Processing Airborne Lidar & Images

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Software developer
Terrasolid Ltd
Processing applications

- TerraScan for MicroStation 5 100 €
  - laser data processing
- TerraModeler for MicroStation 3 400 €
  - terrain modeling
- TerraMatch for MicroStation 5 100 €
  - fix systematic errors in laser data
- TerraPhoto for MicroStation 5 100 €
  - orthorectifying images
Building vectorization
Model visualization
Model visualization
Airborne / Mobile Scanning

Compute Trajectory
GPS / IMU Software

Compute Xyz Points
System Specific Software

Match, Classify, Thin, Vectorize...
Terra Applications
Products

TerraMatch

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<th>Quality</th>
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<td>TerraScan</td>
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Ground model
- classified ground points
- model keypoints for TIN
- lattice
- breaklines

Other classified objects as point clouds

Vectorization
- buildings
- transmission lines
- breaklines

Ortho photos
True orthos if buildings vectorized

Perspective views for vectorization and for classification
Processing steps

- Import points into TerraScan (transforming xy)
- Import trajectories into TerraScan (transforming xy)
- Adjust from ellipsoidal to geoid based height model
- Make sure points & trajectories have matching numbering
- Validate that area is covered
- Validate that flightlines match
- Remove points we do not use
- Classify noise (below ground or in the air)
- Classify ground
- Validate ground classification visually
- Classify by height from ground (low/medium/high vegetation)
- Classify objects manually
- Vectorize (buildings, breaklines, powerlines, trees)
- Classify model keypoints to produce model
# Processing Steps

1. **Match flightlines**
   - Fine tune calibration
   - Improve positional accuracy

2. **Classify**
   - Ground, vegetation, building...

3. **Create delivery products**
   - Contours
   - Powerline model
   - 3D vector models
   - Timber volume

*Expert work Computer time*

*Lower skill work Human time*

*Application specific expertise*
Validating that flightlines match

- Measure a value of how well flightlines match
- Solve/fix misalignment angles & mirror scale
- Solve/fix dz (and optional params) per line
- (Optional) Solve/apply fluctuating z corrections
Removing unneeded points

- Outside project area
- Over water bodies
- Collected when aircraft was turning
- Lower quality when better quality is available
- Edges of scan lines
Why to cut edges of scan lines?

- Produce more consistent pattern of points
- Remove less accurate points
- Many error sources increase at edges:
  - heading, roll, mirror scale
  - poor measurement angle
Point classification

- Automatic and manual routines

1. Default
2. Ground
3. Low vegetation
4. Medium vegetation
5. High vegetation
6. Building
7. Low point
8. Model keypoints
9. Vector building
10. Bridge
11. Wire
12. Tree
13. Breakline ground
Smoothing

- Laser data is dense but noisy
- Smoothing modifies point elevations in places where that produces a smooth surface
- Produces a prettier surface
Model keypoints

- Selects points which are most relevant for creating a triangulated surface model
- User specifies maximum difference between keypoint TIN and ground laser points
Vectorizing Breakline Features

- Draw road feature in 2D using on top of ortho
- Drape to follow laser surface
Vectorizing Breakline Features

- End result is a 3D vector which follows the general laser surface.
- Logic written for and makes use of high density of laser data.
Vectorizing buildings

- Approximate models -- automatic
- Accurate models – require manual work
- User modifies edges with the help of camera images
- Resulting 3D model has walls starting from below ground
Vectorizing transmission lines

• Goals:
  – Mapping of towers and wires
  – Search danger trees
  – Modeling for increased capacity

• One or more cameras during flight
Tower & laser points
Tower & vertical facing camera
TerraPhoto task

*TerraPhoto for MicroStation*

- Produce orthorectified images
- Provide perspective views for
  - laser data classification
  - building vectorization
  - powerline tower vectorization

*TerraPhoto for MicroStation or TerraPhoto Viewer*

- Display background raster images
- Render scenes with large image volume
- Produce flythru animations
TerraPhoto

• Written for digital cameras integrated with laser scanners
• Assumes raw positioning for images is good
  – computed from GPS/IMU
  – best systems provide one pixel level raw positioning
• Does not need any known points
• Uses laser surface as the rectification surface
• Can derive all camera parameters
Perspective view principle

• View the world as seen by one camera image
• Viewer eye is at camera focal point xyz
• Compare any 3D information against the image
Perspective views

Building vectorization