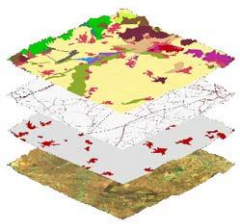

Object Based Image Analysis (OBIA)

Study case 2

BUILDING EXTRACTION USING LiDAR DATA AND ORTHOIMAGES

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GENERAL OBJECTIVE

Building identification (extraction) using LiDAR data and orthophotographs

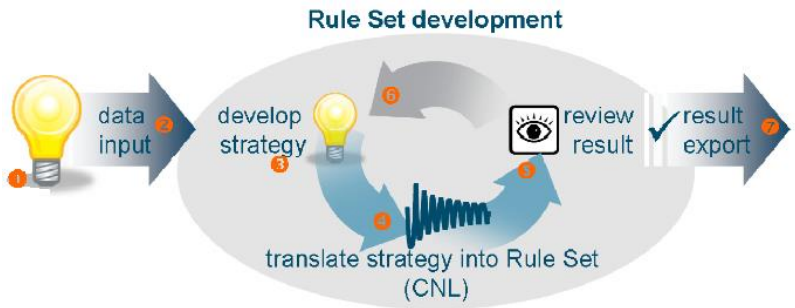
OBIA OBJECTIVES

1. Data fusion: work with LiDAR data (altimetry and intensity) and spectral data
2. Segmentation (comparisons)
3. Classification using thresholds
4. Context relations
5. Refine the classification using spectral characteristics
6. Refine the classification using object properties

DATA

IMAGE	CHARACTERISTICS
orto_2_2_2009_15cm _8bits. tiff	RGB orthophotography, 8 bits. RGB. Spatial resolution: 15 cm.
mdt_2_2_2009.xyz	Digital Terrain Model derived from LiDAR data. Spatial resolution: 1 m x 1 m.
mds_2_2_2009.xyz	Digital Surface Model derived from LiDAR data. Spatial resolution: 1 m x 1 m.
mdo_2_2_2009.xyz	Digital Object Model derived from LiDAR data. Sp. res.: 1 m x 1 m. (MDS-MDT)
int_2_2_2009.tiff	LiDAR intensity. Spatial resolution: 1 m x 1 m.

STUDY CASE



1. Understand the general idea of the analysis
2. Choose the data
3. Develop a strategy
4. Translate the strategy into a rule set
5. Review the results
6. (Refine the strategy and rules)
7. Export the results

GENERAL IDEA

... ... we should think about what general and consistent characteristics are contained in:

- The data
- The object shape
- If there are any context-based characteristics

DEVELOP A STRATEGY

Explore the available data/information.

Segmentation.

Height based classification (MDO).

Export the statistics and the vector file.

Segmentation? (Type?)

Classification: Type? Algorithm (parameters)?

Validation (quality assessment): confusion matrix, stability

TRANSLATE THE STRATEGY INTO A RULE SET

1. Import the data

Create a new project (*buildings.dpr)*.

To work with the raw LiDAR data, they have to be in LAS files. If they are already processed and available as *.xyz file, it is necessary to convert them to raster.

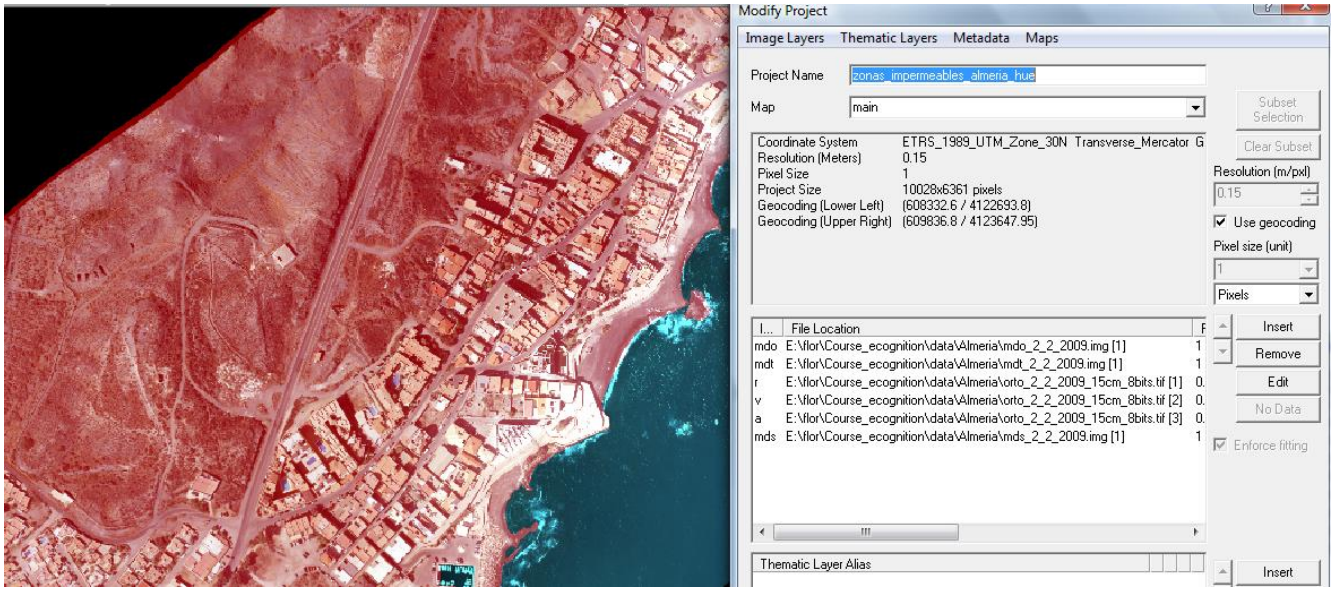
- Suggestion: use ArcGIS, modify the file *schema.ini* so the data can be loaded as points and converted to raster (*.img).

Load the image and the LiDAR data (raster). Check their characteristics.

Assign Aliases to automate the processes: B1= RED, B2= GREEN, B3= BLUE, mdt, mdo, mds, int.

Change the visualization settings.

Visualize the available information.



2. Data exploration.

- Visualize the MDT, MDS, MDO, Intensity and orthoimage.

Buildings have a certain height (MDO as differentiating information)

Trees have also a certain height, but their spectral characteristics are typical for vegetation.

Which other differential characteristics can you extract from the information?

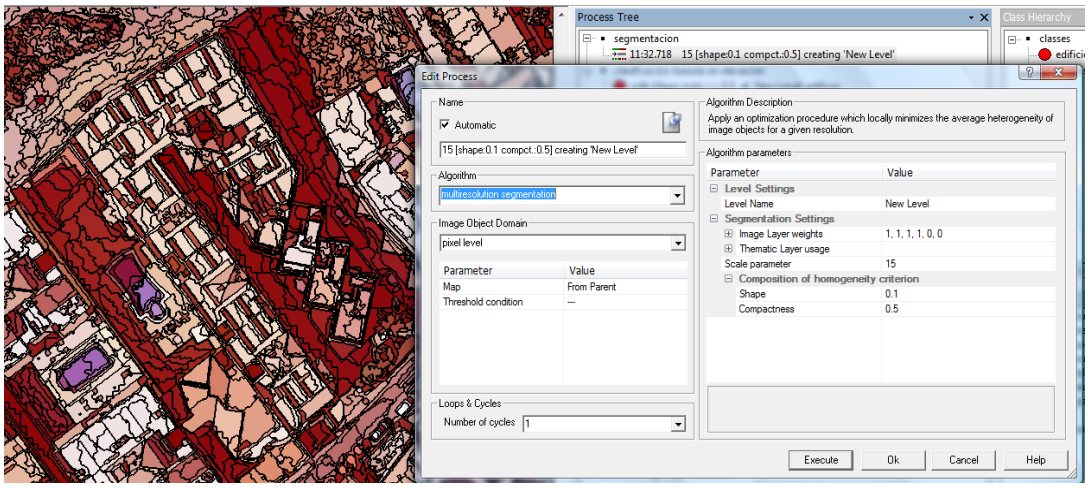
What can be misclassified?

3. Segmentation.

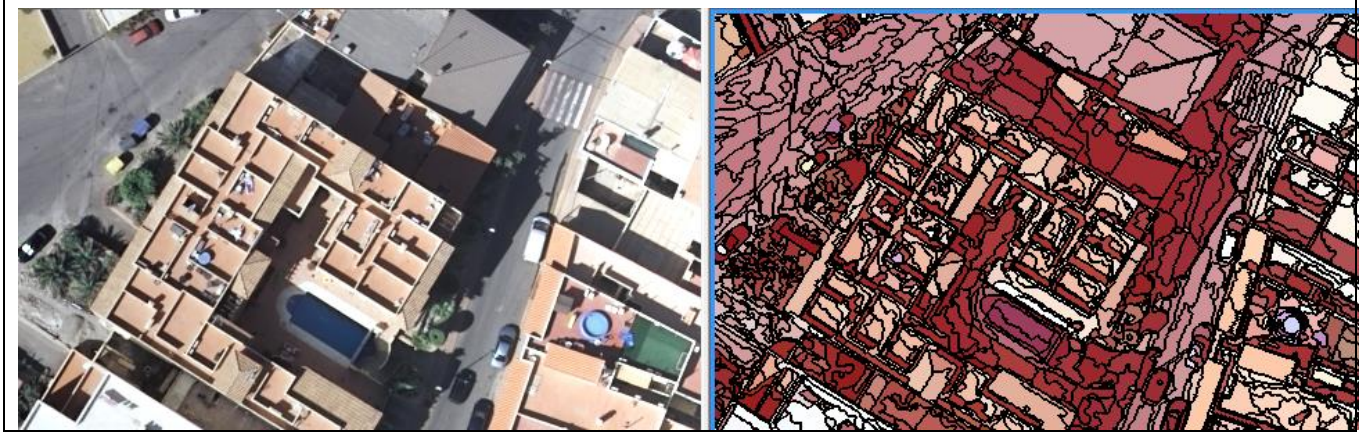
How can we choose the most suitable method? Review the basics

- Suggestion: Multiresolution segmentation
    - Insert the process in the process tree (segmentation) (Append new)
    - Insert the segmentation algorithm as a dependent process (*Insert child*)
    - Image Object Domain: *pixel*
    - Results to be created in the *new level*.
    - Layer weights
    - Scale parameter and homogeneity criterion

The following image shows the parameters we have chosen for the segmentation:



Results:

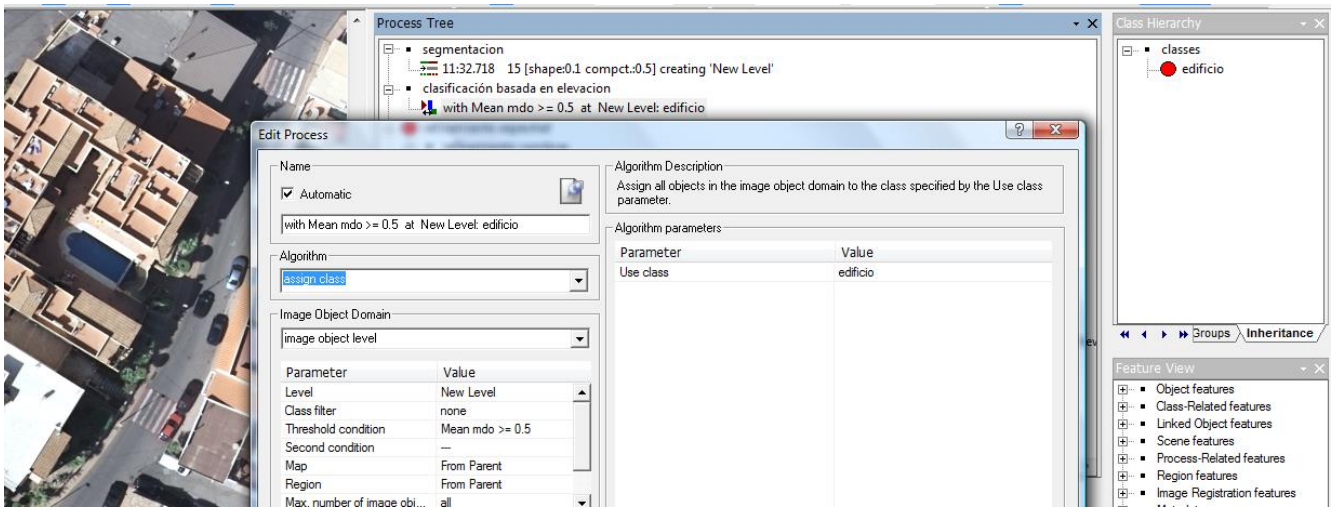


4. Height-based classification to differentiate buildings:

Explore the values in *Feature view*.

Choose the threshold values for the classification.

- Suggestion: Create the class "building" ("*edificio*") and assign (classify) the objects using a threshold value for an attribute (Attribute: *Mean MDO*).
    - Insert process in the process tree *(Insert child*).
    - Algorithm: *Assign class*.
    - Threshold condition: *Mean MDO* ≥ 0.5 m
    - Execute the process.



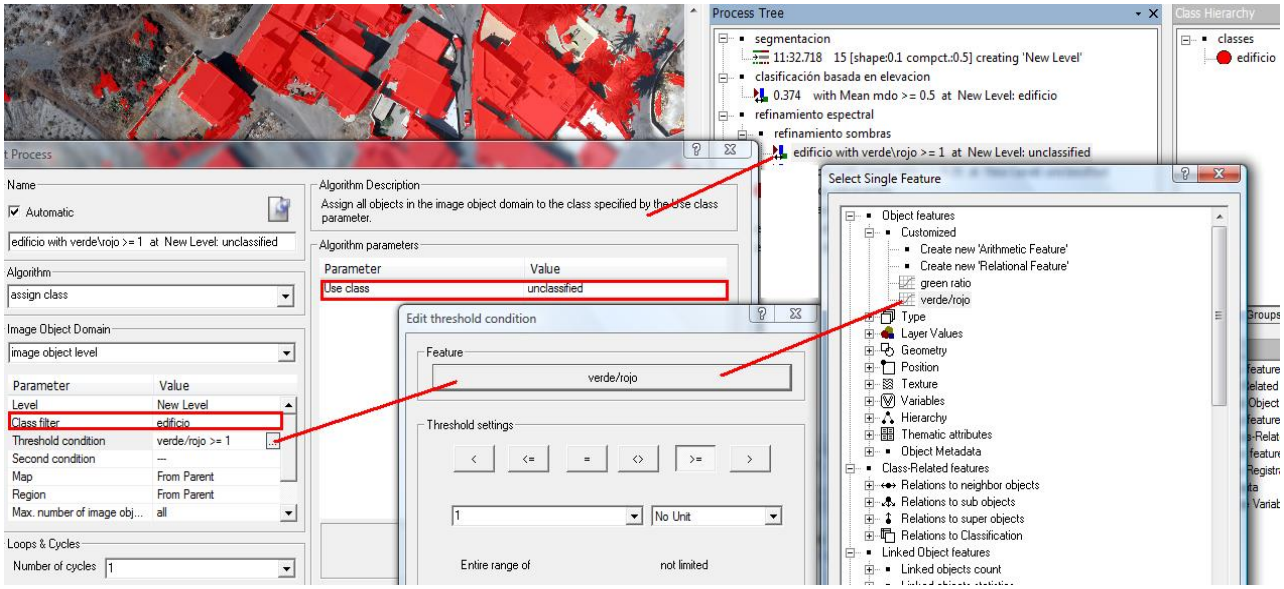
Result:

Identify the omission and commission errors.

Analyze the possibility of improving the classification (shadows and adjacent objects).

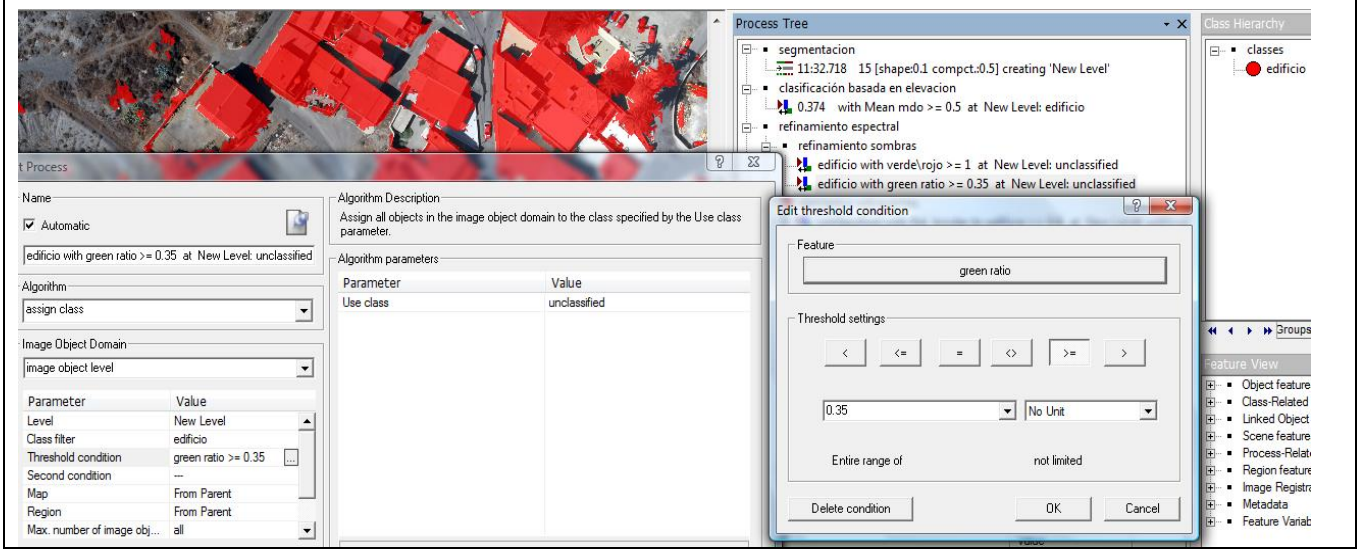
5. Spectral refinement of the classification.

- Remove the shadows from the classification.
    - Use the Green/Red ratio. Algorithm *Assign class*.
    - Use the *green ratio* (G/R+G+B). Algorithm *Assign class*.

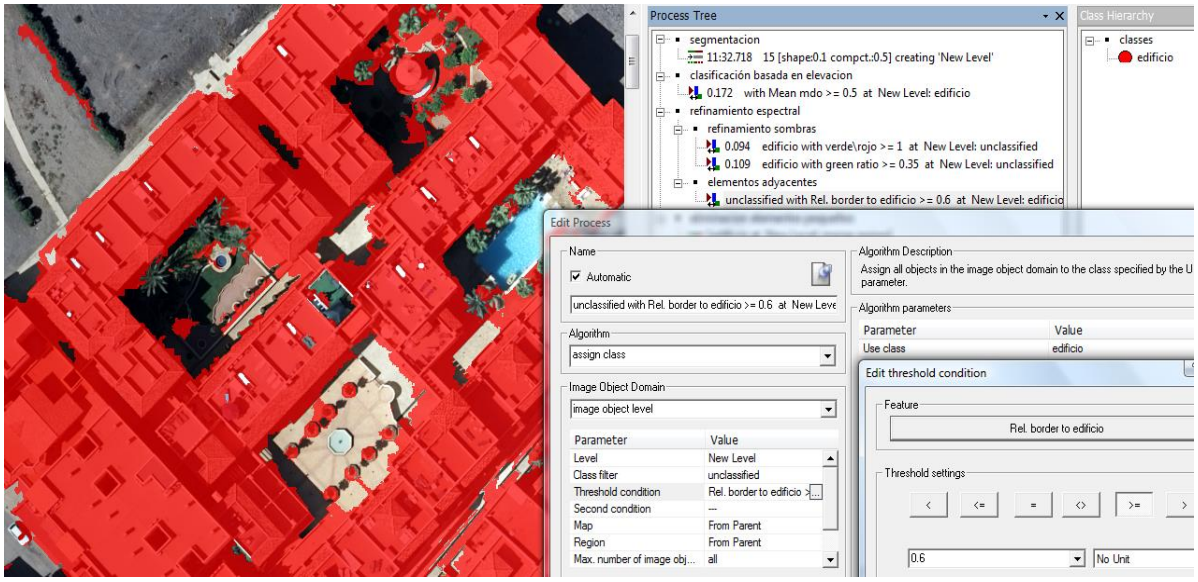


Result: before (left) and after (right) of applying the G/R ratio.

Classification using the *green ratio*.

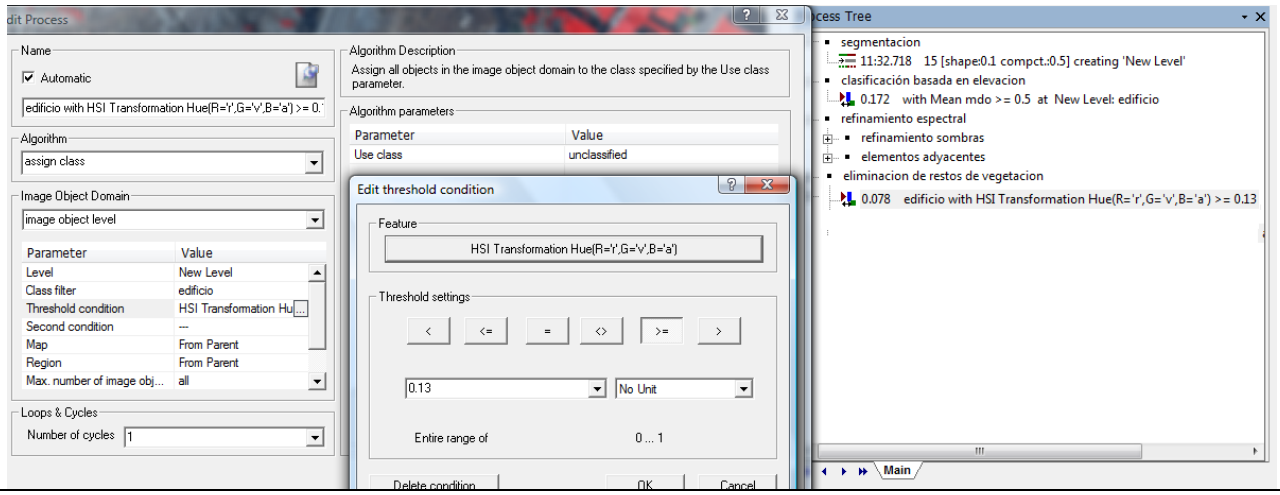


- Classification of objects that belong to adjacent buildings.
  - Use the feature *Rel. Border to.* (>60%). Algorithm *Assign class*.



Result: before (left) and after (right) of applying the algorithm.

- Remove the remaining vegetation and shadows
  - Use the HSI transformation (*Hue, 0.13*). Algorithm *Assign class*.



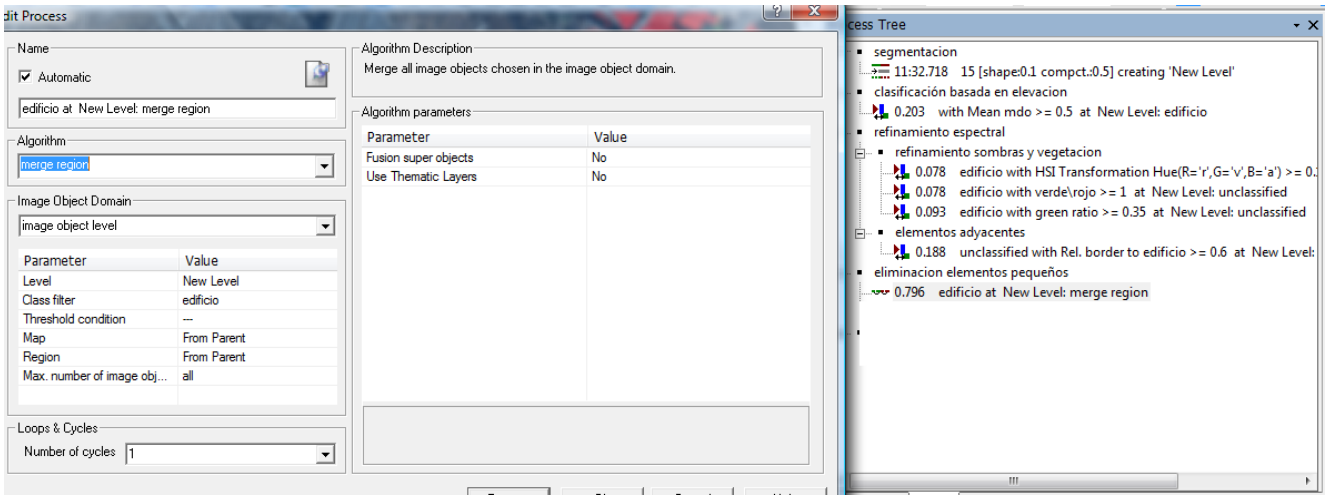
Possibility of applying the HIS feature/algorithm as the first step in the refinement process (shadows and vegetation).

Different results depending of the position of the algorithm in the process tree.

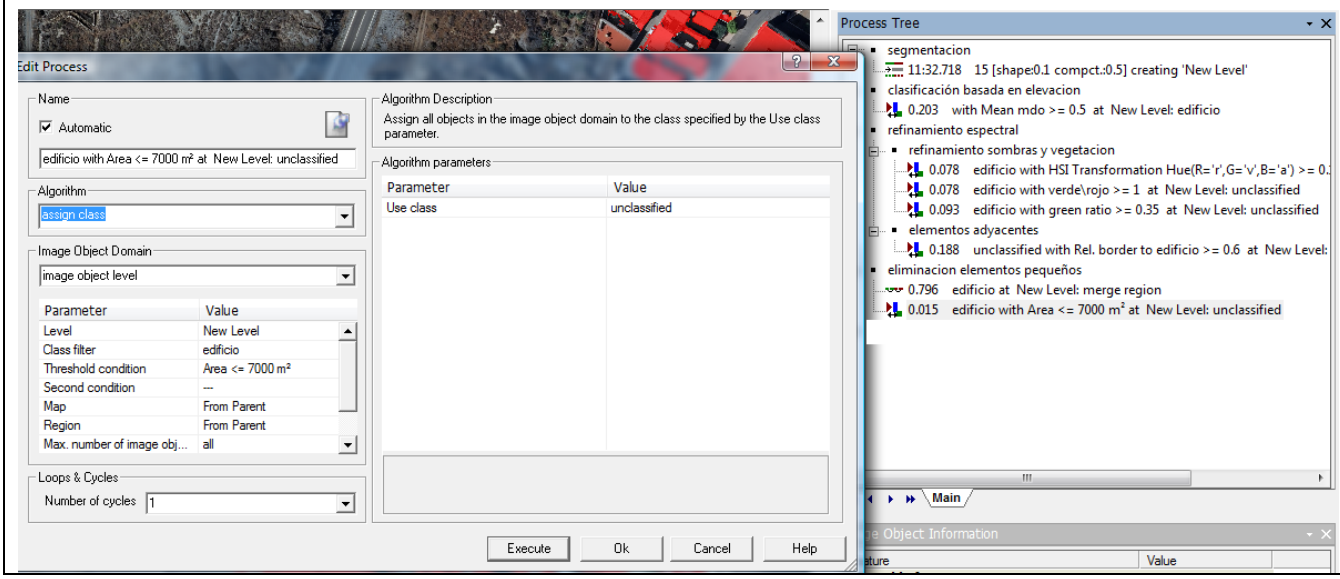
6. Classification refinement using the object properties.

- Remove the small objects (area) from the classification.

  - First, we need to *merge* the segments classifieds as "buildings". Algorithm *merge region*.



  - Use the feature *Area*. Algorithm *Assign class*.



Result:

Need to improve the classification?

Improvements? Add extra information?

7. Other options for the analysis:

Use an *Edge Ratio Split* segmentation based on changes in slope (border detection and abrupt changes in elevation).

Smooth MDO, MDS, MDT (using a *convolution filter*)

Calculate the slope using the smoothed models

Edge Ratio Split segmentation. Input data: slope. Parameters: base on observation.