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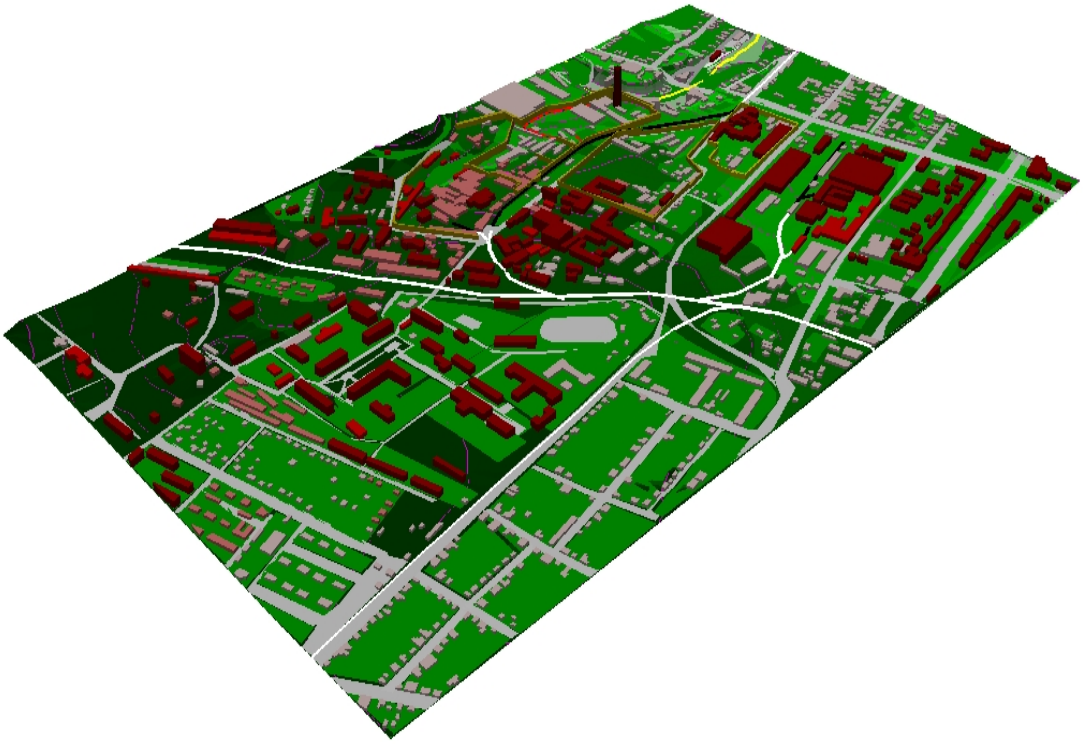

Fig. 3 The fragment of 3D view of Tambov spatial model

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OBJECT BASED IMAGE ANALYSIS FOR URBAN MAPPING AND CITY PLANNING IN BELGIUM

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The 'Object Based Image Analysis' approach (further, OBIA) becomes increasingly popular and is being used for classifying VHR remote sensing images [2]. The use of this innovative approach for urban mapping is highly effective as it

makes possible to include information about features, shapes and other characteristics of urban space and to interpret them for the studies of land cover types.

Fig.1. Study area: eastern part of Brussels

Using very high resolution (VHR) image for mapping enables to identify land cover and land use types within urban environment. Hence, the OBIA approach for processing remote sensing data creates effective tools for urban studies. Furthermore, the application of the priori knowledge is necessary for the case studies where additional knowledge can implement detailed information into the existing databases, e.g. information on land cover and land use types, roads, buildings, vegetation units (parks), etc. Particularly useful becomes a priori knowledge for incomplete or outdated databases (containing e.g. missing areas, or those inside of closed blocks, etc). Additional knowledge about the city structures and urban features should be included while interpreting image. The case study of the current research is focused on the eastern part of Brussels, Belgium (Fig.1). The very high resolution image was processed using eCognition software for detecting typical urban objects (e.g. buildings and houses, trees, roads and streets etc). The methodology is detailed below.

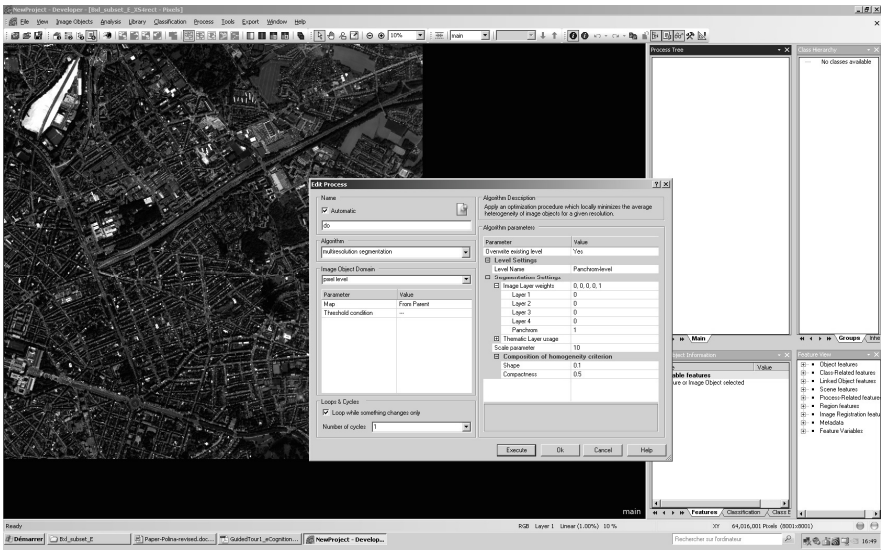

Fig.2. Processing multiresolution segmentation of the panchromatic image in eCognition software

Almost all automation methods of urban mapping require pre- and post-processing, as well as correction of the misclassified elements. Therefore, the use of the existing knowledge and cues about the objects (their location, shape, structure, quantity and quality) enabled to increase the effectiveness and the precision of the classification and automation of the procedures as well. Knowledge about the structure, form and shape of the objects can be applied for image analysis [1].

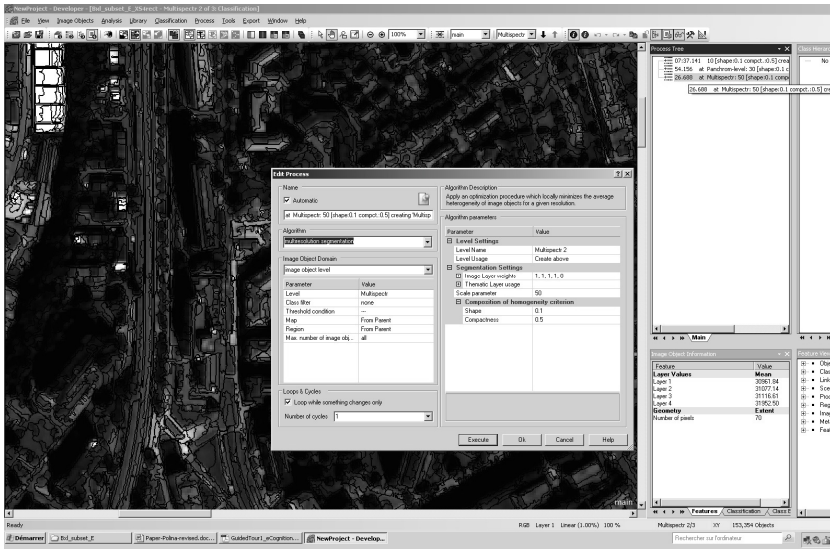

Fig.3. Setup of parameters in eCognition for image processing

These include geometric description and additional attributes (e.g. radiometric, spectral, etc.), semantic or functional properties, as well as topologic information. In this way, the knowledge os GIS user can be transferred to and used by the machine during the interpretation process [3].

The changes in the study area were visualized using available vector layers in ArcGIS where recently constructed buildings are highlighted in red so that it was possible to visually assess the ongoing process of the city reconstruction.

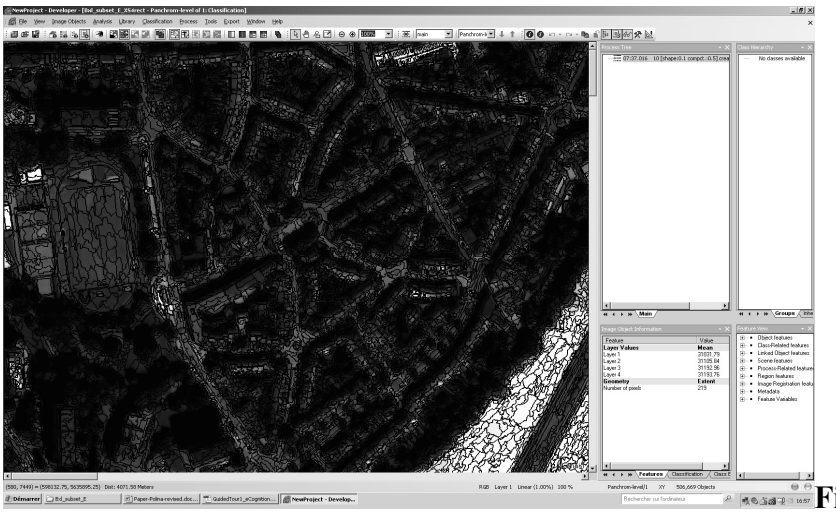

Fig.4. Multiresolution segmentation: urban space is divided into several clusters. Selected objects are recognized

The area occupied by buildings has various usage roles in the urban environment as key element of urban sprawl detecting its growth. In general, it consists of industrial areas, roads, and residential territories (Fig.2). Technically, the image was processed using multiresolution segmentation and thematic classification of the created objects (Fig.3). The semi-automated method included user guidance and supervision as pre- and post-processing of the classification. Important methodological part of the knowledge based approach included semi-automation proof of the classification.

Next research step included applying multiresolution segmentation function of eCognition software to the panchromatic image (Fig.4). According to the algorithm embedded into the multiresolution segmentation, the areas of similar pixel values are grouped into objects. Therefore, the homogeneous areas are recognized as large objects, while heterogeneous areas as smaller ones, respectively. The homogeneity of the objects is defined by the ‘scale parameter’ (10, 30 and 50). which is important factor for the multiresolution segmentation procedure. The results include

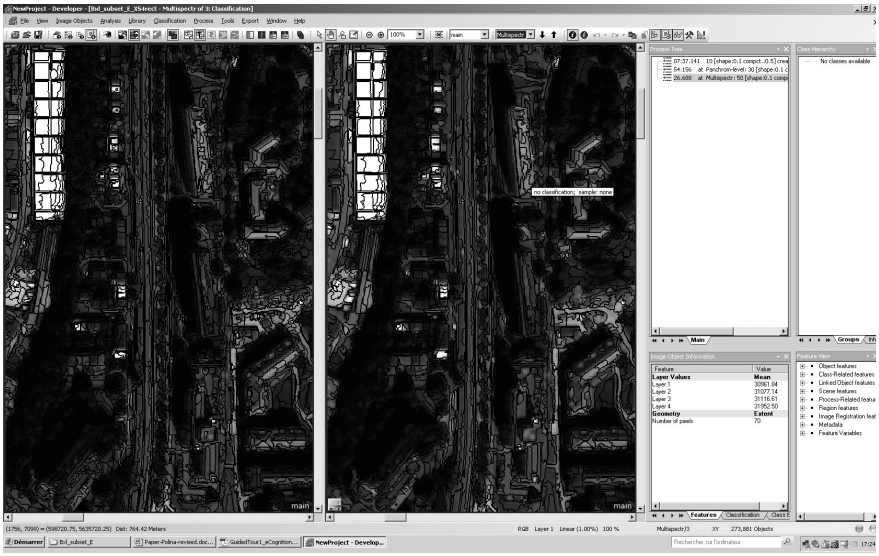

Fig.6. Results of multispectral image processing, fragment

processed and classified image (Fig.5). The detected objects include buildings, roads and other topographic elements of the urban environment, such as vegetation areas, channels, street pavements, gardens, etc (Fig.6).

Some limitations of the OBIA approach are caused by not sufficient and not perfect parameters for the object classification. Thus, the brightness of the objects may vary depending on the location of this object (e.g. shadow and bright parts of the roofs). Another limitation for object detection arise, because of the human based errors: misclassified pixels. However, in general, the OBIA approach provides much more efficient results for the image classification, comparing to the traditional pixel based classification in usual GIS software. As eCognition is specifically focused on raster image processing and adjusted at raster recognition, it maybe successfully applied for the development of geospatial methodology which is demonstrated in the presented research.

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