Image Analysis With the Definiens Software Suite

Definiens Enterprise Image Intelligence

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August 2009
1986 Prof. Dr. Gerd Binnig got Nobel Prize for Physics

1995 Research ’Think-Tank‘ created by Prof. Dr. Gerd Binnig

1998 Cognition Network Technology; 20+ patents

2000 Commercialization seed-funded by TVM; further financing by TVM and CIPIO Partners

2004 Enterprise Image Intelligence: Focus on Life Sciences and Earth Sciences

2008 80+ employees, Headquarter in Munich (Germany), 2.500+ licenses
Worldwide Customers
Manual and pixel based interpretation is the bottleneck in the main processing chain!

The gap in the extraction of GIS data from EO data can be closed by object-/context based information extraction.

Definiens was the first company to fill this gap with a completely new technology and is, to date, not reached by something comparable.
Definiens Enterprise Image Intelligence Suite
Highly sophisticated programming environment for extraction of information from any kind of images and for any application.

Processes available for segmentation, classification, merge, growing, variable calculation...

Standard programming functionalities:
- arbitrary combination of processes
- loops
- variables
- if-then relations

Criteria for information extraction:
- spectral information
- texture information
- shape criteria
- relations to objects in a defined neighborhood

Application development
- Rule sets encapsulated by an easy-to-use user interface
- Execution in Definiens Architect
Rule Set Calibration With Definiens Architect

- Easy to use software tool
- For non-professionals in rule set development with Definiens Developer
- Using a highly sophisticated technology without knowing anything about it.
- Application and user interface are developed in Definiens Developer.
- The calibration of the analysis can be done without direct contact to rule sets running in the background by:
  - sliders
  - buttons
  - drop-down menus
  - text boxes
- Tremendous increase in speeds even with semi-automated applications
- Additional tools:
  - manual editing (re-classification, object reshaping, fast navigation to objects of interest)
  - and workspace organization (batch processing)
Rule Set Calibration With Definiens Architect

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- Additional tools:
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  - and workspace organization for batch-processing
The muscles of the Definiens Enterprise Image Intelligence suite are Definiens eCognition Servers.

Definiens eCognition Servers are engines developed for:
- batch processing,
- processing of very large data sets
- and high data throughput.

Processing can be started and organized with Definiens Developer, Definiens Architect or can directly be integrated into an existing workflow (SDK, API).

EII is fully scalable and can be adapted to the requirements of the user:
- number of images
- processing speed
- image size
Definiens Software, Services and Training

Definiens Software
- Definiens Developer (Development)
- Definiens Architect (Calibrations)
- Definiens eCognition Server (Processing)

Definiens Services
- Problem Assessment
- Application Development
- Implementation

Definiens Training
- Essentials Training
- Rule Set Training
- Training-on-the-job
Urban Land Cover Mapping
GUS/Definiens Settler

Project Background
- GMES Urban Service (GUS)
- Successor of GUS-prototype: Definiens Settler

Data
- Image Data
  - SPOT 5 (5/10 m, 2.5/10 m)
- Thematic data
  - Road network

Data Provider
- Spot Image
- NAVTEQ

Goals/Challenges
- Semi-automatic land use/land cover classification
- Support of urban management
- Map update
- Up-to-date GIS-ready land use information
- Reduced production costs and production time
- High accuracy
Land Cover Rule Set transferrable to many other cities
Definiens Architect for Change Detection
Change Detection Application
Result Visualisation in Arc GIS
Building Extraction
Buildings are extracted fully automatically based on CIR & DEM Information

Irregular outlines are generalized
Ship Detection on TerraSar-X Spotlight Images

by Silvester Fischer

19.8.2008
Data Provided by Infoterra

- **Sensor:** TerraSar-X
- **Product:** Spotlight
- **Resolution:** 0.5 meters
- **Scene size:** ~ 10 Km (width); 5 Km (length)
- **Regions of interest:**
  - Water
  - Mixed areas
  - Ships
Segment and Classify Water Mask

- Process Image with Chessboard Segmentation
- Find water seeds with very low backscatter
- Grow from water seeds border into water candidates if spectrally similar
Classification Strategy – Ship Candidates

- Create Ship Objects
  - Classify ship candidates (TempClass01) by area feature.
Classification Strategy – Ship Candidates

- **Create Ship Objects**
  - Fine chessboard segmentation on ship candidates
  - Unclassify parts of ship candidates with low backscatter
Classification Strategy – Mixed Areas

- Classify Unclassified
  - Very big Objects = mixed Areas
  - Small objects in the neighbourhood of ship candidates = water
Evaluation of ship candidates and classification of ships and ships unlikely in terms of the shown membership functions
Classification of ship length
- < 50 m
- >= 50m < 100m
- >= 100 m < 150 m
- >= 150 m
Ship Detection
TerraSAR-X StripMap Mode
Ship Detection – TerraSAR-X StripMap

Project Background
- Feasibility study for Infoterra GmbH, Germany
- Usability of TerraSAR-X data for detection of ships on ocean water

Data
- Image Data
  - TerraSAR-X: StripMap, 3 m resolution
- Thematic data
  - Shoreline based on GSHHS

Data Provider
- Infoterra GmbH
- Paul Wessel, SOWST, Hawai‘i

Goals/Challenges
- Automatic detection of ships on ocean water
- Handling of different water surfaces
  - rough/calm
  - homogeneous/heterogeneous
- No clear shoreline
due to missing a clear shoreline
  - addition of thematic information based on GSHHS
  - classification of water area

due to spatial inaccuracies need for a buffer zone
  - objects in buffer zone can be ships or objects on land
  - detected objects have to be labeled by operator

more accurate shoreline required
Ship Detection – TerraSAR-X StripMap

- Easy and fast monitoring and quantification of detected ship objects with...
- ...Object Table
- Fast navigation through detected objects
Ship Detection – TerraSAR-X StripMap

- Easy and fast monitoring and quantification of detected ship objects with...
- ...Object Table
  - Fast navigation through detected objects
  - Customization of object table concerning shown object attributes
Ship Detection – TerraSAR-X StripMap

- Easy and fast manual labeling for more detailed categorization
  - Supported manual editing by Object Table
  - Exemplary available attributes:
    - Shape
    - Position
    - Arrangement
- Check of overall statistics with statistics tools or by export of project statistics

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<tr>
<th>Categories</th>
<th>Quantity</th>
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<tr>
<td>&lt; 50m</td>
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<tr>
<td>50 – 100m</td>
<td>6</td>
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<tr>
<td>100 – 150m</td>
<td>13</td>
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<tr>
<td>150 – 200m</td>
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<tr>
<td>&gt; 200m</td>
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<tr>
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</table>
Ship Detection – TerraSAR-X StripMap
Oil Seepage and .html Workspace Report
Data set is processed in batch mode (eCogntion Server).

The automatically created Workspace Report gives an overview of the Workspace results and helps to identify images of special interest.

The Project Report can be accessed from the Workspace Report and gives detailed information about the results for a single Image.
The .html Workspace Report gives a quick overview of the Workspace results and helps to identify images of special interest. This report includes links to the detailed image reports.

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<th>scene_id</th>
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<th>Layer mean of Layer 1 Oil slick</th>
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</tbody>
</table>
Can be opened directly from the Workspace report and gives detailed information about the results for a single Image. It includes a Back-link to the Workspace report.
Geo Applications
Quickmap Mode

- Easy to use mode for simple tasks
- Generate quick solutions using sample based classification
Architect interface optimizations

- Object table for manual editing workflows
- Radio Button Rows
- Toolbars
- Edit box with Slider
- Manual classification buttons
Workspace Collaboration

- Multiple users can access projects within one workspace
- Projects which are edited are locked to other users
New OBIA Dimensions
New OBIA Dimensions: Object Generalization

- Object Generalization
  - Rectangular buildings
  - Smooth vegetation outlines
New OBIA Dimensions: Maps

- Maps
  - True change detection support through independent segmentation
  - Improved performance through down sampling approach

Original scene

Task specific segmentation in different maps

Independant classification approaches

Combined results
New OBIA Dimensions: Regions

- **Regions**
  - Improved performance through limitation of analysis on specific areas
  - Independent processing of specific regions
  - Analyze different regions using individual image resolutions

- Original scene with regions
- Independent analysis of different regions
- Combined results
New OBIA Dimensions: Maps & Regions

- Maps & Regions
  - Performance improvement through resampling approach

- Original scene
- Classification of Area of Interest (AOI) on map with **low resolution**
- Analysis in full resolution map within AOI only
- Results from AOI in **full resolution** map
New OBIA Dimensions: LiDAR support

- LiDAR point cloud support
  - Load *.las files directly
  - Generate object based raster DSM
  - Combine LiDAR with other remote sensing data
Available Resources

http://community.definiens.com/
http://earth.definiens.com/
Definiens Developer Quickstart contains everything you need to start analyzing earth observation data.

The Quickstart Package contains step-by-step introductions and practical examples to make the first steps in the world of object-based image analysis quick, easy, and fun!

And it’s free!

www.definiens.com/quickstart
Welcome to the eCognition™ Community

This community belongs to all eCognition users, including you! The Application Views menu gives you access to the different community resources such as:

- Wiki: collection of eCognition related articles (e.g., rule set tips and tricks, strategies, algorithm documentation...).
- Discussions: ask questions and get answers.
- File exchange: share any type of eCognition related code such as rule sets, action libraries, plug-ins...
- Blogs: read and write insights about what’s happening around our industry.

Use the New button button to add content or start a discussion. If you are interested in specific topics, try the search function to filter content from across the community.

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Welcome to the eCognition Wiki

Welcome to the eCognition Wiki containing technical information related to eCognition and Object Based Image Analysis (OBIA). The Wiki is maintained by the Definiens team in collaboration with eCognition users like you.

Overview
This Wiki is structured in five sections. The User Guide is a good starting point for those working with Definiens software. The Reference Book lists detailed information about algorithms and features. The Strategies section is a collection of approaches, generic methods, etcetera used to solve specific image analysis tasks. In the Glossary you can find definitions/explanations of what specific terms mean in the context of eCognition and Rule Set development. Finally, the Community Pages section gives you the opportunity to create your own Wiki pages.

Remember that this is your Wiki, and so your contributions are more than welcome. If you see wrong or missing content feel free to edit or add new articles!
Benefit
Benefit

- Full customization of analysis according to customer needs
- Fast processing with scalable client-server system
- Reduction of processing time compared to manual change detection
- Very high data throughput due to scalable client server system
- Easy-to-use Applications for rule set calibration and manual editing
- Full integration in existing workflows
- High degree of automation
- Connection to existing data bases
  - e.g. ArcGIS Server, ArcGIS Server Image
Thank you for your attention!

For further information please contact:

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