INTERACTIVE OBJECT SEGMENTATION IN HIGH RESOLUTION SATELLITE IMAGES

J. Osman, J. Inglada

CNES
DCT/SI/AP
18, Av. E. Belin,
31401 Toulouse Cedex 9, France

E. Christophe

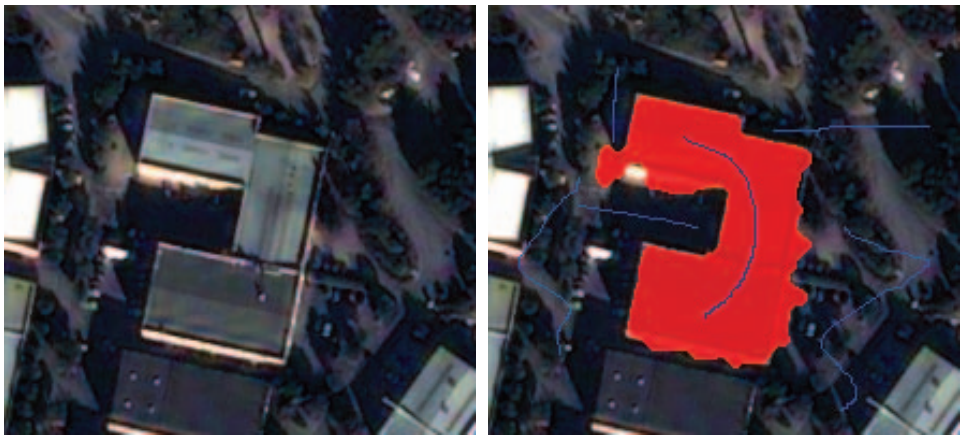
CRISP
Block SOC-1, Level 2,
Lower Kent Ridge Road
Singapore 119260

1. INTRODUCTION

High resolution remote sensing image segmentation is a great challenge in terms of potential applications, but also because of the difficulty of the task. Indeed, metric and sub-metric resolution images allow to access landscape features which are difficult to extract and understand in a fully automatic way.

On the other hand, visual image analysis is time consuming and tedious (therefore error prone). In this work we present a simple, yet powerful approach for interactive image segmentation. This approach tries to combine the best of the automatic image processing together with the ability of a human operator to choose the objects of interest for a given application. It is inspired from approaches proposed in natural image processing as for instance in [1].

In terms of domain of application, the main constraint imposed to our system is that it should perform well for different kinds of objects (no object specificities in the algorithm). Also, since the approach has to be interactive, the processing time has to be very short: less than a few seconds.



(a) Input image (b) Segmentation result

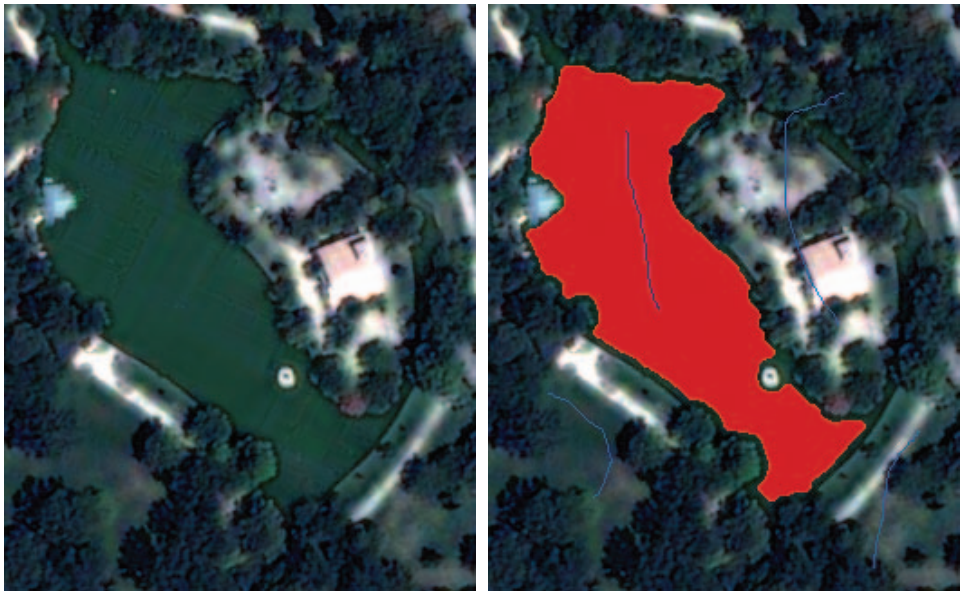
Fig. 1. Building segmentation.

2. ALGORITHM DESCRIPTION

The algorithm considers as input a classical 4-band (blue, green, red and near-infrared) optical high resolution image as the ones delivered by Ikonos, Quickbird and the future Pleiades systems. These images are usually pan-sharpened, but this is not a real requirement for the algorithm.

On the input image, the user is invited to select some samples inside the object of interest and some additional samples on its neighborhood. From these 2 sets of samples, a binary mask is produced in order to represent the selected object. The processing is decomposed into the following steps:

1. feature computation: NDVI, water index, spectral angle with respect to the training samples;
2. unsupervised clustering of the spectral angles extracted from the input samples in order to have a fixed length feature vector;
3. SVM learning using the 2 (inside and outside) training sets;
4. generation of an image of distance to the separating surface: this image gives, for each pixel, the likelihood of belonging to the object of interest;
5. rough detection of shadows to help the next step;
6. region growing segmentation of the likelihood image: the inside samples given by the user are used as seeds for the region growing which uses an Otsu thresholding [2]; shadows are used to stop the growing if they are not selected as an object of interest.



(a) Input image (b) Segmentation result

Fig. 2. Lake segmentation.

Figures 1 and 2 show the results obtained on 2 different images, one presenting a building with an heterogeneous surface and the other one showing a lake surrounded by vegetation areas of similar radiometries. The blue lines correspond to the user input samples. One can see the good performances of the algorithm.

This algorithm is available in OTB [3], `http://www.orfeo-toolbox.org`, as atomic functionality, but also as a stand-alone application with a graphical user interface allowing for simple man-machine interaction.

The full paper will assess the performances of the proposed algorithm when applied to different kinds of objects and with different operating conditions.

3. REFERENCES

[1] G. Friedland, K. Jantz, and R. Rojas, "SIOX: Simple Interactive Object Extraction in Still Images," *Proceedings of the IEEE Symposium on Multimedia (ISM2005)*, pp. 253–259, 2005.

[2] N. Otsu, "An automatic threshold selection method based on discriminant and least squares criteria," *IECE Trans*, vol. 63, pp. 349–356, 1988.

[3] "The ORFEO toolbox software guide," http://www.orfeo-toolbox.org, 2008.