EUROSENSE®

BeGeo 2021: Artificial Intelligence (AI) applied to geo-data

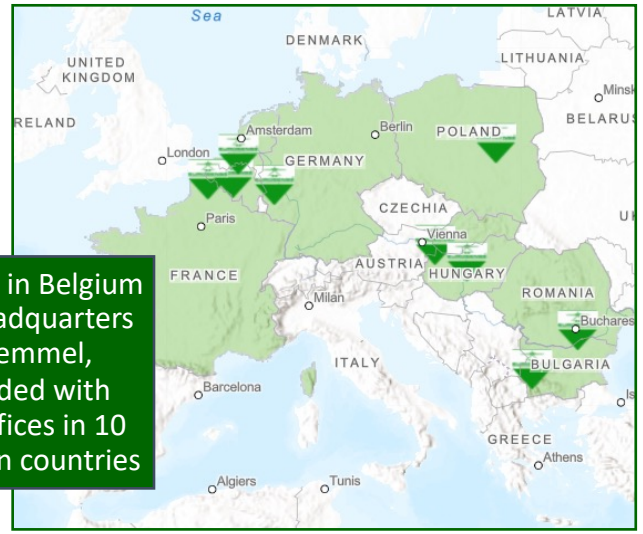
1. **About Eurosense**
2. General Context
3. Deep Learning on raster data
4. Deep Learning on point clouds

About Eurosense

European leader in aerial surveying, geo-data and remote sensing

esri BeLux
THE SCIENCE OF WHERE

Strong collaboration with Esri BeLux



Founded in Belgium with headquarters in Wemmel, expanded with local offices in 10 European countries

Founding member of international associations

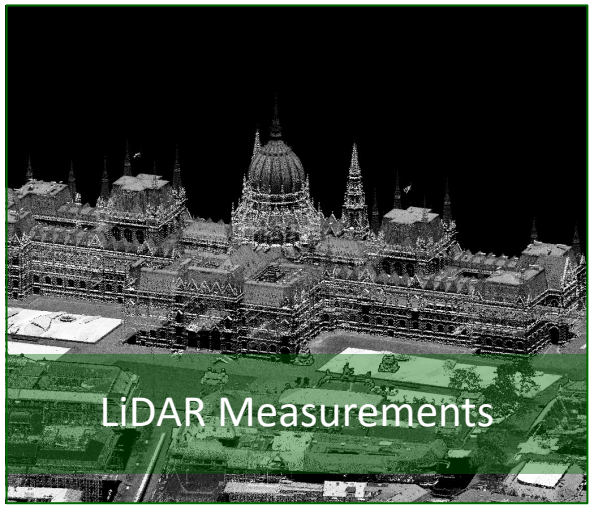
Equipment

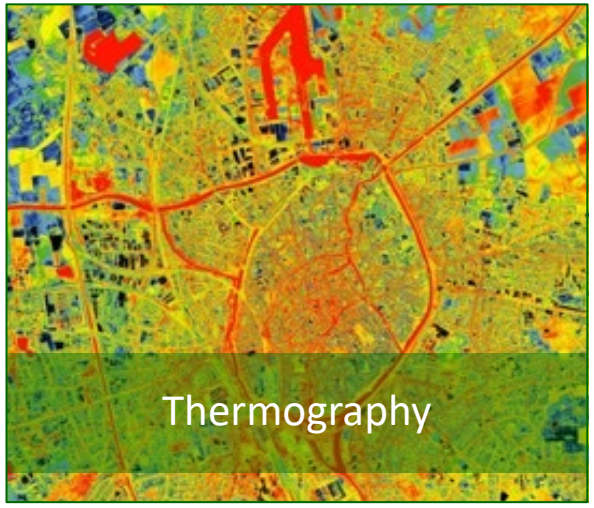
Photogrammetric cameras: Vexcel Eagle Mark 3 large format camera (footprint of 450 Megapixels and resolution down to 2cm)

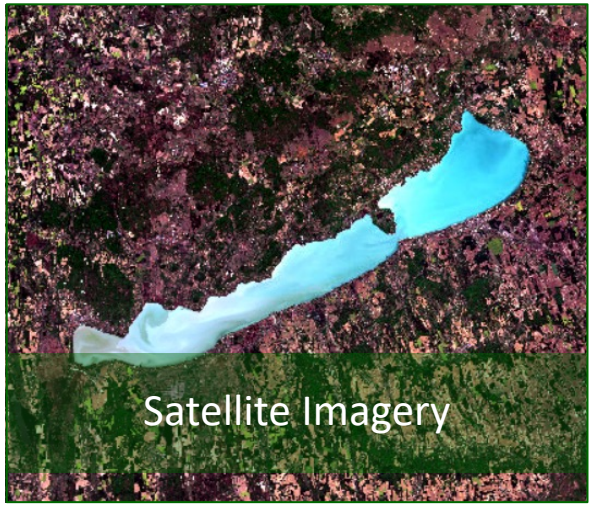
LiDAR Scanners: Riegl VQ 1560 II (pulse frequency of 4 GHz) with integrated Phase One medium-format 150 Mpx camera

Thermographic cameras (Flir)

Specialties







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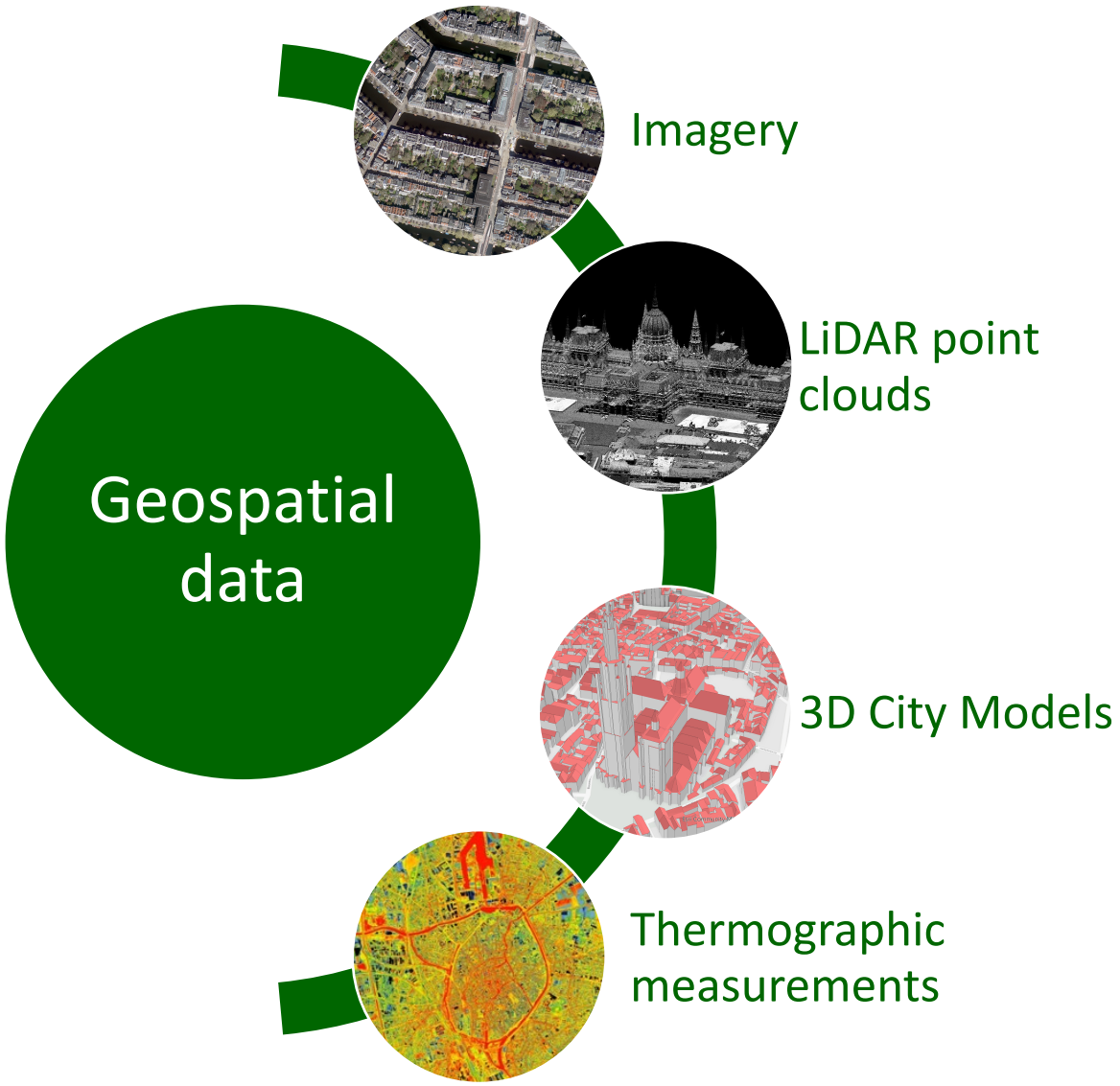
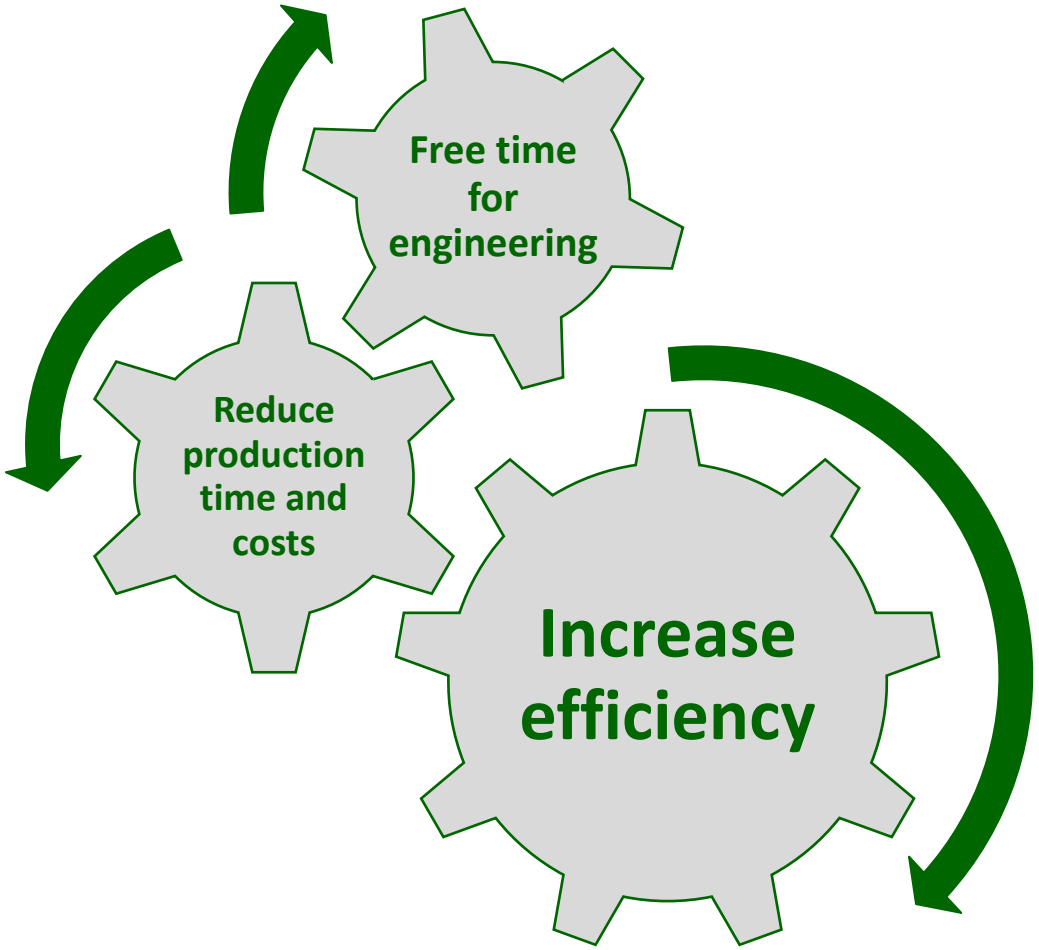
General Context (1/2)



- Increasing amounts of data
- More complex products
- Manual processing of data:
  - Time consuming
  - Prone to human errors
  - Limited possibilities

General Context (2/2)

AI-solution



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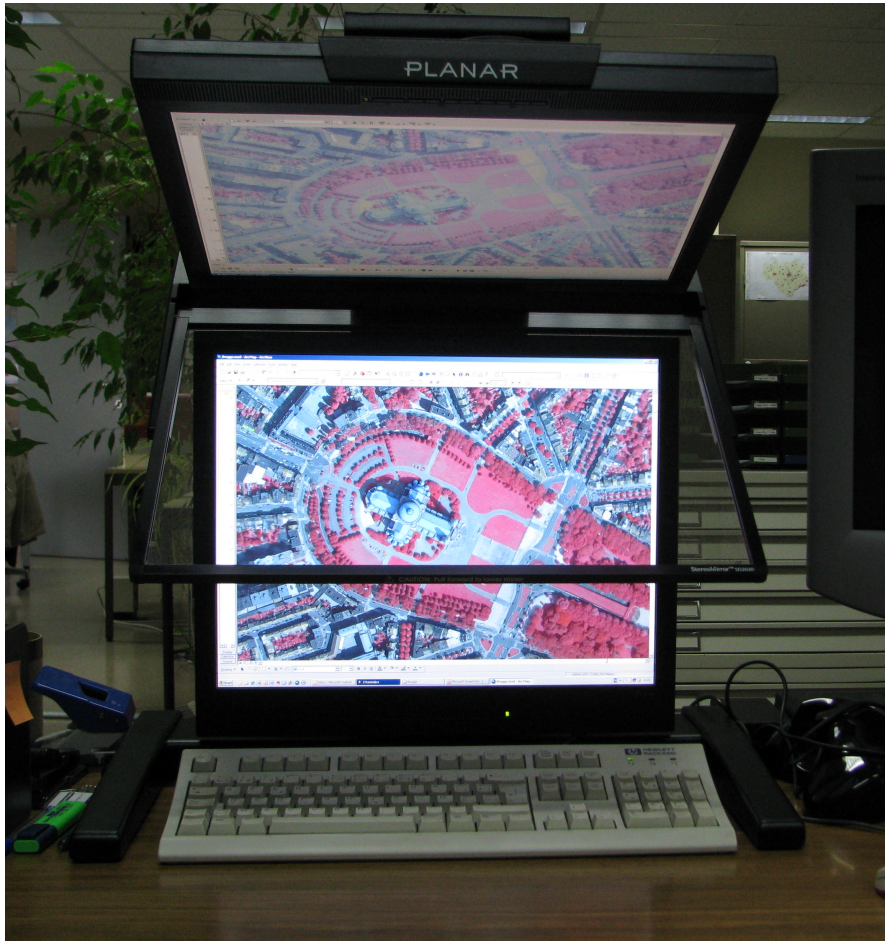
4. Deep Learning on point clouds

Previous production methodology

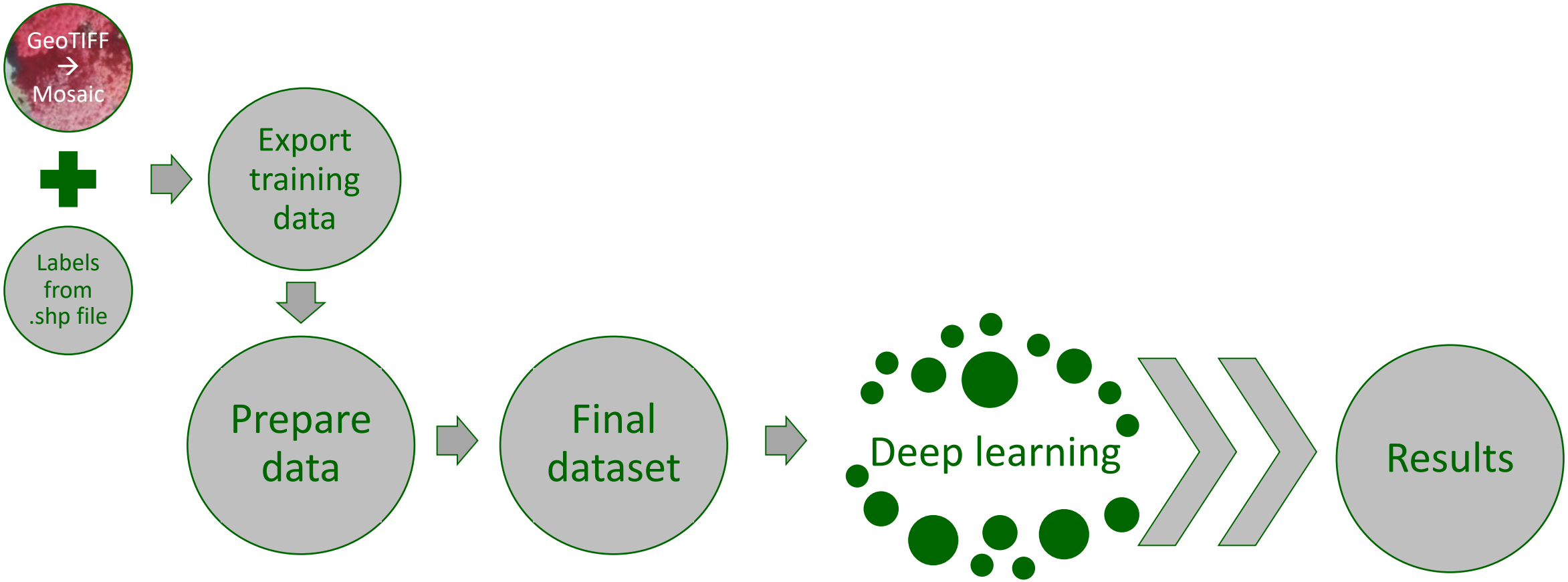
- Interpretation of false colour imagery by an expert:
  - Assign health scores between 1 (dead) and 5 (healthy) to all trees
  - Based on decoloration and defoliation
- Issues:
  - Subjectivity in the production of knowledge
  - Time consuming



Deep learning solution: Training data

- Data source: Multiband imagery
  - Red
  - Green
  - Near-infrared (NIR)
- 256 x 256 pixels
- Centered on the trunk
- Segmented by crown size
- Manual assignment of health scores (1-5)
- 140 different tree species

Deep learning solution: Methodology



Results and challenges

Reliable results

- 5 Classes: **68% accuracy**
- 2 Classes (healthy/unhealthy): **90% accuracy**

Efficiency gain

Consider 1400 trees to be analysed:

- 325 ill
- 1075 healthy

After implementation of the algorithm:

→ Analyse 570/1400 trees

→ **60% less manual work**

Remaining challenges

- Individual segmentation of trees
- Number of phytosanitary classes

Demonstrator case: Urban green management Roeselare

- Actual geographical tree cadastre for the city area (60 km²)
- Ambition: plant 100.000 new trees within the next 6 years

- Identification of trees with Deep Learning techniques in the entire city
- Identification of ill trees
- Identification of trees causing risk (close to powerlines, railway...)
- Modelling water flow at heavy rain events (possible tree positions to reduce risks)

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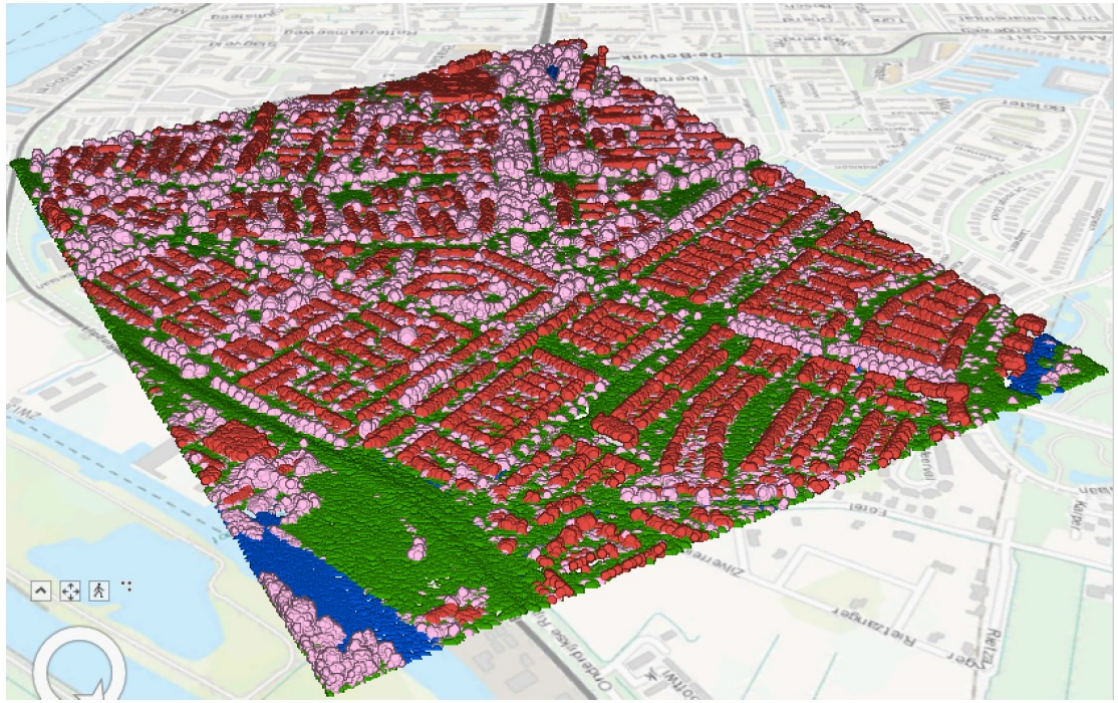
Previous production methodology

- Semi-automatic classification
  - Soil
  - Buildings
  - …
- Manual classification
  - Water

Issues:

- Time consuming

Classified point cloud (Netherlands) – AHN4 Project



Unassigned

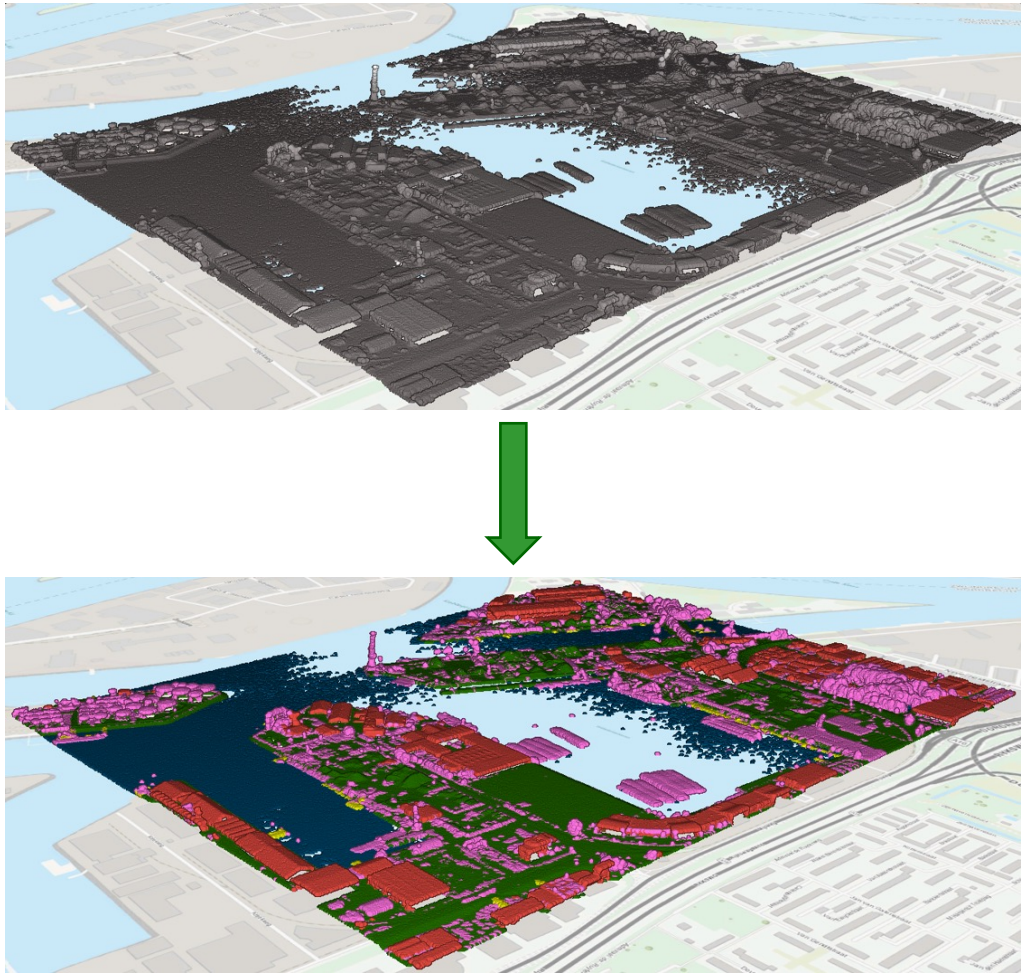
Soil

Buildings

Water

Deep learning solution

- Deep Learning Model: PointCNN
- Manual classification of training and validation data:
  - Tiles: 1,25 km²
  - Point density: 10pts/m²
  - 12 training tiles + 4 validation tiles
  - 4 object classes:
    - Soil
    - Water
    - Buildings
    - Unassigned

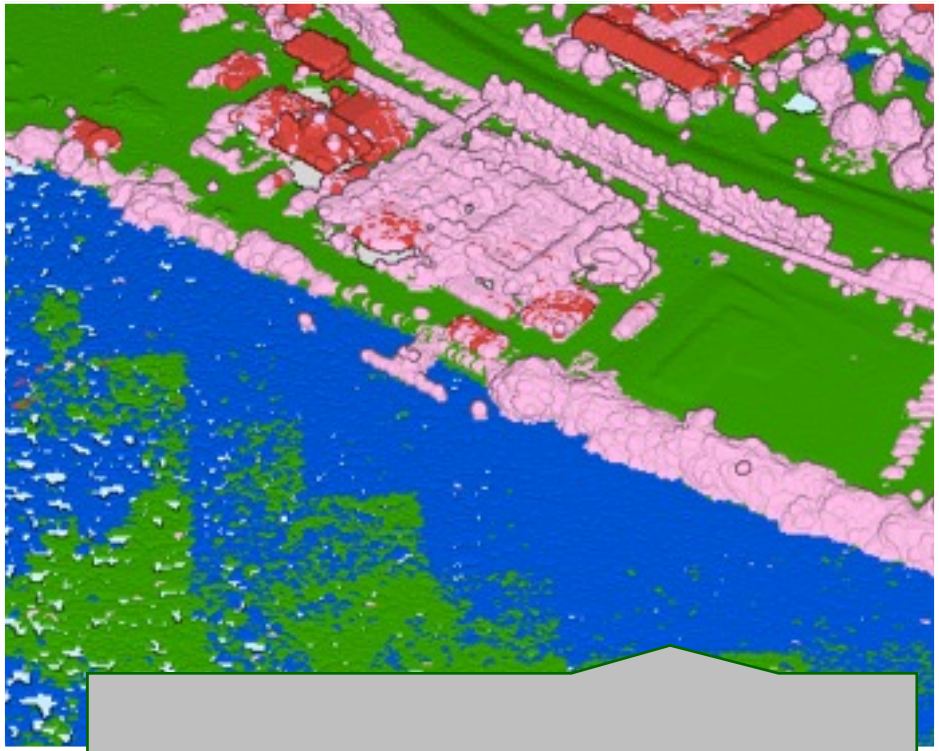


Raw data

Classified data

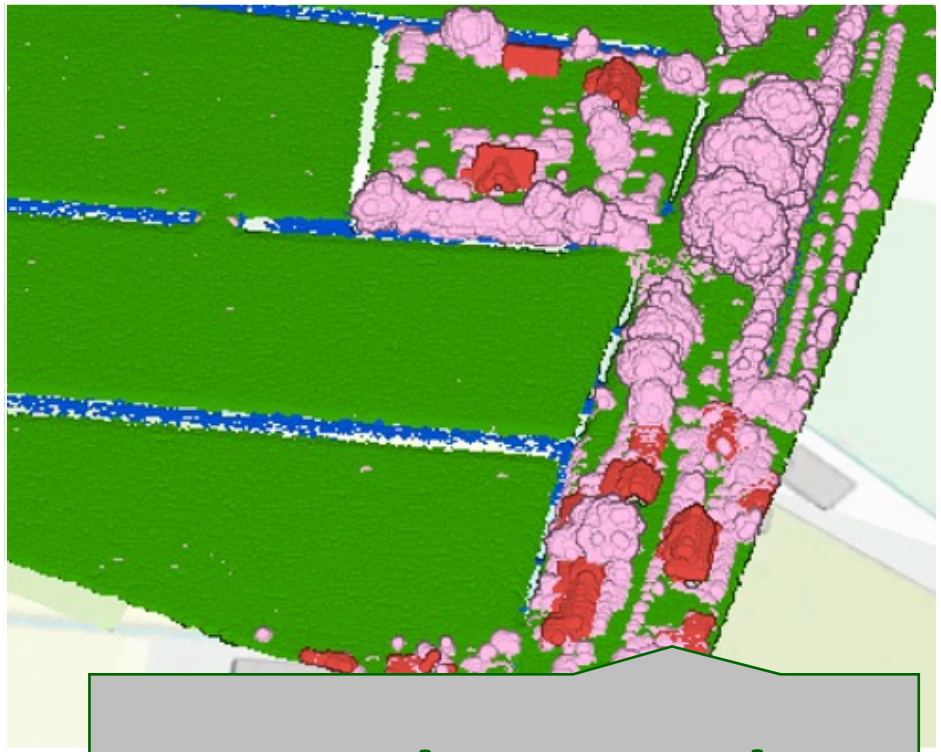
Results: Urban area

Good Results

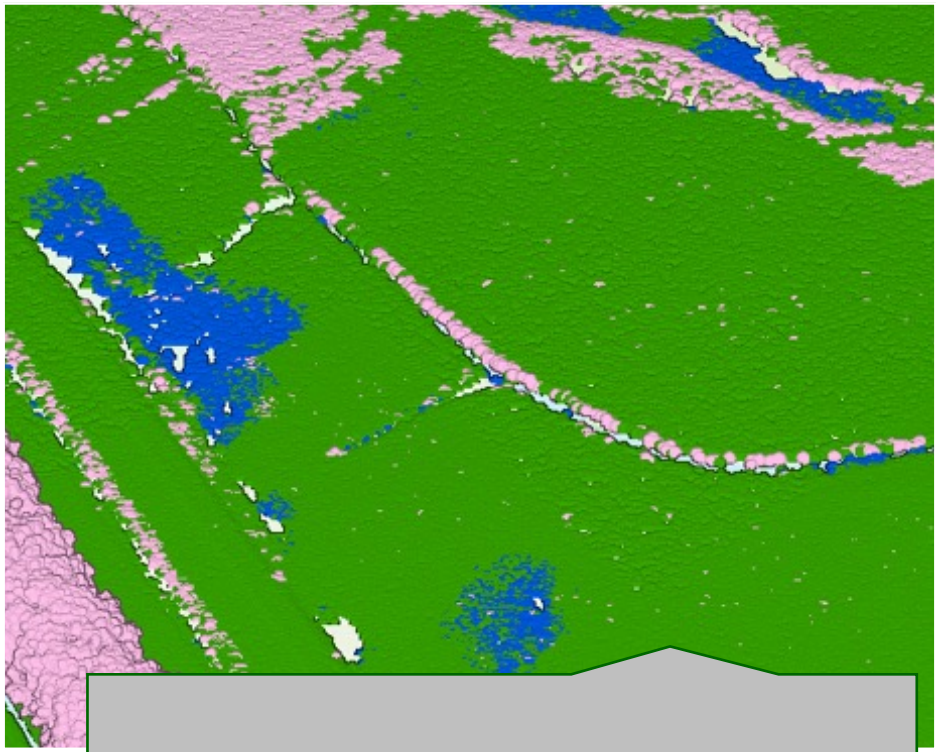


Errors

Results: Rural area



Good Results



Errors

Results: Metrics

Urban + rural	Soil
Precision	0,95
Recall	0,99
F1-Score	**0,97**

- **Precision** = 0.95

→ 95% of the points classified as soil are in reality soil

- **Recall** = 0.99

→99% of the real soil points is classified correctly

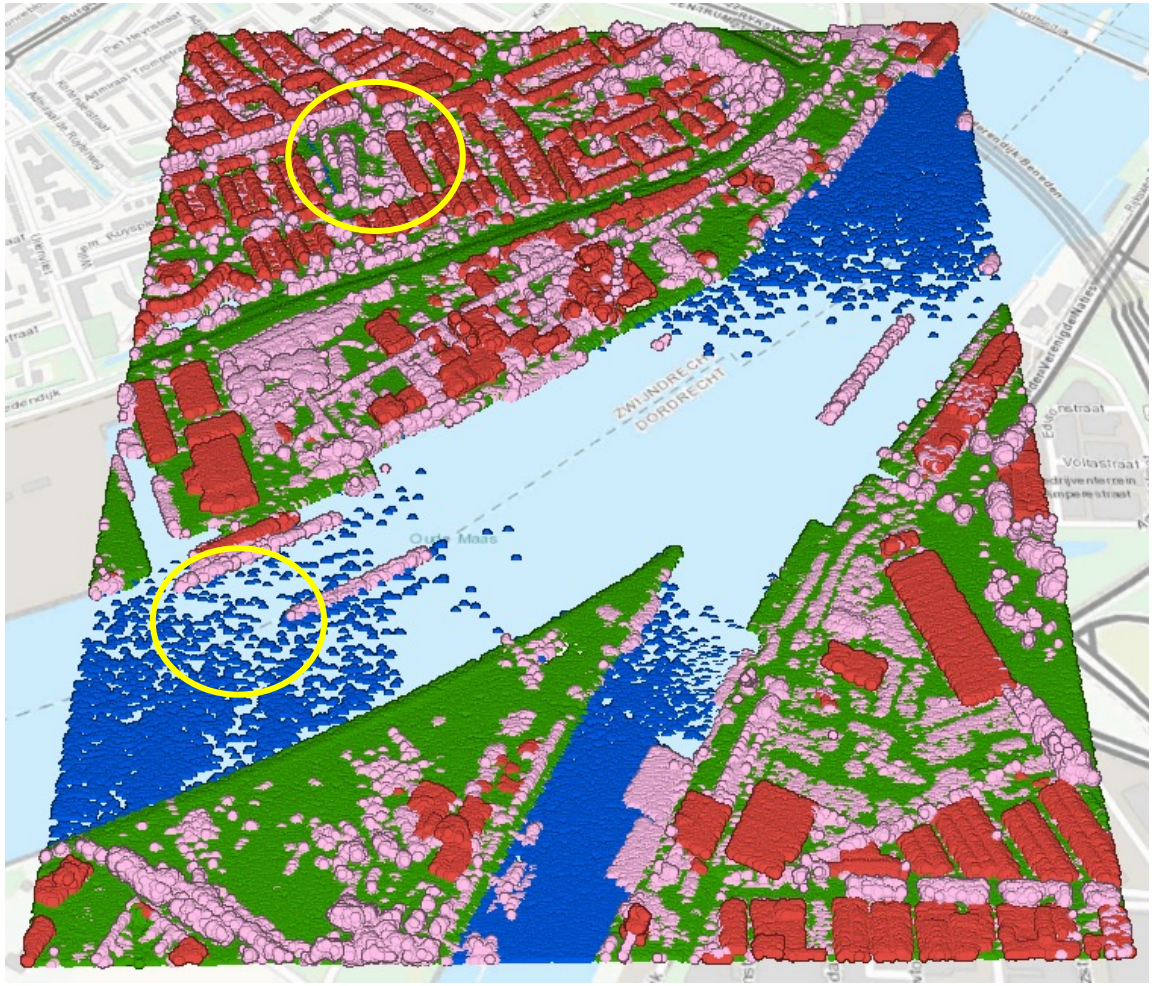
- **F1-Score** = 0.97

→Efficiency measure for the classification

→Combination of precision and recall

Challenges

- Quality of training data needs to be irreproachable
- Point density is variable
- Need a lot of computing power



Next steps

Train the model with data from various regions (France, Slovakia)

Validate results and attainable precisions

Extract roof types and export to CityGML, CityJSON...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Thank you!