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CEST ANALYSIS: AUTOMATED CHANGE DETECTION FROM VERY-HIGH-RESOLUTION REMOTE SENSING IMAGES

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Abstract. A fast detection, visualization and assessment of change in areas of crisis or catastrophes are important requirements for coordination and planning of help. Through the availability of new satellites and/or airborne sensors with very high spatial resolutions (e.g., WorldView, GeoEye) new remote sensing data are available for a better detection, delineation and visualization of change. For automated change detection, a large number of algorithms has been proposed and developed. From previous studies, however, it is evident that to-date no single algorithm has the potential for being a reliable change detector for all possible scenarios. This paper introduces the Combined Edge Segment Texture (CEST) analysis, a decision-tree based cooperative suite of algorithms for automated change detection that is especially designed for the generation of new satellites with very high spatial resolution. The method incorporates frequency based filtering, texture analysis, and image segmentation techniques. For the frequency analysis, different band pass filters can be applied to identify the relevant frequency information for change detection. After transforming the multitemporal images via a fast Fourier transform (FFT) and applying the most suitable band pass filter, different methods are available to extract changed structures: differencing and correlation in the frequency domain and correlation and edge detection in the spatial domain. Best results are obtained using edge extraction. For the texture analysis, different 'Haralick' parameters can be calculated (e.g., energy, correlation, contrast, inverse distance moment) with 'energy' so far providing the most accurate results. These algorithms are combined with a prior segmentation of the image data as well as with morphological operations for a final binary change result. A rule-based combination (CEST) of the change algorithms is applied to calculate the probability of change for a particular location. CEST was tested with high-resolution satellite images of the crisis areas of Darfur (Sudan). CEST results are compared with a number of standard algorithms for automated change detection such as image difference, image ratioe, principal component analysis, delta cue technique and post classification change detection. The new combined method shows superior results averaging between 45% and 15% improvement in accuracy.

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