



GAFAG

Fully operational approach for automatic LPIIS update

**An Operational Agricultural Application
by GAF AG**

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LPIS update is...

- a regular and important duty of agricultural departments
- time-consuming and costly



→ *new and effective methodologies are needed to support this task*

LPIS-Update:

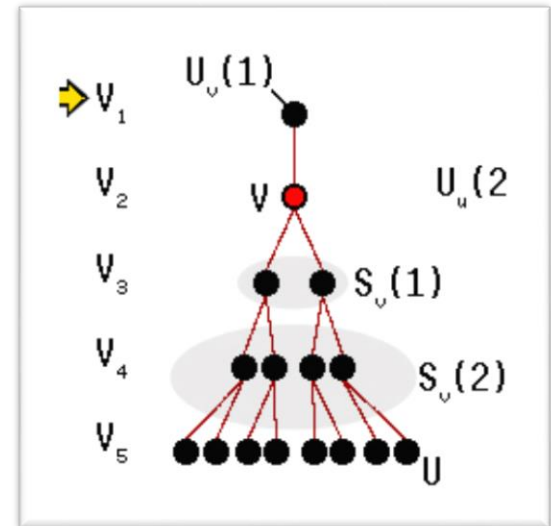
- Pre-check of changes
 - concentrate on parcels that are actually wrong
 - facilitate the revision
- Update of geometry
 - normally performed by agricultural departments
 - background information needed to decide between temporary and permanent changes



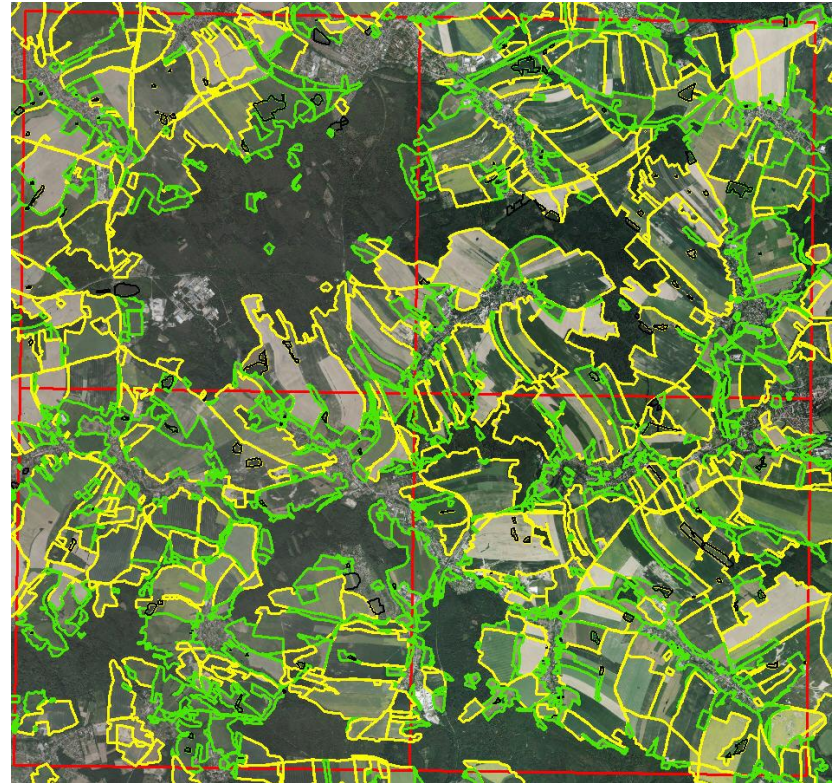
- Automatic change detection
- Comparison between LPIS geometries and new EO data
- Output:
 - LPIS geometry with „change“ attribute
 - Shapefile indicating the changes found (location, size)

Design of a fully automated approach

- Operator input required only for calibration of the algorithm addressing acquisition time and image radiometry
- Object based image analysis
→ Rule-based classification approach
- Modular workflow structure
→ individual composition of the examination scheme



- Method applicable for different reference parcel systems
 - agricultural parcels,
 - physical blocks and
 - cadastral parcels
- Operational in use since 2011



Absolutely necessary

- Reference parcels (vector dataset)
 - EO-data acquired during growing season (e.g. digital orthophotos, RGB)
- monotemporal EO data
- independent of further thematic information, image resolution and plant phenology/acquisition date



Nice to have...

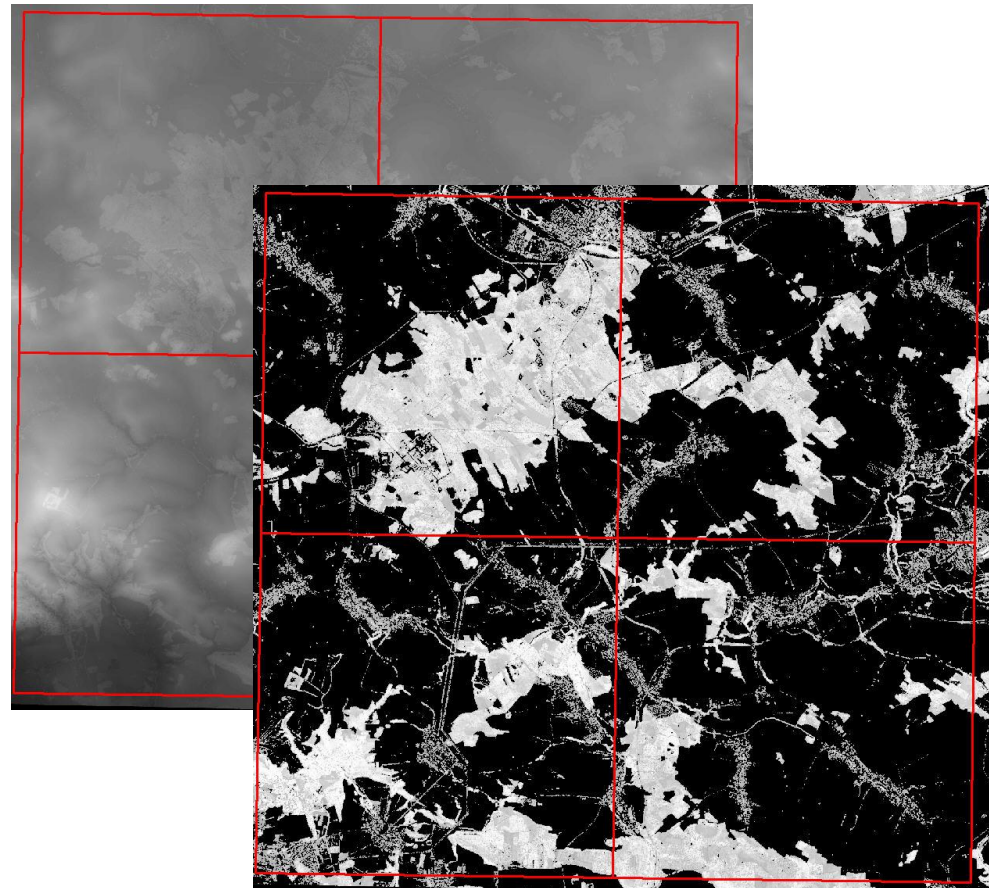
- Any other spatially related information suitable to improve results, e.g.

→ vector layer of landscape elements

→ landuse information like e.g.
farmer's subsidy application

→ thematic landuse and/or
land cover information

→ DSM/DTM



Shapefile (polygon):

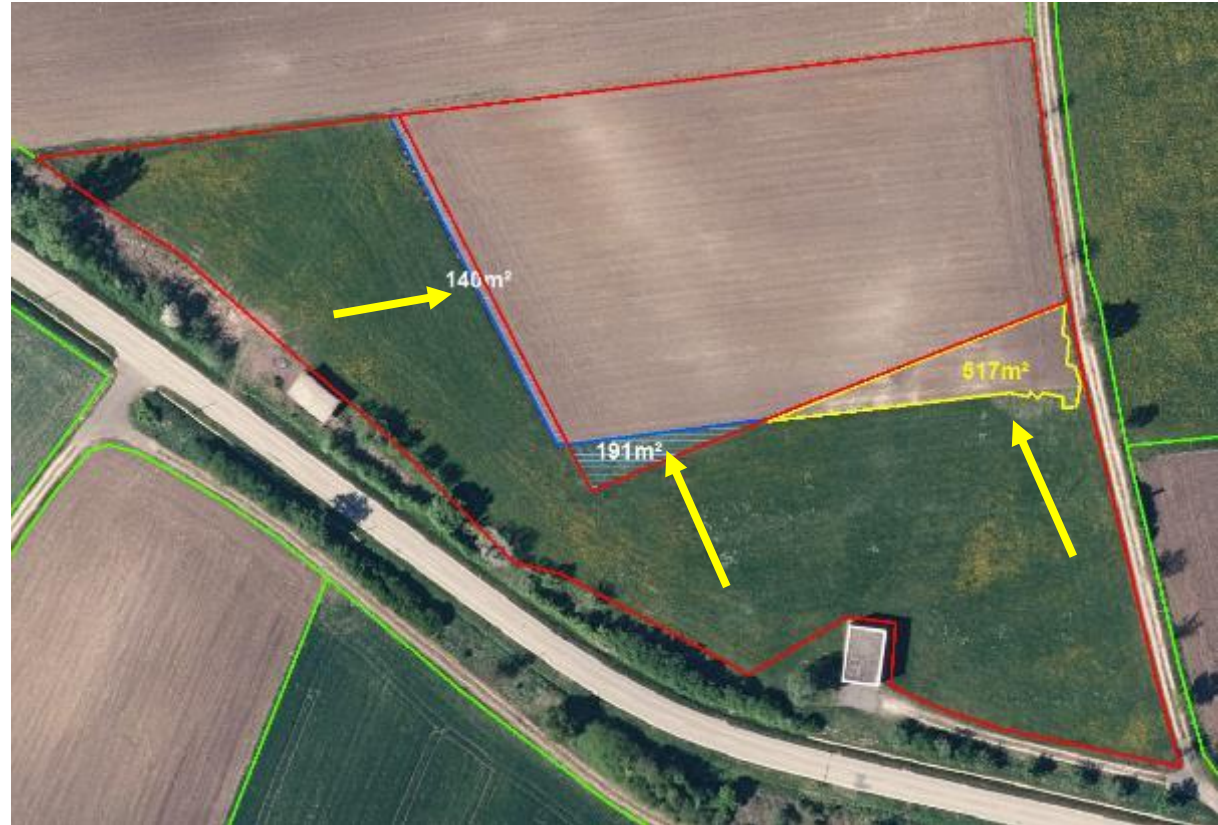
Change indication for reference parcels
(GIS-attribute related to a geometry)

- location and spatial extent of the anomaly
- type of data source used to detect it
- type and size of changes found

The geometries are not suited
to update LPIS polygons



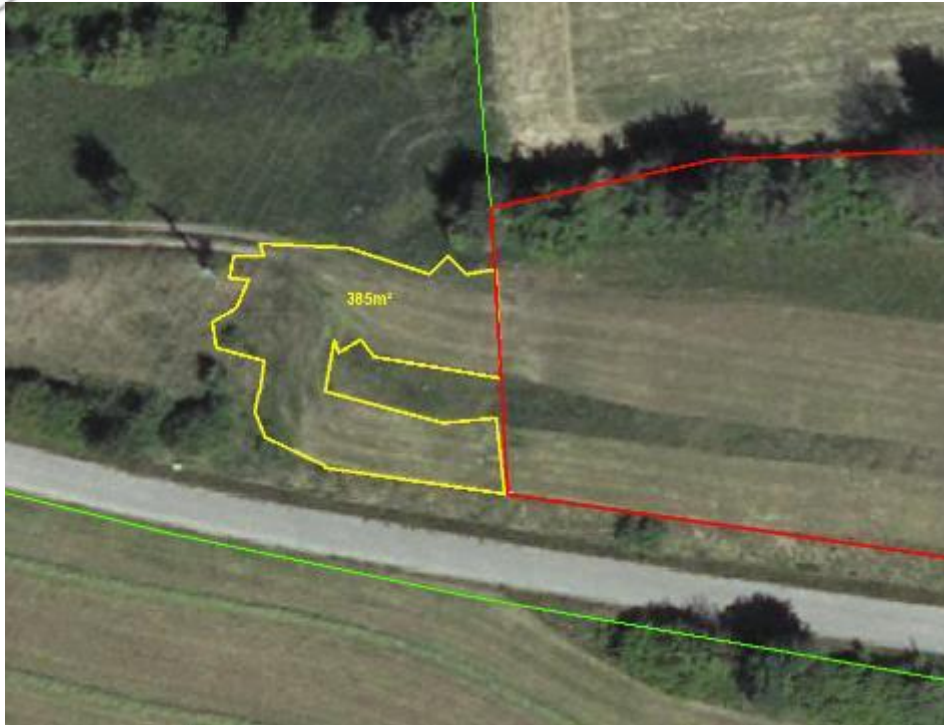
- Area extensions
- Area reductions
- Positional inaccuracy of borders between neighbouring parcels



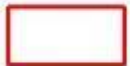
→ The algorithm's sensibility for each type can be regulated independently (minimum width, minimum area)

1. Area Extension/Enlargement

- most frequent type of change
- potentially cultivated area in the immediate vicinity of a reference parcel



Neighbourhood (LPIS)



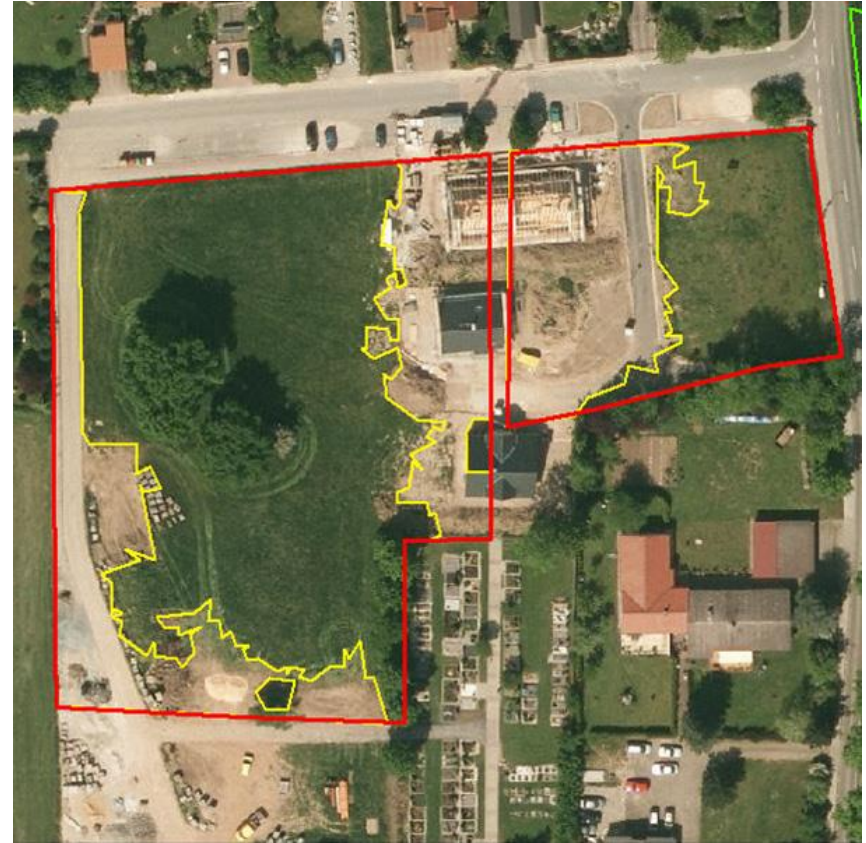
Farmer Block (LPIS)






Automatic Result

2. Area Reduction

- Detection of structural anomalies inside a reference parcel
 - ✓ unvegetated areas
 - ✓ construction sites or man made features with an irregular structure
 - ✓ roads (paved or unpaved)
 - ✓ non-agricultural land use (forest, trees)






-  Farmer Block (LPIS)
-  Automatic Result
-  Manual Delineation

3. Incorrect border between 2 reference parcels

- Combination of area extension and area reduction
- Contextual information is analyzed by the algorithm



-  LPIS Environment
-  Change-Indicated Farmer Blocks
-  Change Area (relevant)

→ bare soil has been identified by the algorithm as agricultural area belonging to the neighbouring parcel



Producer's accuracy:

75-80% of all changes are detected

Unchanged LPIs parcels classified correctly: **~ 90%**

User's Accuracy:

Real changes: **~ 55-58%**

→ **Overestimation** due to temporal changes, shadows and missing contrast in the EO data

Correct classification of unchanged parcels: **> 95%**

→ **~ 5%** of „correct“ parcels show relevant anomalies

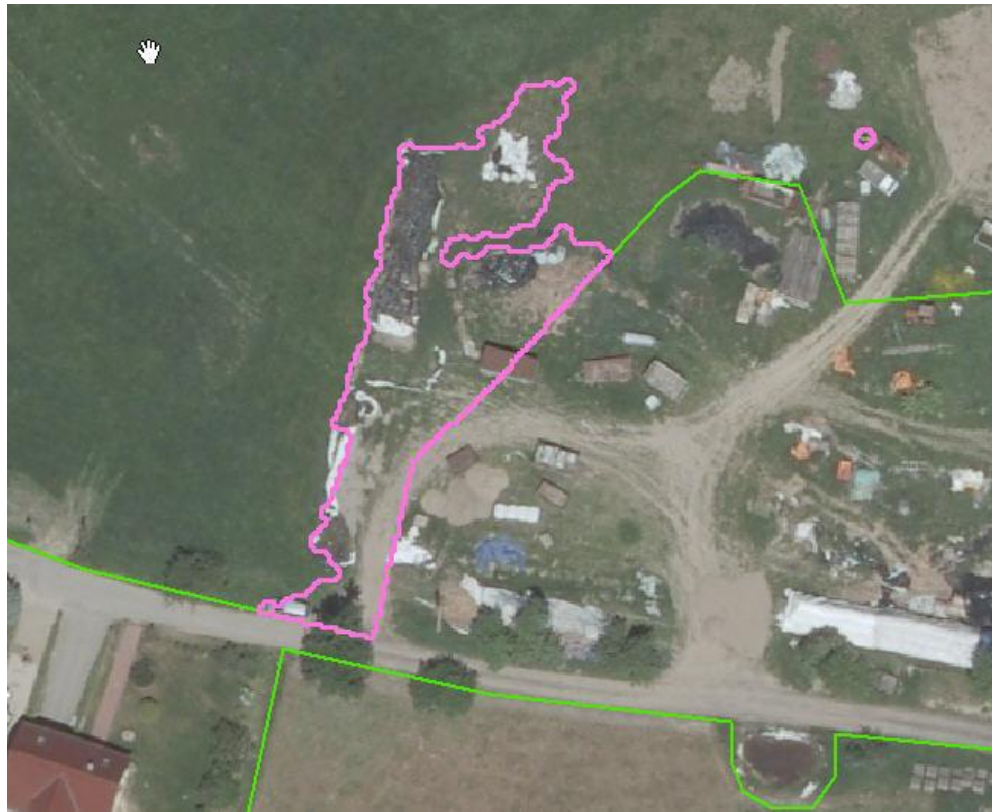
Examples for „overestimation“



Areas covered by trees or tree shadow



Local structure: system detects change
→ water logging, damage caused by wind,
drought or hail, etc.



Temporary changes → system identifies change



Missing contrast → system detects expansion

- ✓ The system supports the work of the agricultural departments in an effective manner

→ **Facilitates work:** Focus on polygons with „change indication“. It is not necessary to check all reference parcels.

Indication where change is located

→ most important for large field blocks

- ✓ There is an overestimation of changes, however,
 - for the operator it is easy to ignore „wrong“ change indications and jump to the next change polygon

- ✓ Automatic and systematic **examination of the complete LPIS** database
- ✓ The system is **cost efficient**: Costs add up to approx. 1/3 of a manual examination.
- ✓ The system is **time-saving**:

Small expenditure of **time** compared to visual pre-check.

→ approx. 3 days for an area extent of 1000km (20 cm DOP)

- ✓ Results are fully **reproducible**

Concerning the methodology:

- ✓ No significant correlation between the quality of the analysis and the acquisition date of the image data
 - ✓ No statistically significant correlation found between the accuracy of the result and predominant landscapes
- Methodology works independent of vegetation state and regional landscape characteristics



Thank you for your attention!

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