Practicals on Land Use/Cover & Change Detection
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Tutorial
Supervised classification in ArcGIS

The supervised classification in ArcGIS is implemented with the several functions of the *Multivariate Tool* of the ArcToolbox.

For doing a supervised classification in ArcGIS you have to follow the steps:

1. Import input data into ArcGIS – ArcMap

2. Collect samples for training the algorithm

3. Specific sample visualization

4. Create signatures

5. Analysis of the training samples

6. Edit signatures

7. Run the supervised classification algorithm – the maximum likelihood is the only available supervised algorithm in ArcGIS

8. Apply a pre-existent symbology to the produced map

1. Import input data into ArcGIS – ArcMap

a) *File → Add data* (Figure 1); select the stack file if importing multi-band images
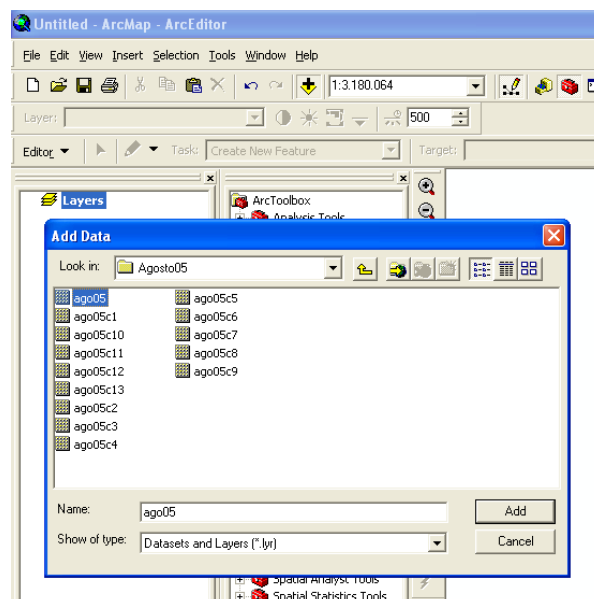

Figure 1

2. Collect / Visualize samples for training the algorithm

2.1. Create a shapefile for sample collection

a)   Open ArcCatalog → Right click workspace folder → *New* → *Shapefile* (Figure 2)

    i.   Set the name of the shapefile
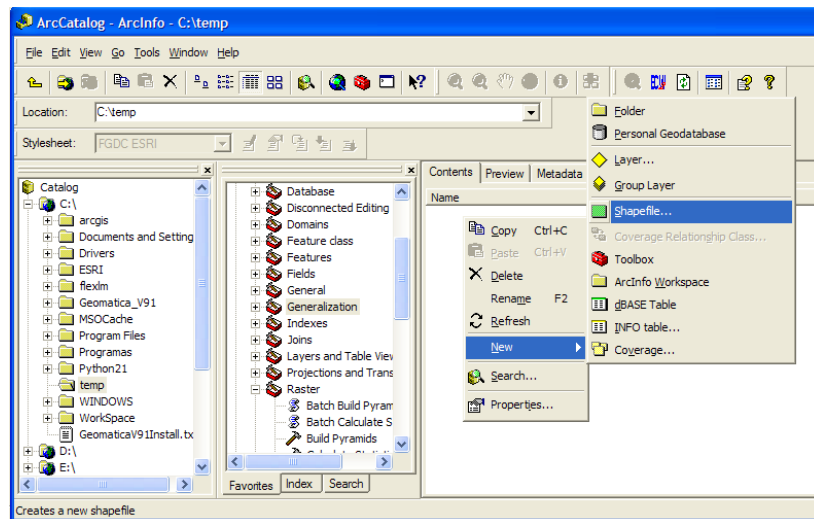
    ii.   Set the feature type as point

Figure 2

2.2. Sample collection

a)   Import samples file, auxiliary and reference imagery data into ArcGIS – ArcMap (see step 1)

b)   Right click samples layer → *Open Attribute Table* → *Options* → *Add Field* (Figure 3); create a new field in the attribute table in order to label the selected samples (Figure 4)

    i.   Set the *name*, *type* and *properties* of the field (Figure 5); set *type* and *properties* attributes as they are in Figure 5
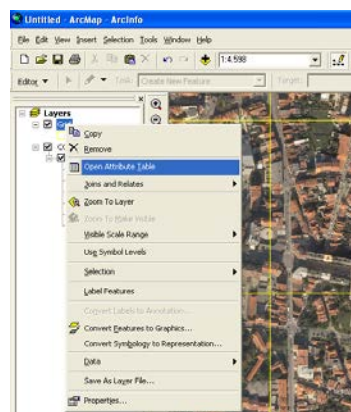

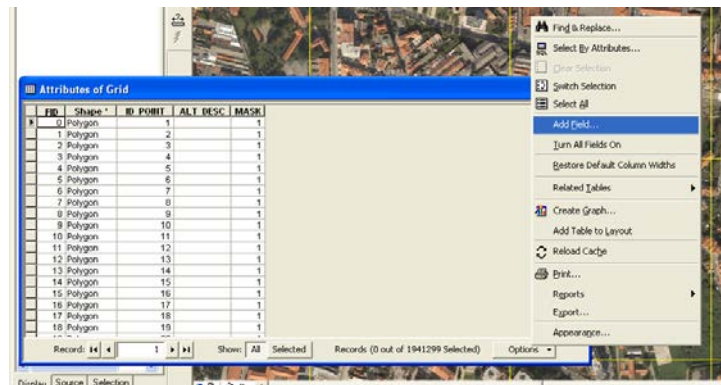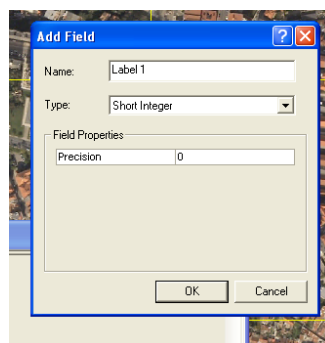
Figure 3

Figure 4

Figure 5

c) *Editor Tool → Start Editing* (Figure 6)

    i.   Select the sample shapefile to start editing

    ii.   Create samples using the pencil tool with edit task on *Create New Feature* (Figure 7)

    iii.   Right click samples layer → *Open Attribute Table*; label created or existent samples according to land cover classes nomenclature

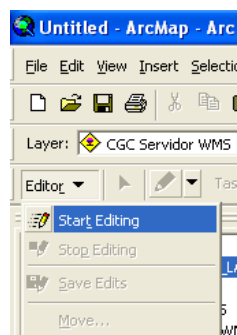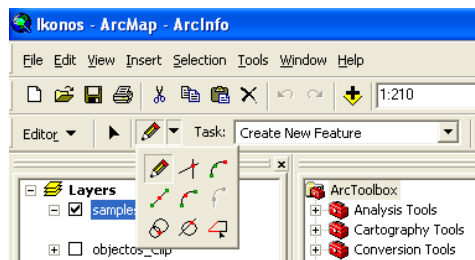   iv.   In the end save your edits and stop editing → *Editor Tool → Stop Editing*;

Figure 6

Figure 7

3. Specific sample visualization

a) Right click samples layer → *Open Attribute Table*

    i. Sort in ascending or descending order samples according to one of the fields by right clicking its header and selecting the wanted option

    ii. Select the sample for visualization by clicking on it with the left mouse button (Figure 8); after selected, the sample entry will become highlighted

    iii. Also, select samples by clicking the *Options* Button and selecting the *Select by Attributes* function. Create a query expression for selecting just the desired samples.

Double-click for zoom to selected

Figure 8

b) Right click samples layer → *Selection* → *Zoom To Selected Features* (Figure 9) or simply double-click the highlighted entry in the attribute table
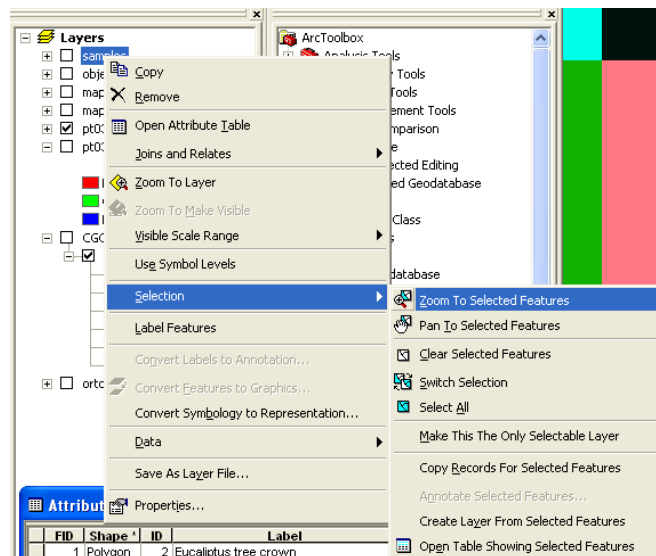
Figure 9

4. Create signatures

c) *ArcToolbox → Spatial Analyst Tools → Multivariate → Create Signatures* (Figure 10)

  i. Select the input raster bands (image bands)

  ii. Select the samples file as input sample data

  iii. Set the input sample field to the one that refers to class codes

  iv. Set the name of the output signature file

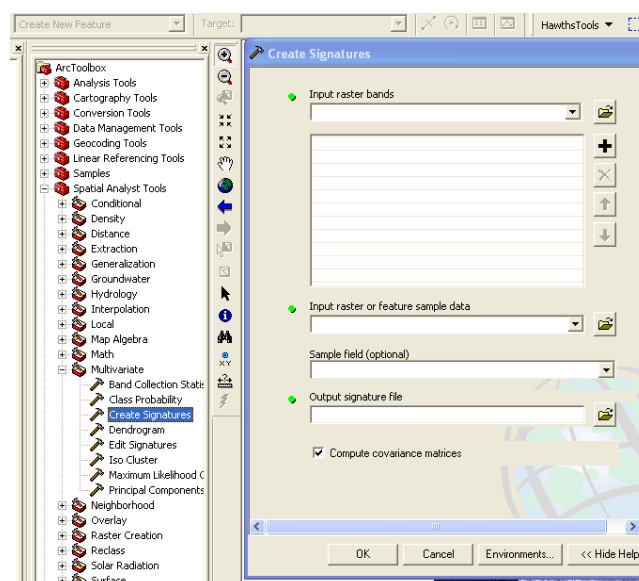 v. The computation of covariance matrices is needed for the maximum likelihood algorithm

Figure 10

5. Analysis of the training samples

An analysis of the training samples can be done using, among others, the *Dendrogram* tool and the *Band Collection Statistics* tool

5.1. Dendrogram Tool

a)   *ArcToolbox → Spatial Analyst Tools → Multivariate → Dendrogram* (Figure 11).

A dendrogram is a diagram that shows the attribute distances between each pair of sequentially merged classes. The *Dendrogram* tool measures distances between pairs of classes based on their means and variances
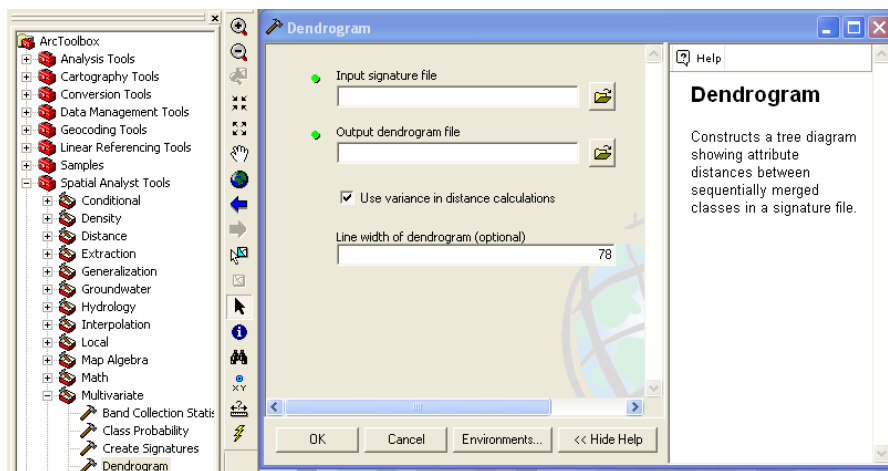

Figure 11

5.2. Band Collection Statistics Tool

a)   Import input raster bands (each of the input image bands) into ArcGIS – ArcMap (see step 1)

b)   *Spatial Analyst → Options* (Figure 12)

   i.   Set *Cell Size* and *Extent* to be equal to input raster bands (Figures 13, 14)

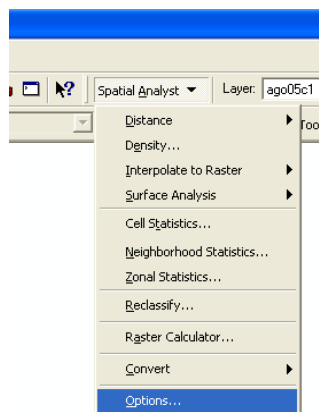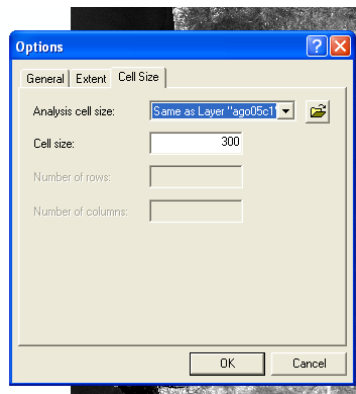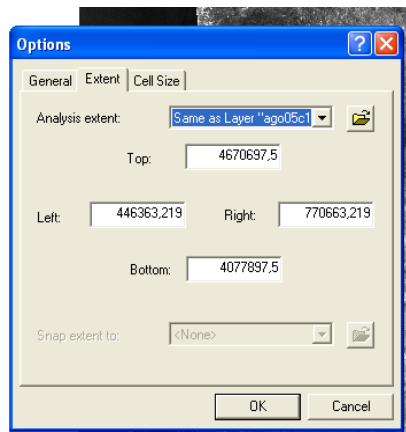   ii.   Set the samples file as *Analysis Mask* (Figure 15)
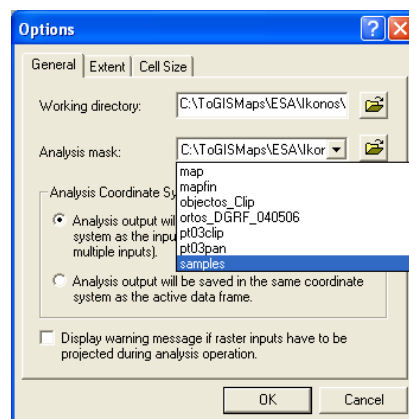

Figure 12

Figure 13

Figure 14

Figure 15

c) *Spatial Analyst → Raster Calculator* (Figure 16)

   i.   Create a raster file (one for each input band) containing the band value for each sample location (Figure 17). The algebra expression must be: "new raster 1" = "input raster band 1"
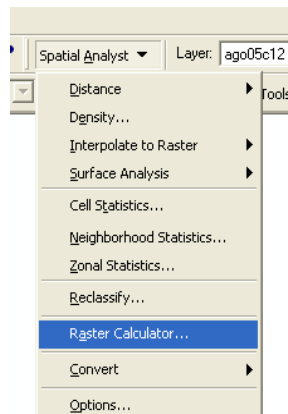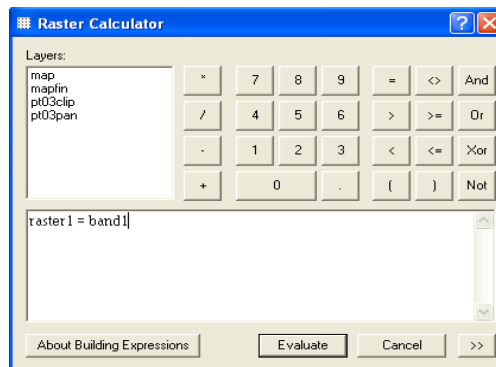
Figure 16

Figure 17

d) *ArcToolbox → Spatial Analyst Tools → Multivariate → Band Collection Statistics* (Figure 18)

    i.   Select the created raster files containing the band value for each sample location as the input raster bands

    ii.   Set the name of the output file

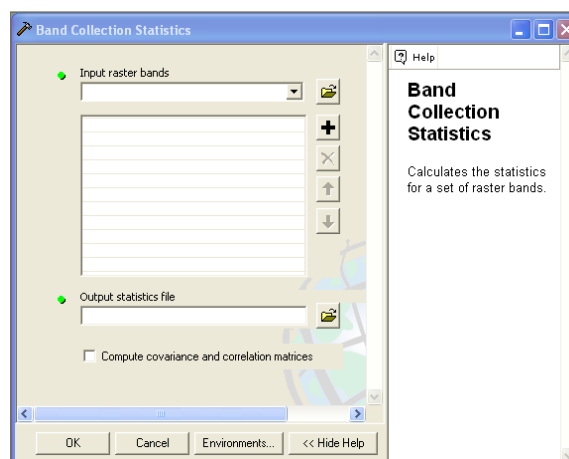   iii.   Check the *Compute covariances and correlation matrices* box

Figure 18

6. Edit signatures

a) *ArcToolbox → Spatial Analyst Tools → Multivariate → Edit Signatures* (Figure 19); edits and updates a signature file by merging, renumbering, and deleting class signatures.

  i.   Select the input raster bands (image bands)

  ii. Select the signature file to be edit

  iii. Select the remap signatures file. The input signature remap file is an ASCII file consisting of two columns. In the first column, the original class IDs are listed in ascending order. The second column has the new class IDs for updating in the signature file. When a set of classes is to be merged, a new class ID must be put in the second column for each class ID of the set. Only classes that need to be edited have to be placed in the signature remap file. Any class not present in the remap file will remain unchanged. To delete a class signature, the value of -9,999 must be entered in the second column of the remap file.
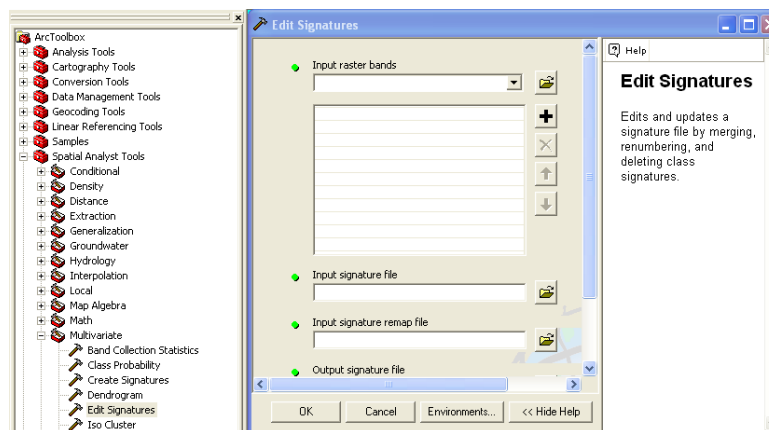
  iv. Set the name of the output signature file

Figure 19

7. Run the maximum likelihood algorithm

a) *ArcToolbox → Spatial Analyst Tools → Multivariate → Maximum Likelihood Classification* (Figure 20)

  i.   Select the input raster bands

  ii. Select the created signature file

  iii. Set the reject fraction to 0 so that all pixels are classified

  iv. Set equal *a priori* probability weighting

Optional settings include: the possibility of using an *a priori* probability file in the classification; and the possibility of creating an output, besides the classification, that specifies the classification confidence for each pixel
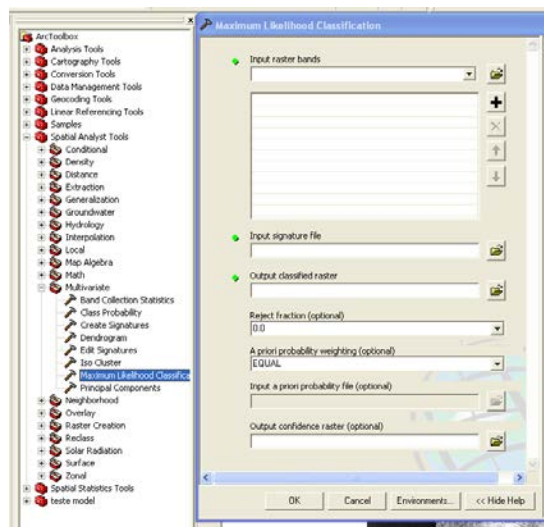
Figure 20

8. Apply a pre-existent symbology to the produced map

b)   Right click map layer → *Properties* (Figure 21, 22)

    v.   Select the *Symbology* Tab

    vi.   Click the *Import* button

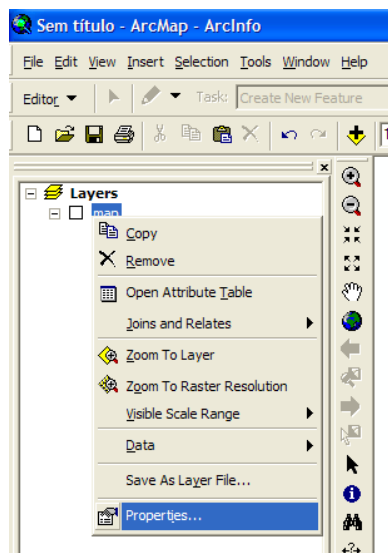   vii.   Browse to the respective *.lyr file and select it
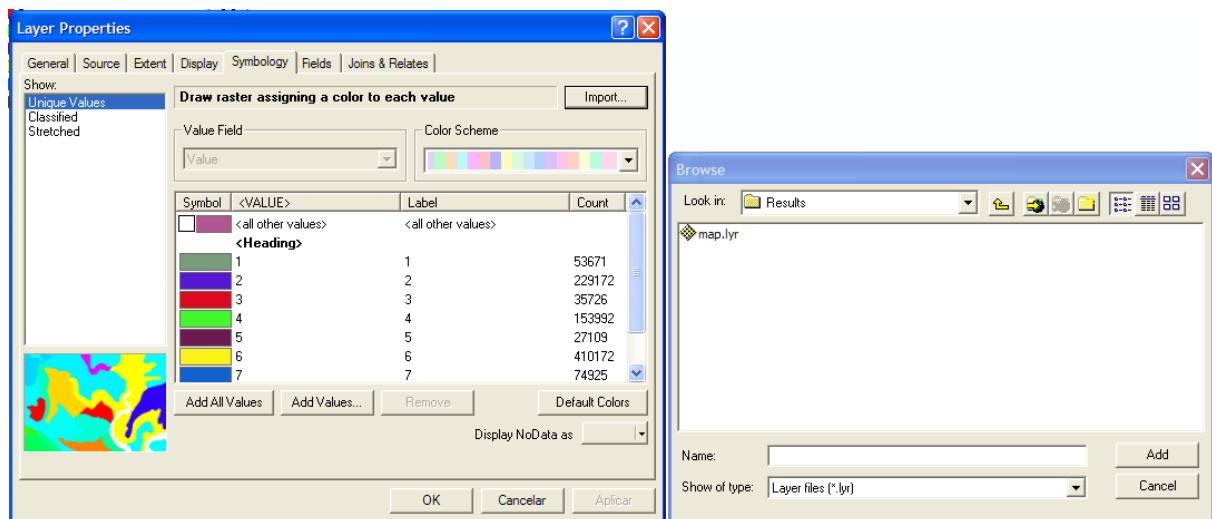

Figure 21

Figure 22