PHOTOGRAMMETRIC NEWS: Doctoral Dissertation

Ms. Leena Matikainen made her doctoral dissertation on the 28th of September 2012 at the Aalto University School of Engineering, Finland. Professor, PhD **Timo Tokola**, University of Eastern Finland, appeared as opponent. The title of the thesis was "Object-based interpretation methods for mapping built-up areas". (Photo: Matti Kurkela)

Abstract of the thesis

There is a growing demand for high-quality spatial data and for efficient methods of updating spatial databases. In the present study, automated object-based interpretation methods were developed and tested for coarse land use mapping, detailed land cover and building mapping, and change detection of buildings. Various modern remotely sensed datasets were used in the study. An automatic classification tree method was applied to building detection and land cover classification to automate the development of classification rules. A combination of a permanent land cover classification test field and the classification tree method was suggested and tested to allow rapid analysis and comparison of new datasets.

The classification and change detection results were compared with up-to-date map data or reference points to evaluate their quality. The combined use of airborne laser scanner data and digital aerial imagery gave promising results considering topographic mapping. In automated building detection using laser scanner and aerial image data, 96% of all buildings larger than 60 m^2 were correctly detected. This accuracy level (96%) is compatible with operational quality requirements. The overall accuracy of a land cover classification into *buildings*, *trees*, *vegetated ground* and *non-vegetated ground* using laser scanner and aerial image data was 97% compared with reference points. A comparison between first pulse and last pulse laser scanner data in building detection was also carried out. The comparison showed that the use of last pulse data instead of first pulse data can improve the building detection results. The results yielded by automated interpretation methods could be used as aids in the manual updating process of a topographic database or as the basis for further automated processing steps.

The synthetic aperture radar (SAR) and optical satellite image data used in the study have their main potential in land cover monitoring applications. The coarse land use classification of a multitemporal interferometric SAR dataset into *built-up areas*, *forests* and *open areas* lead to an overall accuracy of 97% when compared with reference points. This dataset also appeared to be promising for classifying built-up areas into subclasses according to building density.

Important topics for further research include more advanced interpretation methods, new and multitemporal datasets, optimal combinations of the datasets, and wider sets of objects and classes. From the practical point of view, work is needed in fitting automated interpretation methods in operational mapping processes and in further testing of the methods.

Keywords: Mapping, updating, change detection, automation, segmentation, classification, object-based, classification tree, building, land cover, land use, urban, topographic database, laser scanning, aerial image, satellite image, SAR