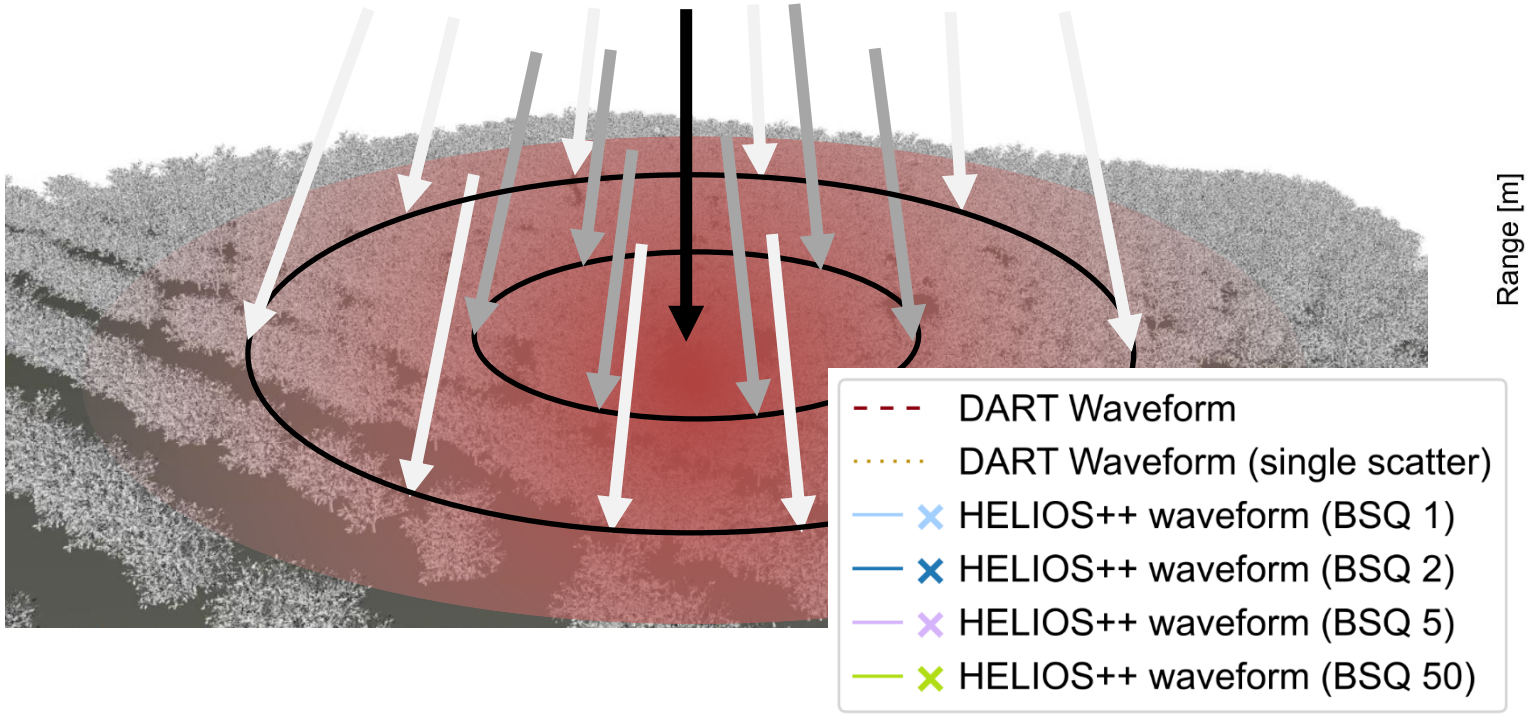
- Direct derivation of target variables, e.g.
  - wood volume
  - stem diameter (DBH)

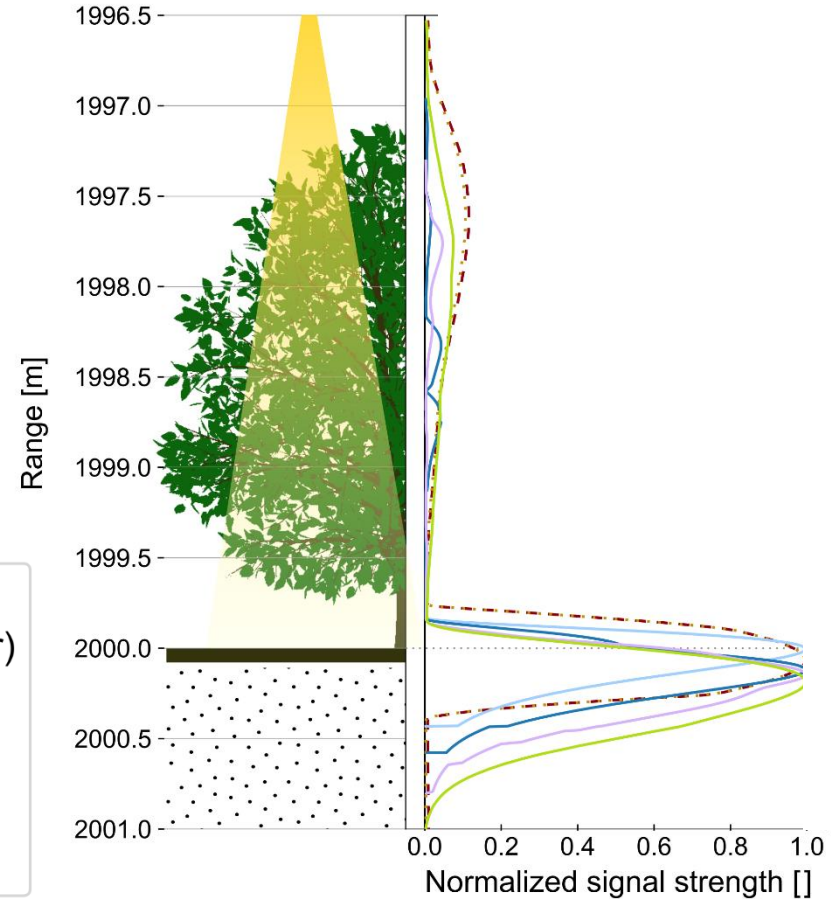


Model from the Arbaro Tree Generator

Application 2: Forestry – Waveform validation

- Using a test scene of a citrus orchard
- Comparison of the waveform with DART
- Single footprint with 50m diameter





Conclusion and Outlook

- VLS as a tool for geodata acquisition where real data is not strictly required
  - Save expensive acquisition costs
  - Create point clouds of fictious/future scenes
  - Simulate different acquisition settings and scenarios
  - Generate annotated data (measurements, labels)
- HELIOS++ as a VLS software
  - Current and future development
- Check it out: https://github.com/3dgeo-heidelberg/helios
- Releases for Windows, Debian-based Linux, Docker

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References

Contact us!
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