THE SYNTHETIC IMAGE TESTING FRAMEWORK (SITEF) FOR THE EVALUATION OF MULTI-SPECTRAL IMAGE SEGMENTATION ALGORITHMS

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1. ABSTRACT

One of the most challenging tasks in Remote Sensing at present is how to handle the huge amounts of image data acquired every day by the existing Earth Observation Satellites (EOS). An alternative approach to the standard per-pixel analysis of multi-spectral EOS images has evolved over the last decade. Instead of focusing on individual image pixels, the object-based image analysis approach consists of partitioning an image into meaningful image-objects. One of the reasons for the development of object-based methods has been the dramatic increase in commercially available high resolution digital remote sensing imagery, with spatial resolutions of 5.0 m and finer [1]. Also it has been recognised that the image pixel is not a "natural" element of an image scene.

A common element of all object-based image analysis systems is the segmentation stage, where the image is partitioned in a number of objects (or segments), which is clearly a critical stage of the whole process. If the segmentation fails to identify as an object a given element present in the image, the subsequent stages will generally be unable to recognise or to classify this element. An evaluation of the abilities and limitations of the segmentation algorithms used is therefore an important aspect of any object based image analysis system. However, there is no established standard procedure for the evaluation of the segmentation results produced for EOS images [2]. The most common approaches are based on discrepancy measures between the segmentation result and a reference [3], but it is usually difficult to have abundant reference segmentation data.

The purpose of this work is to present the Synthetic Image TEsting Framework (SITEF), a tool to evaluate the performance of segmentation algorithms on multi-spectral images. The method is based on the production of synthetic images with the spectral characteristics of the image pixels extracted from a signature multi-spectral image [4]. The knowledge of the exact location of objects in the synthetic image provides a reference segmentation, which allows for a quantitative evaluation of a segmentation algorithm applied to the image. The Hammoude metric and the external similarity indices Rand, Corrected Rand and Jaccard are used [4]. The evaluation of the segmentation results is done with three perspectives: (1) for the various parameter settings used in the segmentation algorithm, (2) for the different parcel sizes and shapes, (3) for the different land cover types (or spectral signatures) and sets of land cover types.

The methodology used here is an evolution of the method described in [4], by considering adjacency effects between neighbouring parcels. A SPOT HRG image from a rural area in Portugal was used as signature image. Based on the signature from the satellite image, 6 synthetic images were produced, each with a different sub-sets of 5 (out of 6) land cover classes. These images were used to evaluate the segmentation algorithms available in the Definiens 7 software as well as the importance of parcel size and land cover type on the quality of the final segmentation result.

2. REFERENCES

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