Data type:

- Aerial laser scanning elevation data
- RGB and near infrared airborne photography (ground resolution 12.5 cm)
- GIS data

Challenge:

- Timely and cost-efficient assessment of large amounts of data (20.000 km^2)
- Concurrent analysis of different data types
- Administration and management of large datasets
- Time-dependent management of topographic datasets
- Integration of various data sources within terrain extraction (laser scanning , photogrammetric and surveying techniques)

Software deployed:

- INPHO TopDM
- INPHO Scop++
- eCognition Developer
- eCognition Server
- ArcGIS for mapping purposes

Key benefits:

- Improved accuracy by combining optical, laser scanning and GIS data
- Reduced costs:
  - Manual analysis of one building accounted for 2 - 4 Euros ($3 - 6)
  - Automated approach 0.1 – 0.2 Euros ($0.06 – 0.13); estimation depending on a classification accuracy of more than 90%
- Automated analysis of an area of 20.000 km^2 allowed for processing of large amounts of data in a timely and cost-efficient manner, consequently allowing for the development of land use models for large areas of land.

About GEOinfo

The Department of Surveying and Geo Information of the State Government of Lower Austria is the major provider of geographic data in the region. The Department's portfolio includes digital data and secondary products, such as maps and graphics, which are created on behalf of the State Government of Lower Austria. The department is structured into three areas – topographical survey, data collection, and data processing.

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T-eC-CS-001-1

GEOSPATIAL **CASE STUDY**

SOUND PROPAGATION MODELING:

URBAN PLANNING USING INPHO AND eCOGNITION

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eCognition®
The most advanced image analysis software available for geospatial applications

"With measured accuracy ratings above 94%, the automated approach provides an information product that would be completely unviable and cost prohibitive to create manually".

SOUND PROPAGATION MODELING:

URBAN PLANNING USING INPHO AND eCOGNITION

Executive Summary

Sound-wave propogation models for traffic noise have been generated over an area of more than 20,000 km^2 in Austria using INPHO and eCognition software. The application detects and quantifies changes in forests, buildings, and water bodies using aerial laser scanning and orthophotos and has been developed by the Government of Lower Austria as part of an urban planning initiative from the European Union. With measured accuracy ratings above 94%, the automated approach provides an information product that would be completely unviable and cost prohibitive to create manually.

The Challenge

The cost and time associated with manually assembling and processing detailed image data is significant. Integrating three dimensional data such as aerial laser scanning vastly improves the value and accuracy of the information product produced, however, this data is practically impossible to manually prepare and analyze. Only by using software to automate data handling and analysis is it feasible for organizations to tackle land-use modeling and mapping projects for large areas. GEOinfo did exactly this when it developed an application capable of automatically analyzing large volumes of data to deliver accurate and reproducible results in a standardized manner.

Handling Airborne Geospatial Data

In the GEOinfo project, automation of photogrammetric processes and digital terrain model (DTM) generation was essential due in part to the large data volume. INPHO, a leading photogrammetry and digital terrain modeling software suite, was used to manage and process GEOinfo's aerial laser scanning data over large areas. The TopDM module was used to manage approximately 30,000 raw data flight strips from which 20,000 DTM and 20,000 digital surface model (DSM) data tiles were derived. Various SCOP++ modules were applied to these data sets to perform tasks such as point cloud classification using powerful filtering strategies, shade calculation, slope calculation, profile tools and other terrain algebra methods. Available breaklines were used during these processes to increase the quality of the terrain modeling, especially in challenging topographic areas.

Without automation software like INPHO, processing laser scanning data of this sort is practically impossible. The output of these processes provides quality input data for the next workflow step: the production of value-added products using eCognition.

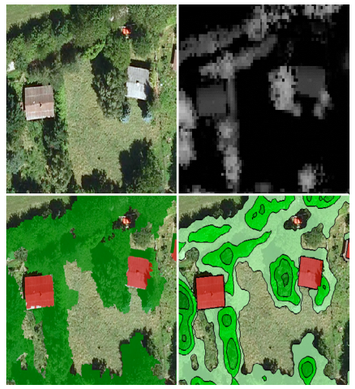

Figure 1.
Upper left: RGB; upper right: nDSM; lower left: basic land cover; lower right: generalized results

Figure 2.
map sheet sample (left) and corresponding classification result (right)

Detecting and Quantifying Changes

GEOinfo utilized eCognition to detect and quantify changes in forests, buildings, field and water areas from the DSMs, DTMs and orthophotos. Within eCognition, a wide variety of source data can be imported, fused, and segmented to create meaningful objects using prescribed conditions such as average elevation and normalized differenced vegetation index. Rather than merely examining individual pixels, eCognition identifies objects and makes contextual inferences. Just like the human mind, it uses the color, shape, texture and size of objects as well as spatial relationships to achieve the same insights as an experienced analyst. These methodologies produce clear, intuitive results that facilitate simpler map construction.

This logic was applied to data representing 20,000 km^2 of Lower Austria. To deal with this volume of data, a tiling and stitching technique was applied creating 2000 x 2000 pixel tiles each representing 1 km x 1 km of territory. Within each tile, eCognition automatically classified elevated objects and distinguished buildings, trees, scrubs and sealed areas. Results were then stitched together and border effects removed to create the final information product for import into ArcGIS.

Project Outcome

The analysis of an area of 20,000 km^2 requires large amounts of data to be processed in a timely and cost-efficient manner. Replacing manual analysis routines with an automated software-assisted approach, it was feasible to develop land-use models for very large areas without a large amount of resources. Where manual analysis of one building might cost 2 – 4 Euros ($3 - 6), the automated approach costs only 0.1 – 0.2 Euros ($0.06 – 0.13).

An accuracy assessment of the resulting shape files showed that built-up and forested areas were correctly classified for 94.3% and 96.1% of the area respectively. With high levels of accuracy achieved at such a low cost, the project was deemed to be highly successful and additional iterations are now planned for each of the next four years.

Client Feedback

"INPHO software allowed us to produce robust terrain models with virtually no manual interaction, enabling us to produce and manage digital terrains in a cost efficient, standardized and automated manner. eCognition allowed us to concurrently analyze both the digital imagery and terrain models reliably extracting the land-cover and land-use information we were seeking. After testing commercially available software currently on the market, we discovered that only eCognition is able to efficiently accomplish this." - *Michael Pregesbauer, Deputy Department Head at GEOinfo.*

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