Building (change) detection in airborne laser scanning data

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3D city modelling

- Urban planning
- Planning for mobile communication
- Disaster management
- Noise and air pollution analysis
- Real estate market
- Cultural heritage
- Safety

Building detection

- Removal of terrain points from point cloud
- Segmentation of remaining point cloud into continuous surfaces
- Derivation of segment properties
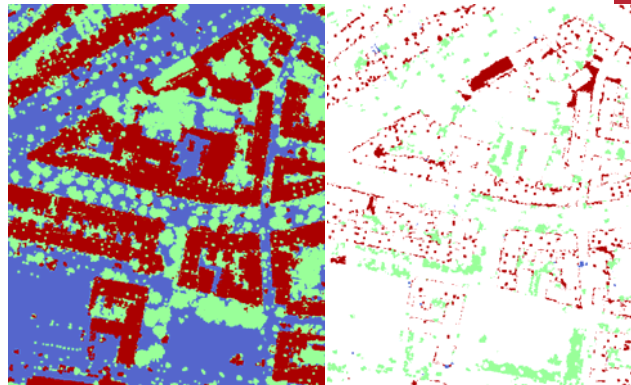- Classification of segments as building or vegetation

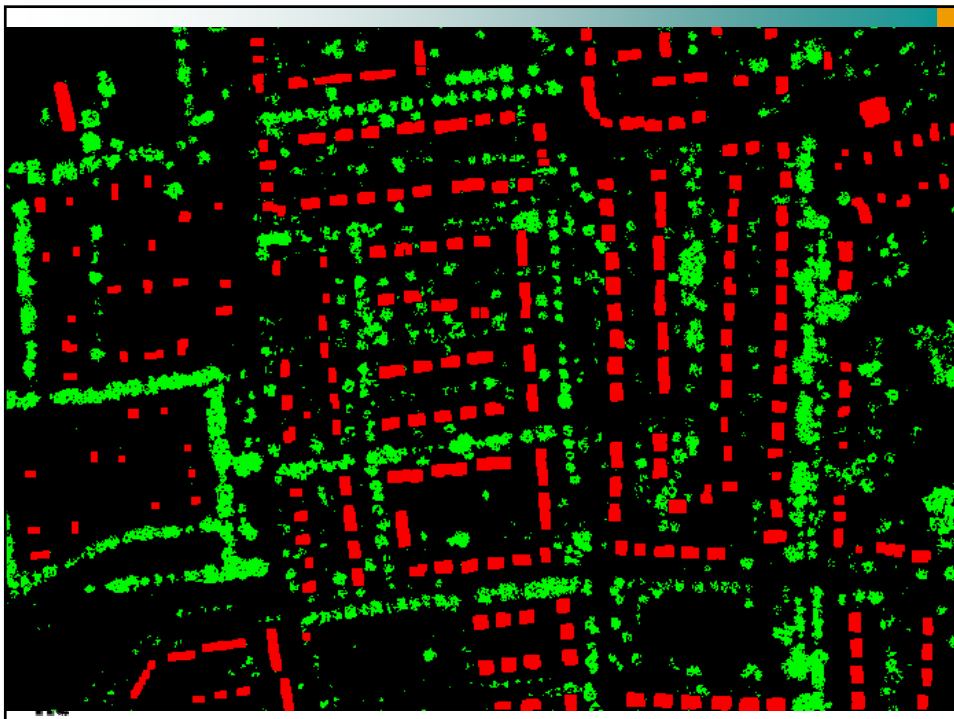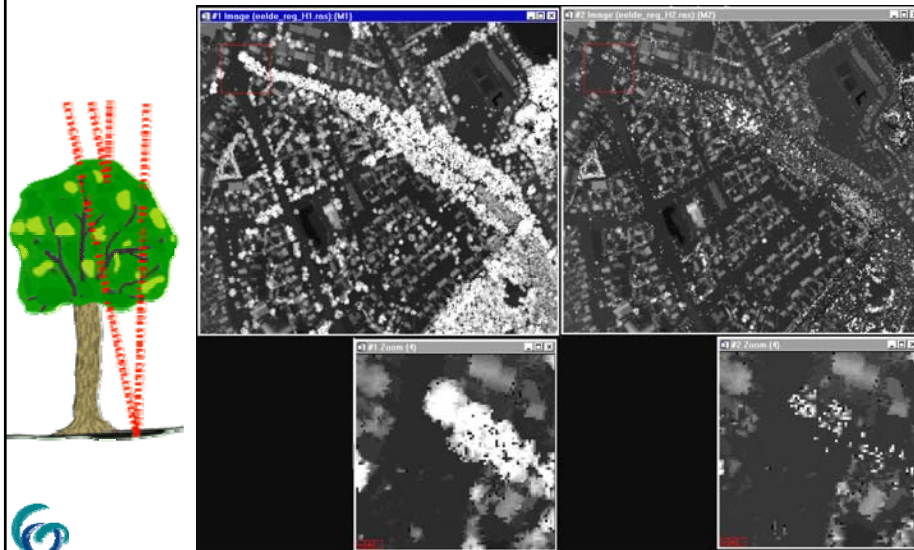## Classification of segments

Attributes
- roughness
- colour
- size

Accuracy
- initially 90%
- low vegetation
- wall points
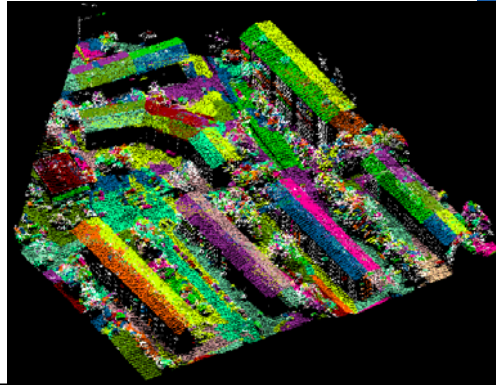- after post-processing 95%

First and last pulse differences

Building detection using point cloud segmentation

- Segmentation of a point cloud by surface growing
- Remove points in small segments
- Remaining segments are
  - Pieces of terrain
  - Roof faces
- Classification by examining height differences between segments

Change detection after disasters

Rapid acquisition of 3D data after disaster
- Earthquakes
- Explosions (industry accidents, terrorist attacks)
- Landslides

Change detection with laser scanning

Laser scanning – Accurate surface models
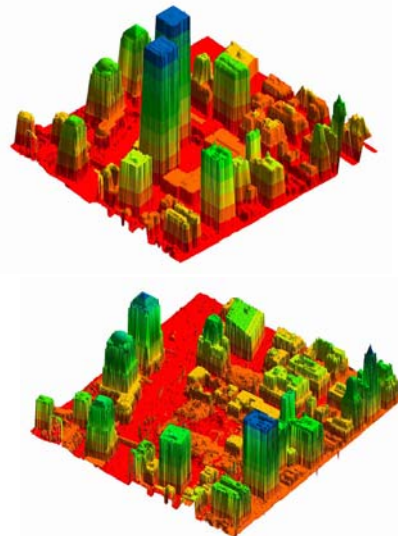Construction activities – Surface model changes

Two approaches
- Multi epoch data (difference DSM)
- Single epoch data and an outdated map
  - Segmentation and classification of laser data
  - Formalisation of mapping rules (selection, generalisation)
  - Change detection

Multi-epoch laser scanning data

- World Trace Center

World Trade Center: Damage Assessment

Change detection pilot

<u>Data</u>
ALTM1225 scanner
1.4 m point spacing

<u>Results</u>
- All buildings detected
- Some vegetation attached

Mapping rules

Generalisation
- Protrusions and intrusions up to 3x3 m are omitted

Selection
- Buildings larger than 3x3 m
- Only buildings visible from the road

Change detection

- 🟥 Demolished buildings
- ⬛ Old buildings (map)
- 🟩 New buildings
- ⬜ Old buildings (laser)

Results
- All new buildings detected
- All demolished buildings detected
- Some sheds detected

Change detection (II)

- 🟩 Changed buildings (map)
- ⬜ Old buildings (laser)

Detected "changes"
- Real changes
- Trees attached to buildings
- Mapping errors
  - Rigorous generalisation
  - Interpretation error

Interpretation error

- ■ Map data
- ■ Laser data

Conclusions change detection pilot

- Point spacing of 1.4 m not high enough for detecting small changes

- Additional usage of imagery could improve classification

- Implementing mapping rules may be difficult

- Change detection with laser data valuable as quality control tool