WG II   Acquisition

George Vosselman

Acquisition of 3D geo-information

- Data sources
  - Images
  - Point clouds
- Processing steps
  - Sensor calibration
  - Geo-referencing
  - Feature recognition
  - Model reconstruction
  - Change detection

Airborne sensor specifications

Cameras

- 1:1000 map
- H=2600 m
- 15 cm pixel
- σ_Z=25-50 cm
- multiple overlaps

Lidar

- H=375 m
- 10 pts/m^2
- σ_Z=2-3 cm
- bias 2-4 cm
- multiple returns
- full waveform
- H=900 m
- σ_Z=8-15 cm

Satellite

- H=400-800 km
- 50 cm pixel (WorldView)
- IKONOS
- σ_Z=1 m
- TerraSar
- 5 m resolution

Airborne sensor pro and cons

- Flights with airborne cameras at much higher altitude than lidar surveys -> less flight lines -> cheaper
- Images needed anyway
- Lidar surveys at night
- Lidar penetrates onto ground in forests
- Lidar point distributions may be inhomogeneous
- Texture from imagery
- Better surface extraction from multiple overlapping imagery

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Terrestrial sensor specifications

Cameras

- High speed 100 Hz
- super-resolution
- 1 cm pixel
- multiple overlap

Lidar

- σ_Z=0.5-3 cm
- bias depending on surface properties
- ghost points in CW scans

GPS

- σ_{XYZ}=2-3 cm
- breaklines
- eaves

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Problems in processing

Geo-referencing
- registration of images to point clouds
- sensor error modelling

Data storage and retrieval
- Dealing with huge data amounts

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Problems in processing

Surface reconstruction

- data gaps
  - poor reflectance
  - occlusions
  - bathymetry/lidar
- filtering
- breakline extraction

3D building models

- automation
- segmentation
- classification
- outlining
- data gaps

Trees

- species classification
- timber volume
- biomass

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Potential directions for future research

- Usage of additional information
  - 2D maps
    - filtering point clouds
    - 3D building reconstruction
  - hyperspectral images for tree species classification
- Self-diagnosis of algorithms
- Modelling knowledge
  - classification
  - hypothesis generation for complex building shapes
  - outlining buildings
- Change detection
  - low resolution surveys
  - collective mapping