

Agricultural parcel detection with Definiens eCognition

Monitoring agriculture is one of the major applications in remote sensing today. In particular, verifying eligibility for area-based subsidies in the EU makes a quick and precise check of farmers' applications necessary. Using very high resolution aerial and satellite imagery, parcels declared in the applications must be recognised by their geometry (size) and land use, whereby confirmation of field size is normally done by an interpreter manually digitizing on the screen. In this case study, Definiens eCognition with its vector handling capabilities was used to detect and classify parcels to analyse whether Definiens eCognition's object oriented approach is suitable for detecting parcels by their geometry and land use.

Test site and image data

For the case study, the subset of a standard colour-infrared aerial image (CIR, figure 1) was used, having a spatial resolution of one meter in the three channels green, red and infrared. The image was acquired by GAF Munich on behalf of BayStMLF on 21st of May 2001 and shows part of the administrative district of Neuburg Schrobenhausen, a region in Bavaria, Germany (the village in the northeastern part of the image is Hasnhofen), a rural landscape in the Danube valley. The test site covers a 2.60 km by 2.68 km area and contains parcels with different types of cereals (winter wheat, oats, winter barley, and others) and other agricultural use (maize for silage, meadow, other grassland, winter rape).

Image segmentation

Before classification, Definiens eCognition performs an automatic segmentation of the imagery into image objects, which are stored in a hierarchical network. The segmentation process is influenced by the parameters, depending on the user's demands upon the object resolution. In this application, a relatively high



Figure 2: extracted image objects

scale parameter was chosen to get the parcels as single objects. Definiens eCognition's segmentation distinguishes between colour and shape - in reference to the CIR image, colour is the decisive parameter - and subdivides the shape criterion into smoothness and compactness. Due to their cultivation most parcels have a very compact form, so compactness is the important parameter here. The results are shown in figure 2.

Cadastral units (figure 3) are the administrative reference for parcel declaration. In general the segmentation matches the shape of the agricultural parcel boundaries satisfactorily, although there are some small differences due to not perfectly smoothed



Figure 1: CIR aerial photograph (2.60 km by 2.68 km)



Figure 3: cadastral units

boundaries (compare figures 2 & 4).

Definiens eCognition allows automatic creation of a vector layer of polygons, which is build up on the previously segmented im-



Figure 4: parcel boundaries manually digitised by photo interpretation



Figure 5: first classification step - masking of parcels



Figure 6: second classification step - in depth land use classification

age objects. This vector layer has a smoothed border, in contrast to the raster object nearer to a parcel geometry, which is commonly rather linear (figure 4).

Land use classification

In addition to standard nearest neighbour classification with samples, Definiens eCognition offers a fuzzy logic based classification which uses spectral, shape, texture and hierarchical features of the image objects simultaneously. Customized features for classification can also be developed, something which was done in this case in order to mask the parcels from non-agricultural parcels in a first classification step (figure 5). The land use within the parcels was classified in a second step (figure 6). In general, classification of the segmented parcels after the primary masking was easy to complete.

Export into an administrative GIS

Finally, the segmented and classified image was exported as a smoothed vector layer into a geographic information system for parcel administration (LaFIS 2.0; figure 7). Without any problems, the object information delivered by Definiens eCognition could be analysed and stored in the system (colour, shape and texture features of the image objects).

Conclusion

Definiens eCognition’s object oriented approach is suitable for detecting agricultural parcels. The quality of the received field geometries by image segmentation is close to the real parcel boundaries, but this is, of course, highly influenced by the quality of the raster data and the acquisition date. The classification results are satisfactory and indicate the high potential of Definiens eCognition in contrast to non-object-oriented classification techniques. The vector export is easy to handle and makes possible compact storage in an administrative GIS. Definiens eCognition is able to support and optimize the process of field parcel declaration

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Data courtesy of the Bayerisches Staatsministerium für Landwirtschaft und Forsten (BayStMLF).

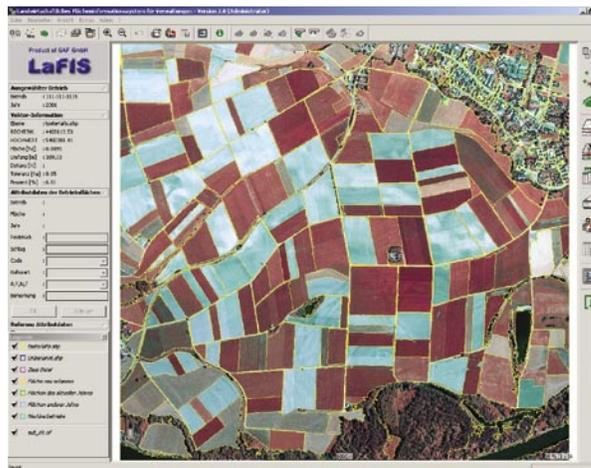


Figure 7: vectorized classification imported into LaFIS 2.0

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