Template matching to support earth observation based refugee camp analysis in OBIA workflows

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Accurate and reliable information about the situation in refugee or internally displaced person camps is very important for planning any kind of help like health care, infrastructure or vaccination campaigns. The number and spatial distribution of single dwellings is a very important piece of information to manage the coordination and growth of camps. This information can be extracted from very high resolution satellite imagery.
Currently, semi-automated dwelling extraction algorithms for refugee camp monitoring, using a set of OBIA methods, are state of the art. The accuracy of the extracted dwellings can vary quite a lot depending on various factors such as the contrast of dwellings to surrounding areas, the weather situation (e.g. dusty conditions) but also the dwelling density/complexity of the camps. To enhance single object detection in such difficult situations, in this research the integration of stratified template matching methods in object-based workflows are tested. Although template-matching methods are not new, there is still little research on combining them with OBIA methods in one workflow. Typical problems of template matching approaches, like e.g. a high number of false positives in complex images can be tackled by a stratified usage in OBIA workflows. An important factor, which was assumed to address, is the shadow effect of dwellings, which, especially for a human interpreter, helps to distinguish them from other similar spectral and spatial features like e.g. surrounding bare soil in dusty conditions. A template library for various dwelling types (template samples are taken from ten different sites in eastern Africa using 16 different satellite images), incorporating the shadow effect of dwellings, was established. The template library aims to be generally applicable in similar conditions and can be integrated in already existing workflows for object-based dwelling extraction.
In order to check the accuracy of the templates, the template library was tested on three test sites of different complexity levels for dwelling extraction and results were compared to a visual image interpretation. As assumed, applying the template matching approach only, results showing many false positive alarms the producer's and user's accuracy across the test sites are 72.0% and 72.4% respectively. The combined approach, stratifying the template matching approach within an initial object-based analysis, revealed 81.7% producer's and 90.3% user's accuracy.
Compared to pre-existing OBIA classifications, this approach could increase producer's accuracy by 11.7% and slightly increase the user's accuracy. These results of this master thesis show that the integration of template matching in operational OBIA workflows is a possibility to further improve results of semi-automated dwelling extraction, especially in complex camp situations.