

Detect buildings and roads from Ikonos and DEM data with Definiens eCognition

Using high resolution remote sensing data such as IKONOS data makes it possible in principle to detect man-made features such as buildings and roads. However, due to the high spatial resolution of the IKONOS data, an automatic or semi-automatic detection of such features based only on their spectral entities can be difficult, especially in heterogeneous situations such as dense urban areas. Using a DEM and additional semantic information helps to detect them more adequately. When combining spectral and elevation data, significant elevation information for the objects in question and their spectral properties can be used to outline their shape and to classify them adequately with Definiens eCognition.

In the present project a pan-sharpened IKONOS scene from Tsukuba, Japan, combined with a laser-scanning DEM was used. The pan-sharpening was applied by using a principal components transformation and substituting the first principal component with the IKONOS 1m panchromatic channel. The new combination was then re-transformed into colour space.

To generate meaningful image objects Definiens eCognition's multi-resolution segmentation was applied to the enhanced image data and the DEM.

Therefore, several different segmentation parameters were used. However, large buildings were best outlined by only using the DEM as input data. Roads were extracted using the spectral channels of the enhanced image.

To classify the outlined objects of interest the DEM information could be used beneficially: Larger buildings and houses were detected mainly by their difference in elevation to neighbouring objects. Form features helped to separate roads from other impervious areas by describing their typically elongated shape. Thereby, contextual features helped to describe the objects' semantic relationships to each other, such as, roads do not cross houses' or, riversides border on ditches'.

To summarise, due to Definiens eCognition's advantages compared to pixel based methods the software is best suited to handling complex scenes such as high resolution images from urban areas. Especially its segmentation technique and its object oriented classification approach give new possibilities when facing typical problems in the urban remote sensing domain: shadows can easily be handled by neighbourhood relationships; impervious areas can be better differentiated by their shape, and last but not least houses can easily be identified by their relative height to neighbouring objects.

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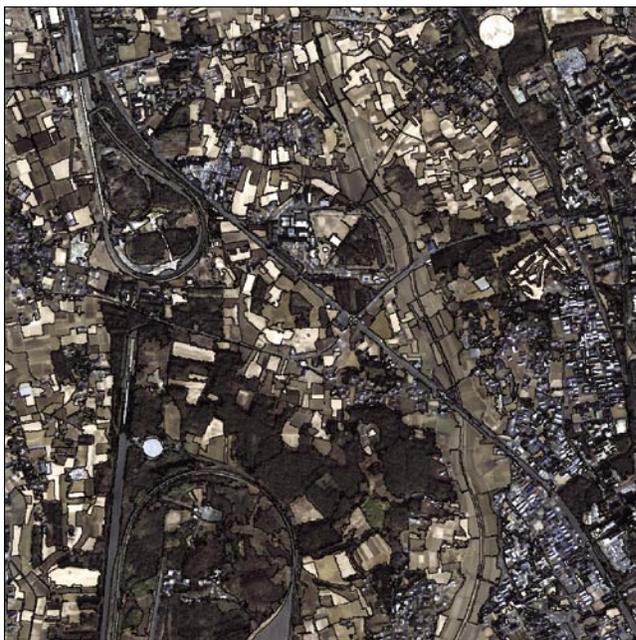


Fig. 1: Segmentation based on the pan-sharpened IKONOS channels only

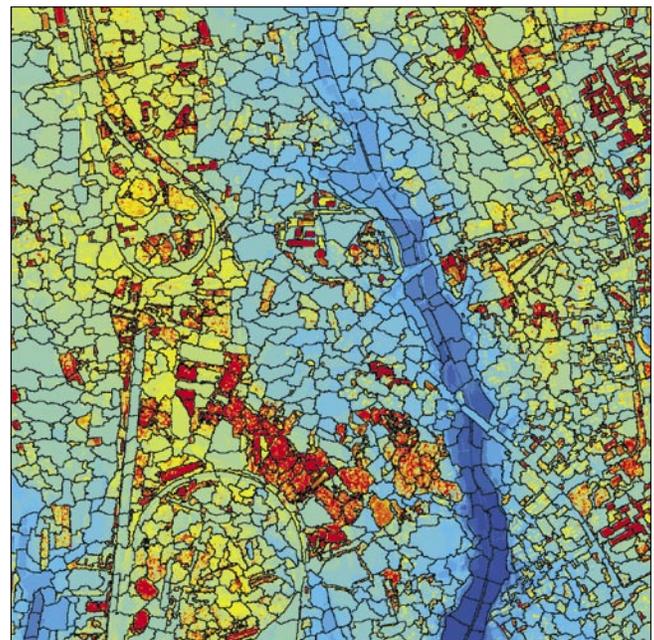


Fig. 2: Segmentation based on the DEM only

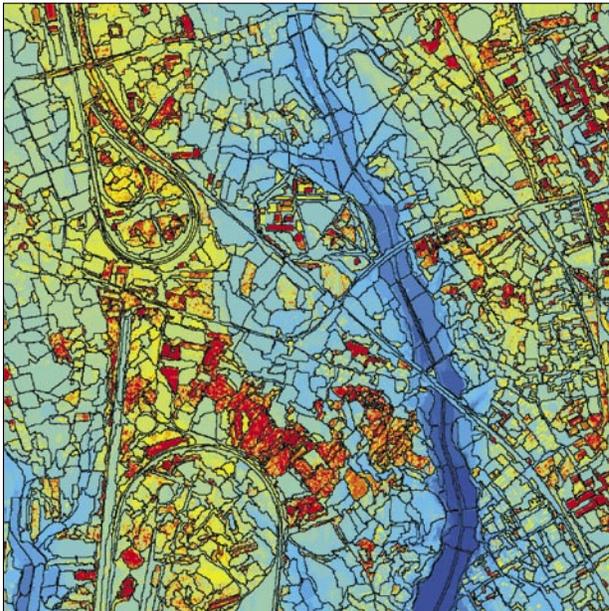


Fig. 3: Combined segmentation based upon spectral and elevation information

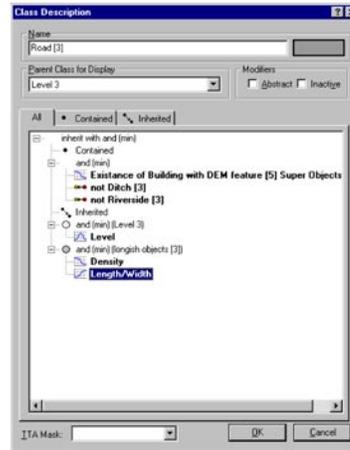


Fig. 4: Class description of roads. Roads must not occur where buildings on a higher level still exist. They inherit the same properties as ditches and river-sides do, but they are not similar.

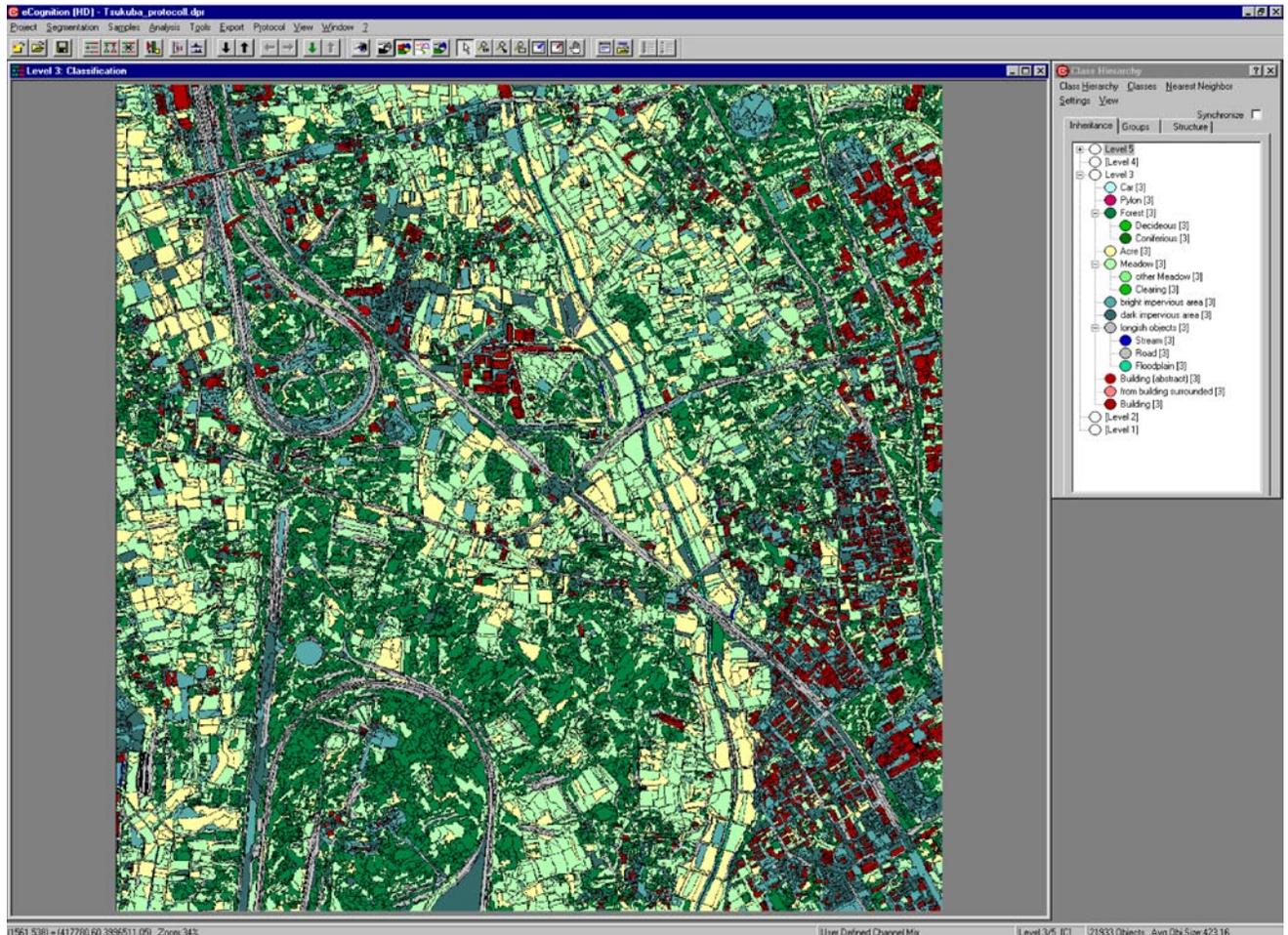


Fig. 5: Classification result

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Definiens' products are built on its platform technology (eCognition) that represents a quantum leap in the realms of digital image analysis. Our products are offered across chosen markets, initially focusing on Earth Observation/Remote Sensing and Life Sciences. Definiens offers advanced and robust image analysis solutions to accelerate the drug discovery, development, and diagnostics processes in life sciences, and perform satellite and aerial image classification more intelligently, more accurately, and more efficiently than traditional methods. Definiens has customers worldwide in the areas of Life Sciences and Earth Observation, including leading companies, academic centers, and government agencies.

Founded in 1994 by Nobel Laureate Prof. Dr. Gerd Binnig, Definiens is a multi-national organization with headquarters in Munich, Germany and offices in the US and UK.



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