OBJECT-ORIENTED APPROACH AND TEXTURE ANALYSIS FOR CHANGE DETECTION IN VERY HIGH RESOLUTION IMAGES

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ABSTRACT

Change detection of landscape features is an important stake to understand relationships between human and natural phenomena.

In the remote sensing community, most of change detection methods have been developed to detect abrupt changes from low or medium resolution imagery [1;2]. Such techniques, based on a pixel approach, are not well adapted to Very High Resolution (VHR) images. Due to the huge amount of data and to the spatial relationship of the pixels inside such images, a simple pixel approach is indeed limited since it does not exploit any spatial information.

In the last five years, some object-oriented approaches have successfully been applied to VHR images [3;4]. These techniques allow to identify landscape features and to extract some information about shape, contents and context from a single image [5]. Unfortunately, the problem of change detection based on such objects approaches has rarely been studied at the moment. Most of available approaches rely only on pixel intensities but are not focused on additional dimensions such as texture or shape.

The objective of this paper is to develop an object-based change detection method able to qualify the nature of changes, in terms of geometry and content. The originality of the approach consists in jointly dealing with the shape and texture of objects. The geometric change detection is based on the analysis of the object contours. It detects changes such as existence or non-existence, size and shape, and location that may occur. The content change is based on the analysis of texture evolution. To that end, a wavelet transform is used and the analysis of the coefficients in different bands enables to detect abrupt and subtle content changes.

The method is validated on grassy strips. These latter are landscape buffers between cultures and surface water (rivers, ditches…) and are imposed by the European Union's Common Agricultural Policy. Their aim is to maintain biodiversity and limit water pollution and soil erosion. The monitoring of changes concerning such landscape features is very important since they can affect or cancel their fundamental environmental properties. From an image point of view, these units are visible on color aerial photographs. In our application, airborne images have been acquired during three successive years (2005, 2006, 2007). In practice, their quality is rather poor due to several artifacts (pitch and roll, different weather conditions for instance) and this yields the problem of change detection and analysis quite difficult.

The experimental results bring the efficiency of our approach. Indeed, the geometric changes, most of abrupt content changes and some of subtle change, have been accurately detected. A geometric change index that quantify the intensity of change (date to date) and that qualify it according to its properties (such as the length and width) is proposed. We also present a content change index that distinguishes a local occurrence (like a tree or drain pipe apparition) and a global change affecting the whole land cover. Lastly, our approach reveals its worth on VHR data and will be applied to spaceborne images such as Quickbird.
REFERENCES


