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A NOVEL SPATIO-TEMPORAL CHANGE DETECTION APPROACH USING HYPER-TEMPORAL SATELLITE DATA

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Abstract

The use of hyper-temporal MODIS time-series data for the detection of land cover change in South Africa has been an active research area the last few year. This paper expands on previous studies that show that this type of data can be effectively used in the detection of new informal settlements in South Africa. In this paper, the feasibility of using the temporal evolution of the distribution of MODIS reflectance values within a pixel neighborhood to detect land cover change is evaluated. More specifically, the covariance at each time point is evaluated for a specific pixel neighborhood and MODIS band combination and the temporal evolution of the Mahalanobis distance (between each pixel's reflectance value and the reflection distribution of the neighborhood) is calculated. The feasibility of using this derived time-series to detect land cover change was evaluated. Preliminary results indicate that using this derived time-series as opposed to the raw reflection time-series to do land cover change detection reduces false alarms in the order of 7% while maintaining above 90% accuracy value relative to the reflectance values of its spatial neighbourhood. The reason for using this approach is that groups of pixels are often affected by changes due to, for example, drought and agricultural activities which is not related to the change relevant to this study. Areas affected by new settlement developments usually does not affect more than a few contiguous MODIS pixels and as such the behavior of these pixels relative to a neighborhood of pixels is expected to be substantially different. The method is applied to all pixels in the scene (i.e a sliding window approach is used) and the Mahalanobis distance between the center pixel and the distribution is then calculated for each time-point which results in a new time-series of Mahalanobis distances. It was found that the separability of change and no-change pixels was increased using the derived Mahalanobis distance time-series as opposed to using raw reflection time-series data.