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Applications of GEOBIA (Geographic Object-Based Image Analysis) algorithms on medium and very high resolution satellite images

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INTRODUCTION

In the last decades, with the advent of high resolution satellite imagery, remote sensing moved from pixel-spectra based model to a dynamic multiscale object-based contextual model that attempts to emulate the way humans interpret images (Hay and Castilla, 2008). This typology of approach establishes a new methodology to classify the satellite images named GEOBIA (Geographic Object-Based Image Analysis) (Blaschke, 2009; Blaschke et al., 2014; Estoque et al., 2015). Obviously, it derives from the term OBIA (Object-Based Image Analysis) but this acceptation may be too broad because it is used in many different disciplines such as Biomedical Imaging, Astronomy, Microscopy, Computer Vision and others.

According with Hay and Castilla (2008), it can be considered as a sub-discipline of GIScience devoted to partitioning remote sensing imagery into meaningful image-objects, and assessing their characteristics through spatial, spectral and temporal scale; at its most fundamental level, it requires image segmentation, attribution, classification and the ability to query and link individual objects in space and time.

Blaschke and Strobl (2001) claim a different handling of entities between pixel and object units, introducing the concepts of neighbourhood, distance and location, since using the pixel as the basic scale of analysis may have certain drawbacks. Aplin and Smith (2011) declare that object-based approaches, which operate at the scale of real-world objects rather than pixels, offer a means to analyse Earth observation data in a realistic context and integrate associated ancillary information to support real-world applications.

GEOBIA represents a critical bridge between raster domain of remote sensing data and the vector domain of GIS (Geographic Information Systems). Aryal (2013) remarks the urgent need of research in testing the robustness of extracted objects and making a recommendation to measure it.

This thesis is aimed to investigate methodological aspects concerning the application of GEOBIA to Medium and Very High Resolution satellite images.

Particularly two fundamental purposes are considered: coastline automatic extraction and horticultural crops identification.

About the first aspect, two indices are used on WorldView-2 satellite images to perform the segmentation for coastline extraction: Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI). To enhance geometric resolution of the results pan-sharpening is applied so to obtain maps with the same pixel dimensions of the panchromatic data (Maglione et al., 2014). Image segmentation is carried out using and comparing both free and open source software (QGIS) as well as commercial software (eCognition).

About the second aspect, object-based image analysis and a decision tree classifier (DT) are applied to a set consisting of eight Landsat 8 OLI images and a single WorldView-2 satellite image. In this approach, basic spectral information, textural features and several vegetation indices (VIs) derived from Landsat 8 and WorldView-2 multi-temporal satellite data are computed on previously segmented image objects in order to identify four of the most popular autumn crops cultivated under greenhouse in Almería, Spain (Aguilar et al., 2015).

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