



Semi-automated extraction of landslides in Taiwan based on SPOT imagery and DEMs

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The vast availability and improved quality of optical satellite data and digital elevation models (DEMs), as well as the need for complete and up-to-date landslide inventories at various spatial scales have fostered the development of semi-automated landslide recognition systems. Among the tested approaches for designing such systems, object-based image analysis (OBIA) stepped out to be a highly promising methodology. OBIA offers a flexible, spatially enabled framework for effective landslide mapping.

Most object-based landslide mapping systems, however, have been tailored to specific, mainly small-scale study areas or even to single landslides only. Even though reported mapping accuracies tend to be higher than for pixel-based approaches, accuracy values are still relatively low and depend on the particular study. There is still room to improve the applicability and objectivity of object-based landslide mapping systems.

The presented study aims at developing a knowledge-based landslide mapping system implemented in an OBIA environment, i.e. Trimble eCognition. In comparison to previous knowledge-based approaches, the classification of segmentation-derived multi-scale image objects relies on digital landslide signatures. These signatures hold the common operational knowledge on digital landslide mapping, as reported by 25 Taiwanese landslide experts during personal semi-structured interviews. Specifically, the signatures include information on commonly used data layers, spectral and spatial features, and feature thresholds. The signatures guide the selection and implementation of mapping rules that were finally encoded in Cognition Network Language (CNL). Multi-scale image segmentation is optimized by using the improved Estimation of Scale Parameter (ESP) tool.

The approach described above is developed and tested for mapping landslides in a sub-region of the Baichi catchment in Northern Taiwan based on SPOT imagery and a high-resolution DEM. An object-based accuracy assessment is conducted by quantitatively comparing extracted landslide objects with landslide polygons that were visually interpreted by local experts. The applicability and transferability of the mapping system are evaluated by comparing initial accuracies with those achieved for the following two tests: first, usage of a SPOT image from the same year, but for a different area within the Baichi catchment; second, usage of SPOT images from multiple years for the same region.

The integration of the common knowledge via digital landslide signatures is new in object-based landslide studies. In combination with strategies to optimize image segmentation this may lead to a more objective, transferable and stable knowledge-based system for the mapping of landslides from optical satellite data and DEMs.