

Theoretical background:

Drăguț, Lucian, Tiede, Dirk and Levick, Shaun R. (2010) 'ESP: a tool to estimate scale parameter for multiresolution image segmentation of remotely sensed data', *International Journal of Geographical Information Science*, DOI: 10.1080/13658810903174803

<http://www.informaworld.com/smpp/content~db=all~content=a919605464> (the full article is freely accessible and licensed under a Taylor & Francis iOpenAccess Agreement)

Preparation

Unpack the zip File (**ESP_Estimation_of_Scale_Parameters.zip**) to a new folder. It should include the following files:

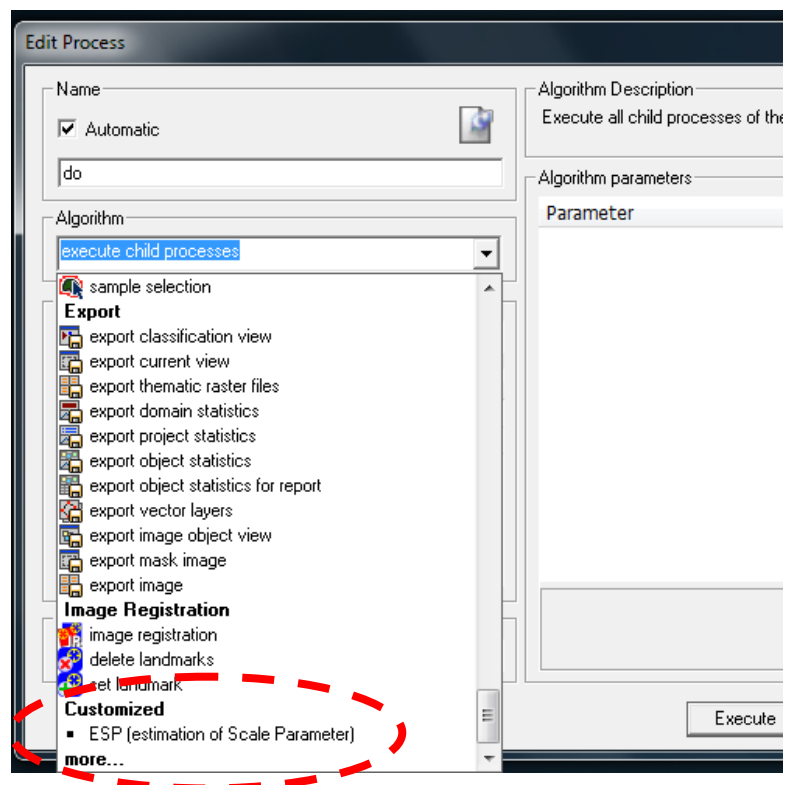
- **ESP_estimation_scale_parameter.dcp** (eCognition rule-set)
- **ESP_User_Guide.pdf** (this document)
- **ESP_Estimation_Scale_Parameter_Chart.exe** (a stand-alone tool for visualizing and interpreting the results. This tool is programmed in .NET, therefore the .NET framework needs to be installed on your machine. If it is not installed you can download it via the Windows Update function or here: <http://www.microsoft.com/downloads>)
- **ZedGraph.dll** (a dynamic link library which is needed to run the ESP_Estimation_Scale_Parameter_Chart.exe tool)

Processing steps

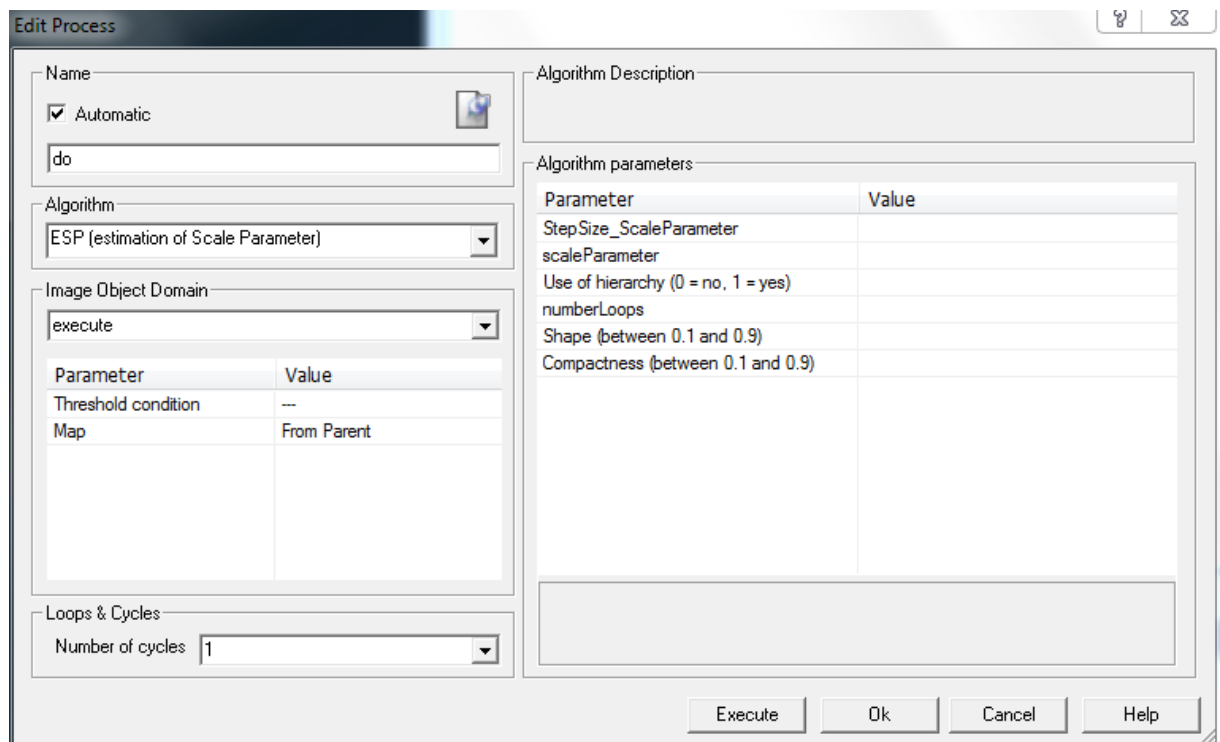
1. Loading and running the tool (it's a so called *customized algorithm*) in eCognition 8 (or Definiens Developer version 7)
2. Visualizing and interpreting the outputs file using the Chart tool (**ESP_Estimation_Scale_Parameter_Chart.exe**)

1. Loading and running the tool in eCognition

- Open eCognition and start a new project. Note that ESP works at the moment with a single layer only. If more layers are used, ESP will process the first one. ESP can handle both entire images, and defined areas of interest within images (e.g. administrative boundaries). In the later case, no data values must be defined for the respective layer in order to prevent segmentation outside the area of interest. Otherwise, the segments outside the area of interest will impact on the results!
- Load the rule set / customized algorithm '**ESP_estimation_scale_parameter.dcp**' (indicate the path where ESP is stored on your computer) and append the new process ('**Append New...**'). Find the ESP in the Algorithm section under '**Customized**' (see figure below). If the ESP algorithm is not appearing there, you have to click the 'more' tab to add the algorithm to the list.



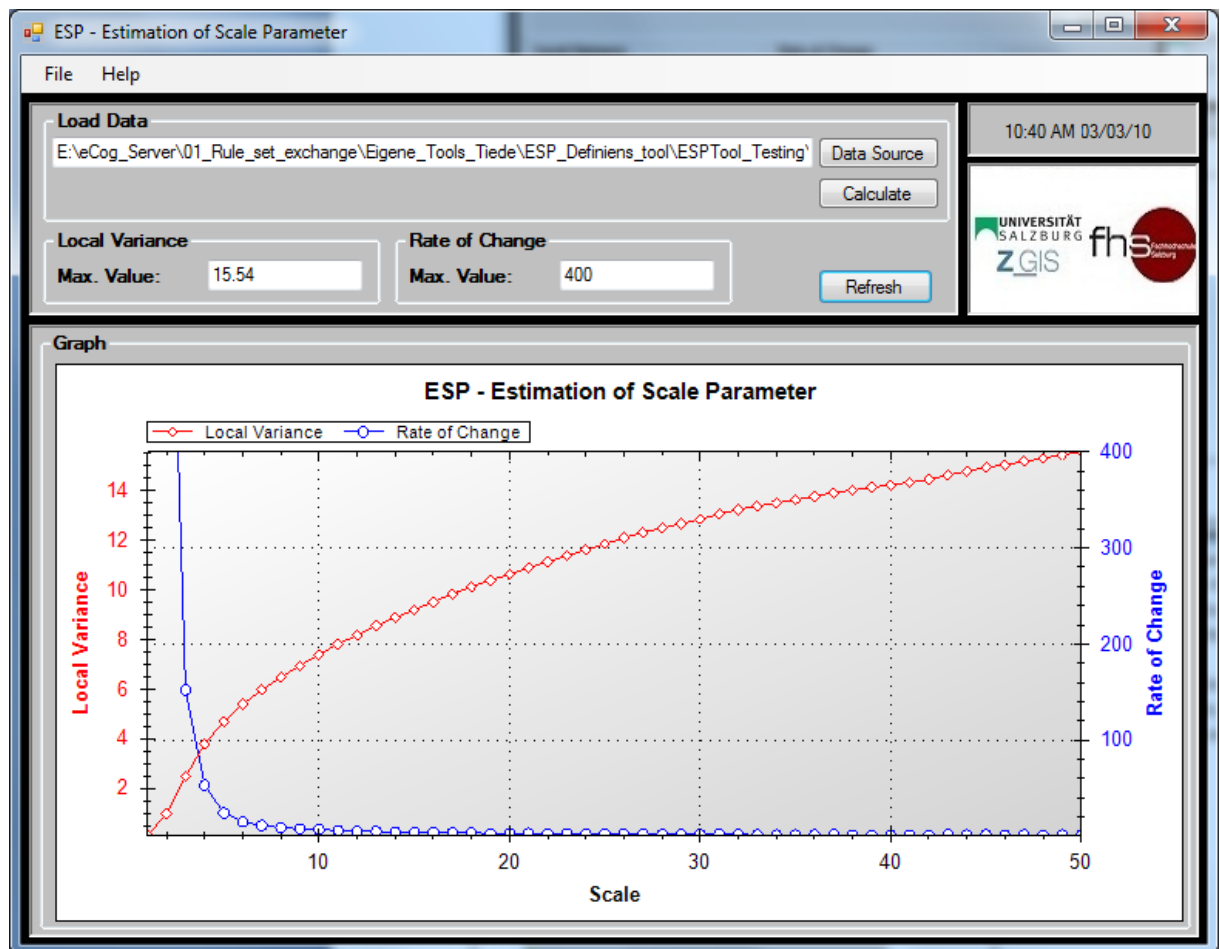
- Run ESP. Indicate (see figure below):
 - **'Step size scale parameter'** (the increment of scale parameter for the step-wise segmentation processing, e.g. 1)
 - **'Starting scale parameter'** (the minimum scale parameter at which the processing starts. Note that the ESP works in a bottom-up manner)
 - **'Use of hierarchy'** (0= each scale parameter is generated independently, based on the pixel level; 1= each scale level is generated within a hierarchy, where higher level is based on segmentation results at lower level. Note: Processing without using a hierarchy takes much more time, but the individual results are independent from other segmentation levels)
 - **'Number of loops'** (the number of scales to be generated, e.g. 100).
 - **'Shape'** and **'Compactness'** (composition of the homogeneity criterion as implemented in the multiresolution segmentation)



- Results of processing are saved as a *.txt file (where * will be automatically replaced by the name of the current eCognition project), which is written in the folder where the eCognition project was saved. **Important: if a new run of ESP is needed, make sure the previous .txt file has been renamed or moved into another folder; otherwise, it will be overwritten!**

2. Visualizing and interpreting the outputs file using the chart tool (ESP_Estimation_Scale_Parameter_Chart.exe)

- Run the **ESP_Estimation_Scale_Parameter_Chart.exe** tool (no installation needed)
- Load the processing result (*.txt file) using the “**Data Source**” button. Press the “**Calculate**” button to start the visualization of the data
- The tool plots values of local variance (**LV**) and rate of change (**ROC** = rate of change in local variance between the scale level of interest and the previous one) against scale levels. The graph shows a sudden decrease in ROC of local variance at the lowest scales, followed by level off. However, if ROC extremely high at first scale levels, the evolution of local variance is not visible (see figure below)



- Adjust values of vertical axis in order to see both curves. This can be done by reducing the **Rate of Change Max. Value** in the field above the curve, refresh the plot by clicking the corresponding button.
- **Zoom** function (just open a zoom rectangle by dragging using the left mouse button) and **export** function (right mouse-click) are also available.
- **Interpretation:** Local variance increases with the increase in scale parameter as the homogeneity of objects in the scene increases. The highest values of LV just before successive levels along the curve indicate scales where objects reached meaningful levels of organization in terms of variation of their homogeneity. However, separating only important thresholds on this graphic is difficult. Therefore, we introduced ROC as a mean of identifying them. Thus, the amount of change of LV from a level to another indicates how important is the respective scale level in structuring the

information on objects variability relative to the whole scene. Example: in the graphic below, 50 scale levels were automatically processed. The peaks of the ROC curve corresponding to scale levels of 21, 31, 37, 43 and potentially 47 indicate the meaningful scale parameters for segmentation in this example (segmentations with scale parameters in between the above mentioned will only bring minor modifications in the structure of objects).

