OBJECT-BASED IMAGE ANALYSIS USING DEFINIENS' ECOGNITION I – INTRODUCTORY LEVEL

In this exercise, you will become comfortable with using Definiens Professional 5.0 (formerly known as "eCognition") for segmentation, classification, and accuracy assessment of high spatial resolution imagery. You will become familiarized with the general workflow of object-based image analysis in eCognition.

For the first part of the exercise, you will use ADAR (Airborne Data Acquisition and Registration) of a portion of China Camp State Park for this exercise. The data is 4-band multispectral (blue, green, red, near infrared) image with 1-meter spatial resolution. The image contains small- and large-scaled features, so you can choose if you want to classify by species or by land cover type. For the second part of the exercise, you will have access to several different types of high spatial resolution data, including NAIP imagery, color-infrared photography, LiDAR, and IKONOS, Quickbird, and Landsat satellite imagery.

In this exercise, you will perform 7 lessons:

1. Creating and displaying a new project
2. Changing the appearance of the imagery
3. Performing a segmentation
4. Classifying using standard nearest neighbor
5. Classifying using nearest neighbor
6. Assessing the classification accuracy
7. Exporting your results

***** START THE EXERCISE ON THE NEXT PAGE! *****

These are important points that you should read before you go any further!

These are informative tips that may help you in the future!

Lesson 1: Creating and Displaying a New Project

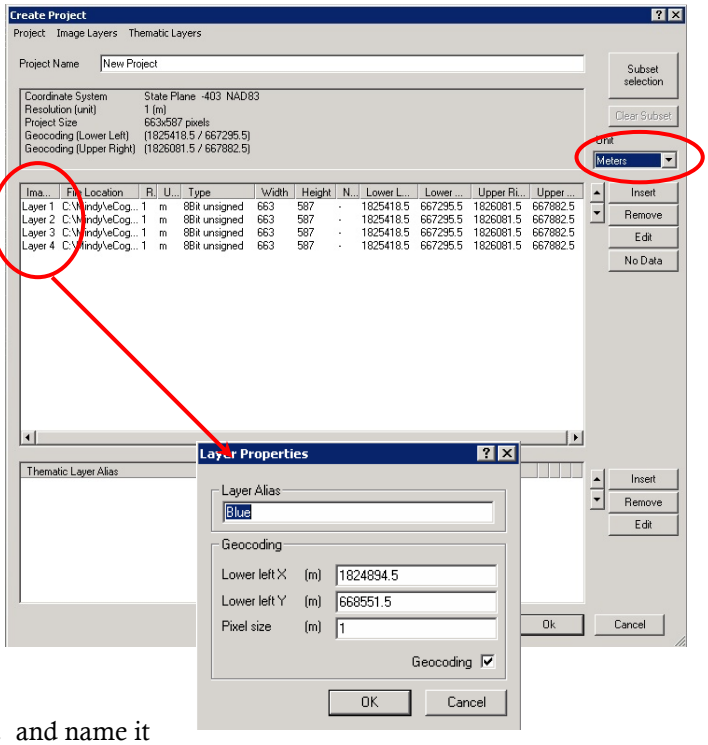
1. Start Definiens Professional, and click **File > New project**. Navigate to your working directory (to be provided).

2. Select the Erdas Imagine (*.img) file type

3. Click on the **Chinacamp03.img** file and click **Open**.
   a. You will see the ***Create project*** dialog box. Make sure **Unit** is set to *meters.*
   b. Assign a layer alias by selecting the layer and double clicking it. The ***Layer Properties*** dialog opens.
   c. Assign the following aliases to the layers:
      Layer 1 → Blue
      Layer 2 → Green
      Layer 3 → Red
      Layer 4 → NIR

4. Click **OK** at the bottom of the ***Create Project*** Dialog Box and a new project appears and the raster image is displayed.

5. Save the project by going to **File > Save Project as…** and name it **ChinaCamp.dpr**.



In addition to importing raster data, you can also import **vector** data into Definiens, including GIS shapefiles. However, vector data are converted into a raster layer during import and are applied as a thematic layer.

A variety of raster file formats can be imported into Definiens Professional:

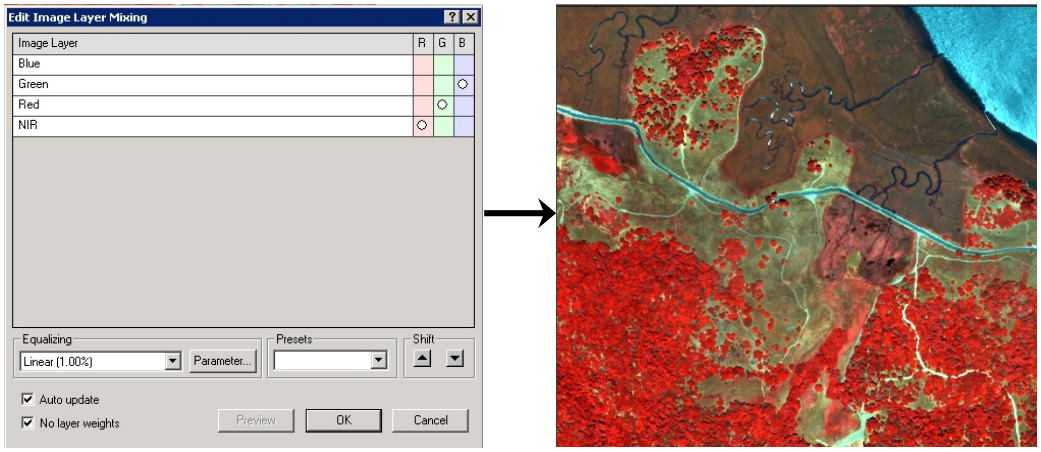
- Arc/Info Binary Grid (.asc)
- Compuserve GIF (.gif)
- ER Mapper Compressed Raster (.ecw)
- ESRI ASCII GRID File (.asc)
- Erdas Imagine Images (.img)
- JPEG JFIF (.jpg)
- JPEG 2000 (.jp2)
- PCI DSK image format (.pix)
- Portable Network Graphics (.png)
- Tagged Image File (.tif)
- Tagged Image File (Geocoded) (.tif)
- Windows or OS/2 Bitmap files (.bmp)
- National Imagery Transmission (NITF) (.ntf)

Lesson 2: Changing the Appearance of the Imagery

You can change the display/appearance of the imagery in the window by (1) assigning the different bands to represent in different colors, either R, G, or B; (2) adding weights to different bands in different colors; and (3) changing the *Equalizing* setting. We'll do each one of these here.

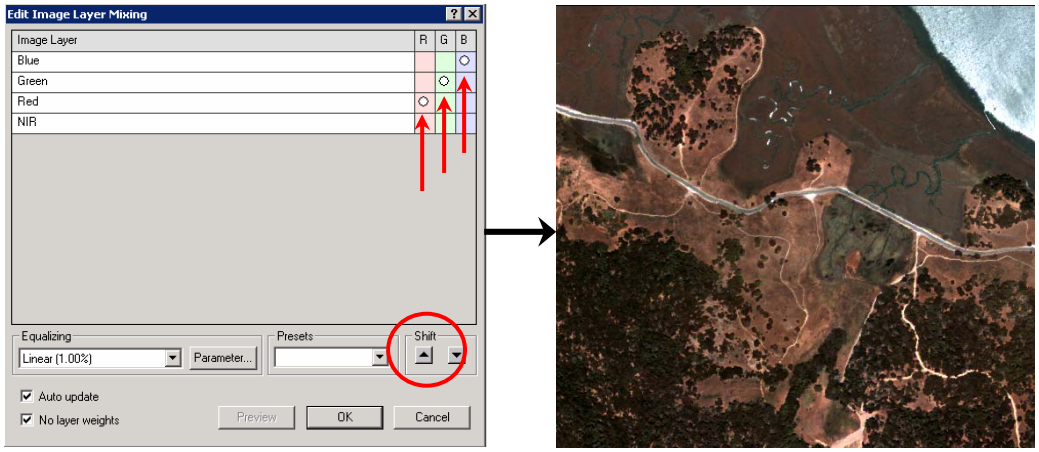
1. Go to **View > Edit Image Layer Mixing** or click on  button in the toolbar. The **Edit Image Layer Mixing** window opens. Assign the following bands to the corresponding color pens:
   - Green → B (blue)
   - Red → G (green)
   - NIR → R (red)

   This displays the image in "false color" as seen below. This band combination is often used to enhance the visualization of vegetation, as vegetation (high NIR reflectance) is shown in red.

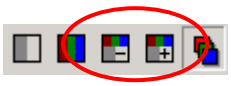


2. In the **Edit Image Layer Mixing** window, click on the up-arrow under **Shift**.

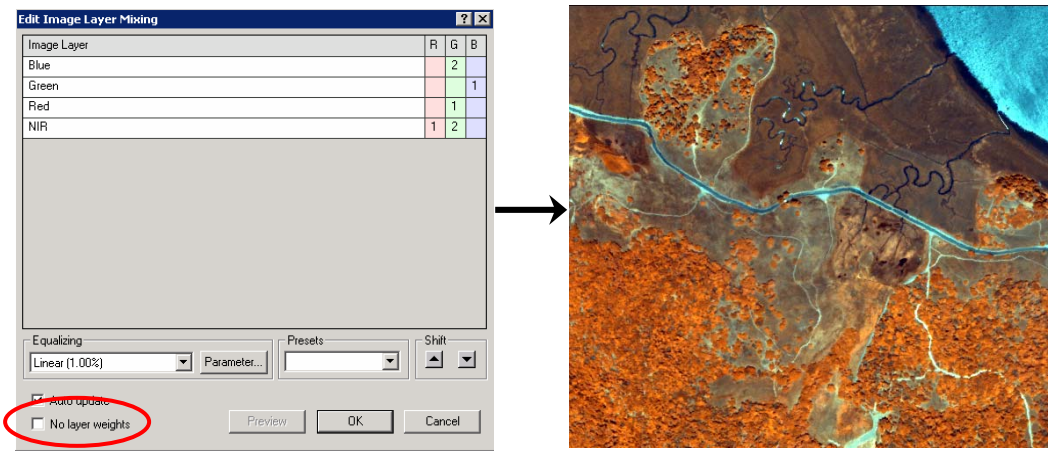
This shifts all the pen assignments up one level.



Back in the main eCognition window, you can also easily click on the View Settings toolbar buttons to shift up and down the pen assignments.

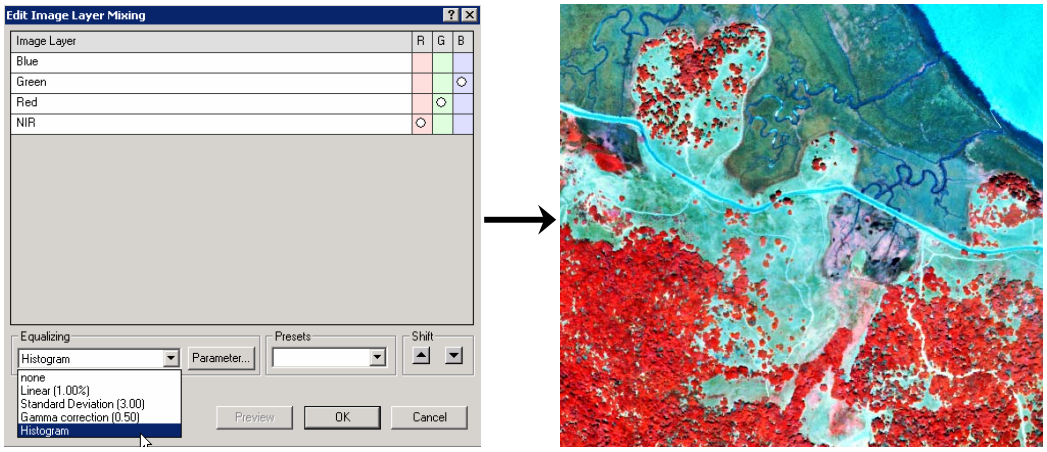


3. Next, in the **Edit Image Layer Mixing** window, un-check "No layer weights" in the lower left-hand corner. Then using your mouse buttons, increase/decrease layer weights to display a weighted combination of the imagery.
    - Use the **LEFT** mouse button to increase the layer weights.
    - Use the **RIGHT** mouse button to decrease the layer weights.



4. Assign the following bands to the corresponding color pens to put it *back* to false color:
    - Green → B (blue)
    - Red → G (green)
    - NIR → R (red)

    Under the *Equalizing* drop-down menu, choose "Histogram" which stretches all the values in the band histograms. Experiment with other *Equalizing* options.



These display commands **DO NOT** change the actual data of the imagery, nor do they affect image segmentation and classification. They are **ONLY** for display purposes, to help you distinguish patches, patterns, and other data features.

5. When you are finished experimenting, choose "Linear (1.00%)" and click **OK**.

Lesson 3: Performing Segmentation

The Segmentation procedure is a knowledge-free extraction of image object.

While Definiens does not distribute the actual algorithms used for the aegmentation, they have document how it works, in general. Multiresolution Segmentation in eCognition starts with one-pixel objects, which are merged into bigger and bigger objects, based on a criterion that minimizes heterogeneity in the objects. During the object-merging process, objects will continue to merge until the criterion, or threshold, is exceeded. The criterion in this case is controlled by segmentation parameters *that you enter* into the software, most notably the **Scale Parameter**.

Please refer to the ***Reference Book*** in the **User Guide** folder of your Definiens Professional installation for detailed information on the segmentation algorithm.

Image objects resulting from a segmentation procedure are intended to be *image object primitives*, serving as information carriers and building blocks for further classification or other segmentation and fusion processes.

The first major step in eCognition is always to extract image objects. You will now produce such image objects with the segmentation dialogue.

1. Go to **Image Objects > Segmentation** or by clicking on  button to perform segmentation.

2. Click on the layer named Blue and in the **Edit weights** field, insert **0**. This layer will not be considered in the segmentation.

Image layer weights, ranging 0 – 1, can be set for different layers, depending on the layer's suitability for being considered in the segmentation. The higher the weight, the more of the layer's information will be used in the segmentation.

When using vector data, you cannot assign a weight other than 1 (to *use* the vector data later) and 0 (to *ignore* the vector layer) in the segmentation.

3. Type **Large Segments** as Level Name.

   All level names must be unique, or else it will not run the segmentation (it will remind you). It is a good idea to name your segment levels with a descriptive names, such as "Large/Medium/Small Segments" or "Focal Level/Level –1/Level +1". The level name is case sensitive, so "Level 1" and "level 1" will be two different layers.

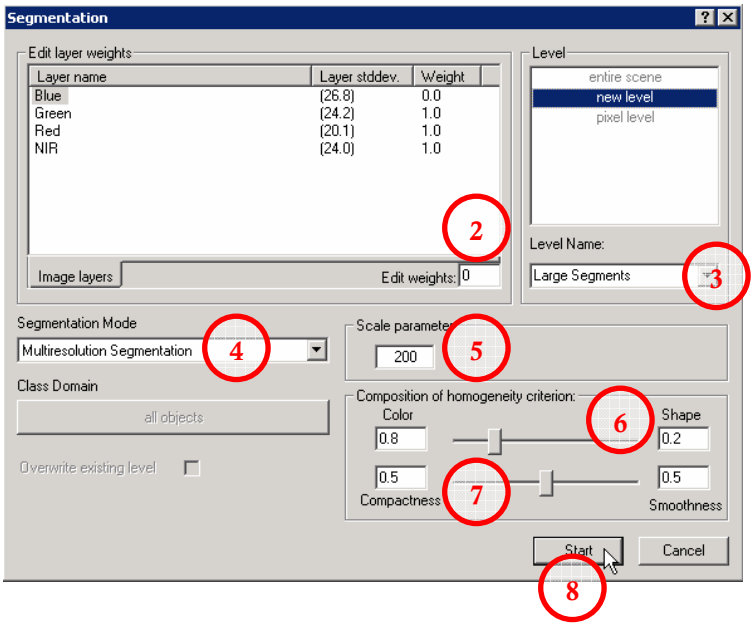
4. In the field Segmentation Mode, select **Multiresolution Segmentation**.

5. Enter **200** for the Scale Parameter.

6. In the Composition of homogeneity criterion, move the slider to the right until color is 0.8 (the shape factor will automatically change to 0.2).

7. Leave the defaults for Compactness and Smoothness (0.5 and 0.5).

8. Click **Start**. It will take a few moments for the segmentation to complete.



Parameter Descriptions

Below are brief descriptions of most of the parameters used in the Segmentation tool. These descriptions are excerpts from the Definiens Professional Training course materials.

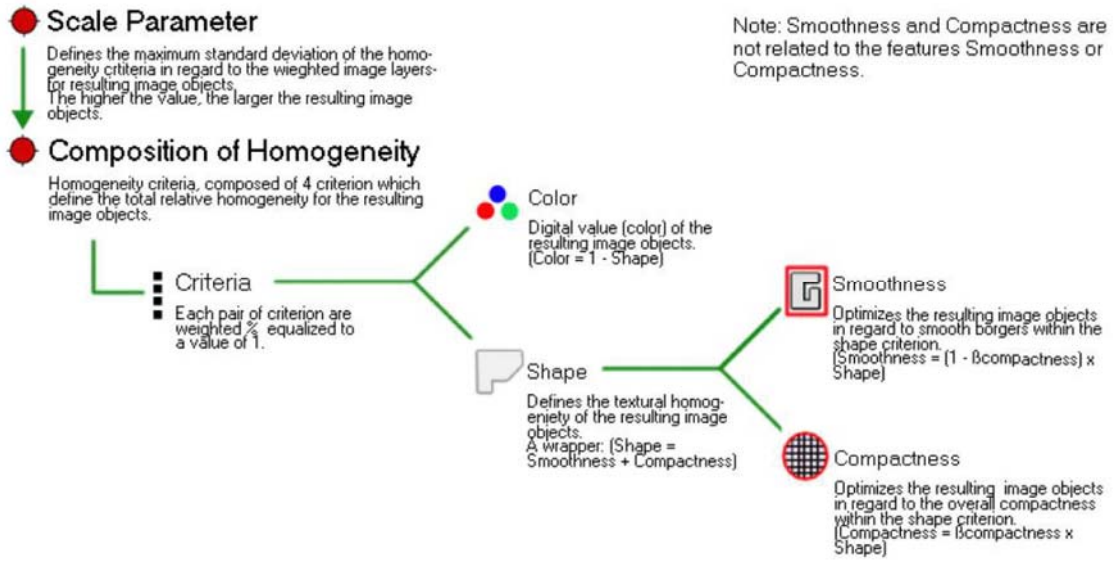
Scale parameter
The Scale Parameter is a unitless abstract term that determines the maximum allowed heterogeneity of the resulting image objects. In heterogeneous data, the resulting objects for a given scale parameter are smaller than in more homogeneous data. By modifying the Scale Parameter in the input field, you can vary the size of image objects and the total number of objects.

Composition of homogeneity criterion
The object homogeneity, to which the scale parameter refers, is defined by the *composition* of the homogeneity criterion. ECognition computes the homogeneity criterion internally by four criteria:

1. Color,
2. Shape
3. Smoothness, and
4. Compactness.

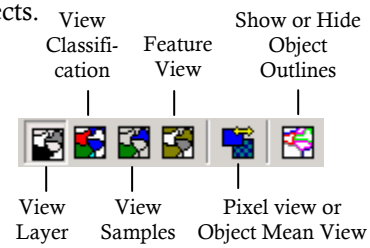
Color vs. Shape:
The **Color** criterion defines to which percentage the overall homogeneity is defined by the spectral values of the image layers as opposed to the **Shape** homogeneity criteria. Changing the weight for the shape criterion to 0 will result in objects entirely optimized for spectral homogeneity. In most cases, the color criterion (i.e. how highly you weight **color** vs. shape) is the most important one for creating meaningful objects (not necessarily smoothness vs. compactness). The shape criterion especially helps to avoid a "fractal" shaping of objects in strongly textured data (e.g. radar data) and defines to which percentage objects are optimized for shape as opposed to the spectral, or color, values of the image layers.

Compactness vs. Smoothness:
The Shape criterion is defined by the two parameters **Compactness** and **Smoothness.** The **Smoothness** criterion is used to optimize image objects with regard to smooth borders. The **Compactness** criterion is used to optimize image objects with regard to compactness, with finger-like characteristics. Although they do not share an antagonistic relationship, they sum up to 1. When the compactness value is set to 1, the shapes of the objects will be only optimized for compactness, and vice versa. The influence of the values for Compactness and Smoothness are dependent on the value of Shape, since it is defined by how heavily Shape is weighted.



Explore image objects

When the segmentation process is finished, you may not have noticed that anything has finished. You will now use the View Settings toolbar to explore the image objects.

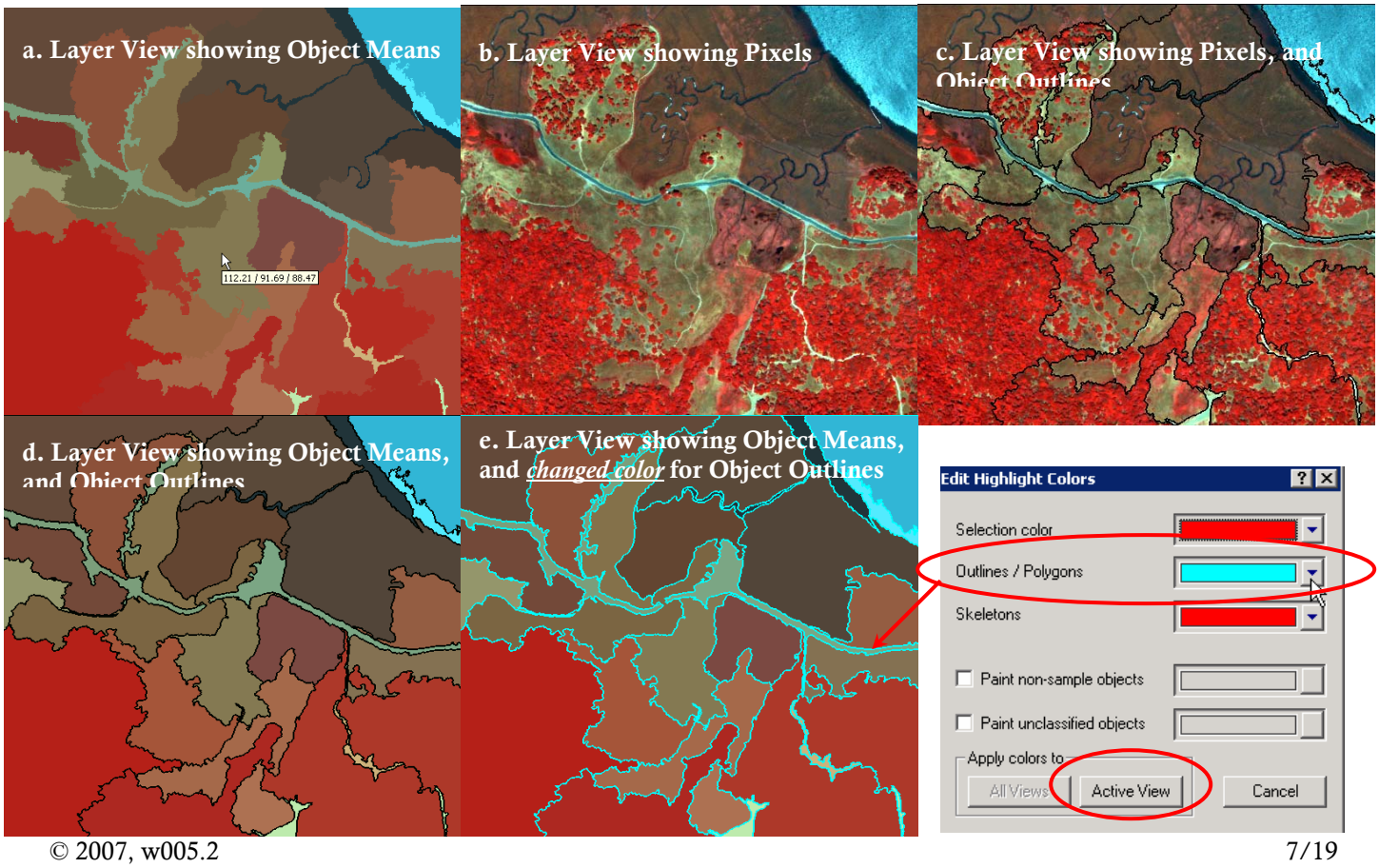


1. Click on  to show the **Layer View**, and then click on  to toggle between pixel view and object means view. Show the object means view, with a fill color calculated from the mean value of the pixels. You can visualize the image objects easily this way.

Hover the mouse/arrow over a shape. You will see the object mean for each of the represented layers (Green, Red, and NIR in this case). See (a) below. If you changed the display to true color (Blue, Green, and Red), then it would show the object means for those three bands.

Click on an object. The outlines of image objects are visible..

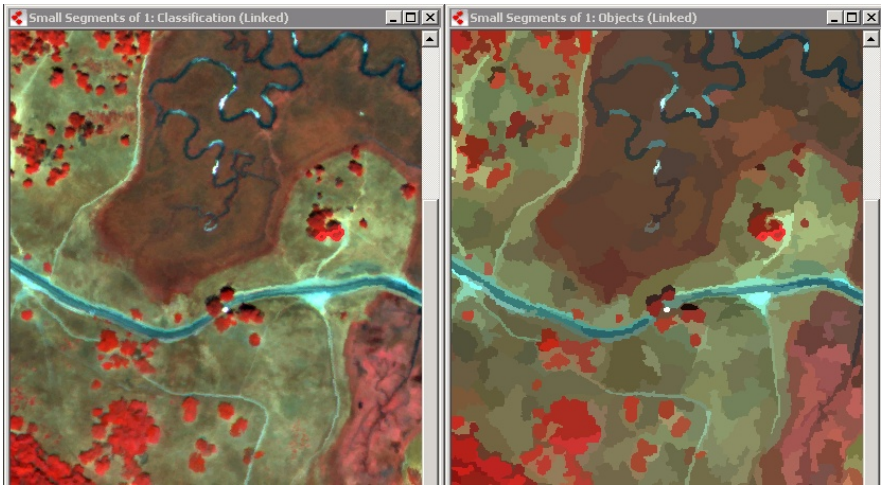
2. Click on  again to show the pixel view (b).
3. Click on  to show the object outlines (c).
4. Click on  again to show the object mean view, with object outlines (d).
5. Go to **View>Display Mode…>Edit Highlight Colors…** to change the **Outlines/Polygons** color to turquoise (e, f).



If you only see WHITE outlines, you have the *Classification View* toggled on. To see BLACK lines, or whatever color your set the outlines/polygons to be, click on the *Layer View*  .

6. Go to **Window > New Window**. A second window will appear with the same image. Click on the **Image Layer Mixing** button  to edit the display to the False Color composite.

7. Go to **Window > Link All** to link the two windows. Use the zoom tool to view how the two windows move together.



   a. Click on the left window and then click on the **Pixel/Object view** button  to get the pixel view. Click on the right side window and then click on the **Pixel/Object view** button  to get the object view.

   b. Navigate the image using the zoom functions to compare the information between the two windows. Evaluate the segmentation by using the buttons you just learned in this exercise. Remember to save your project periodically.

Zoom function tools

Perform ANOTHER segmentation

We will perform another segmentation with smaller segments, *building* on the one we just did. All of the outlines in the previous segmentation will be topologically maintained, which essentially means they will share boundaries.

1. Go to **Image Objects > Segmentation** or by clicking on  button to perform a segmentation.

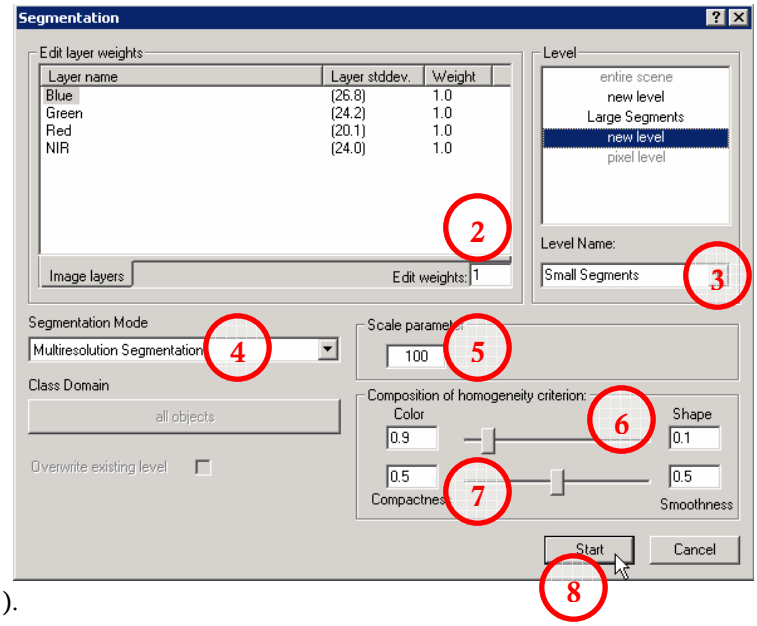
2. This time, keep all layer weights as **1**.

3. Click on **new** level *underneath* **Large Segments** to create segments small (or *under*) the **Large Segments** segments. Type **Medium Segments** as Level Name.

4. In the field Segmentation Mode, select **Multiresolution Segmentation** again.

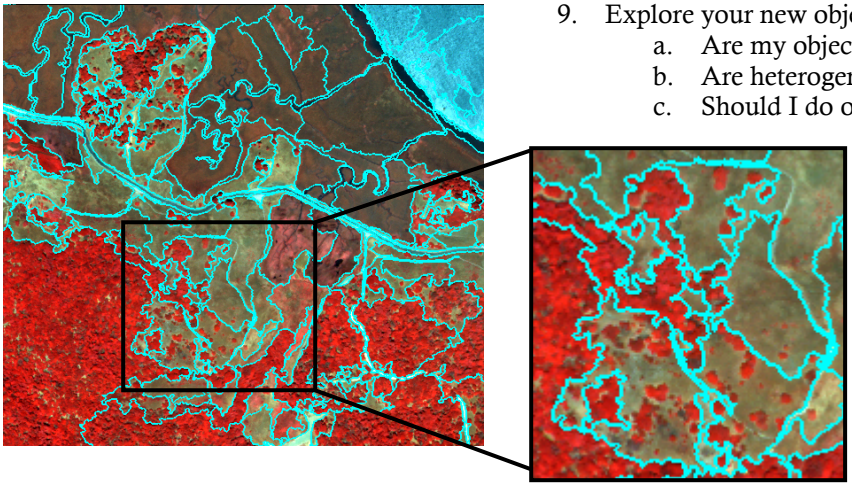
5. Enter **100** for the Scale Parameter.

6. In the Composition of homogeneity criterion, move the slider to the right until color is 0.9 (the shape factor will automatically change to 0.1).



7. Leave the defaults for Compactness and Smoothness (0.5 and 0.5).

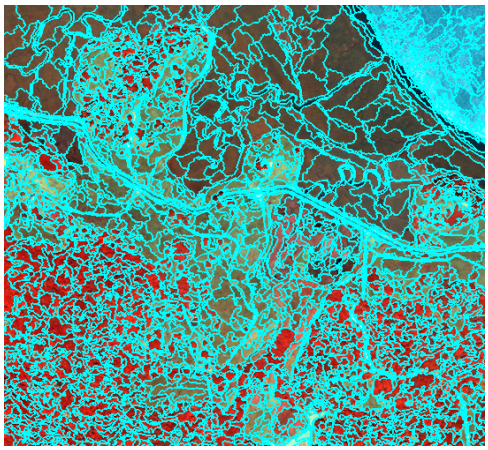
8. Click **Start**. It will take a few moments for the segmentation to complete.



9. Explore your new objects from your new segmentation. Ask yourself:
   a. Are my objects of interest being segmented adequately?
   b. Are heterogeneous areas getting segmented appropriately?
   c. Should I do one more smaller segmentation to get at fine-scale shrub patches?

Let's do one more smaller segmentation to make sure that the fine-scale shrub patches are segmented adequately.

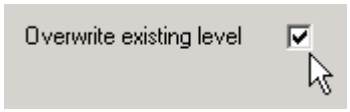
10. Segment again, this time making a **Small Segments** as a new layer *underneath* the level **Medium Segments** with all layers weighted at 1. Use the following parameters:
    a. Scale parameter = ***25***
    b. Color **0.9**, Shape **0.1**
    c. Compactness **0.5**, Smoothness **0.5**.



11. Explore the objects, zooming into the shrubs to see if they are now segmented properly.

12. If you are not happy with the segments, continue to segment until you are.

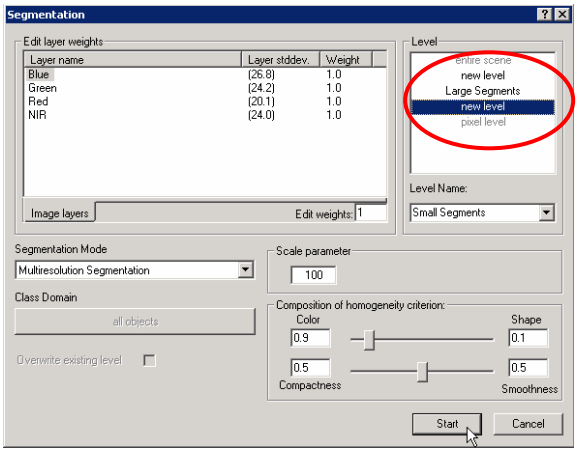
To delete a segment, click  and then click the segmentation level that you wish to delete.



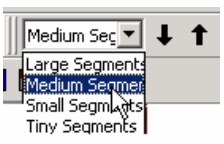
If you wish to *overwrite* a segmentation level during a new segmentation, click the "**Overwrite Existing Level"** AND select that level you want to overwrite in the Level list.

If you're different segmentation levels look the *same*, it's most likely because you clicked on **new level** *above* instead of *below* the **Large Segments** segmentation level.

When creating a segmentation level under or over an existing level, ***you must place it in the correct place in the Level List***. For example, you must place your new *smaller* segmentation level under **Large Segments**, but if you were creating a *larger* segmentation level with a Scale Parameter greater than 200, you could select **new level** *above* **Large Segments**.



Use the drop-down menu and arrows to move easily between segmentation levels.



Lesson 4: Classifying Objects Using STANDARD NEAREST NEIGHBOR

Definiens Professional offers two different ways to classify image objects: **nearest neighbor** and **knowledge-based rulesets**.

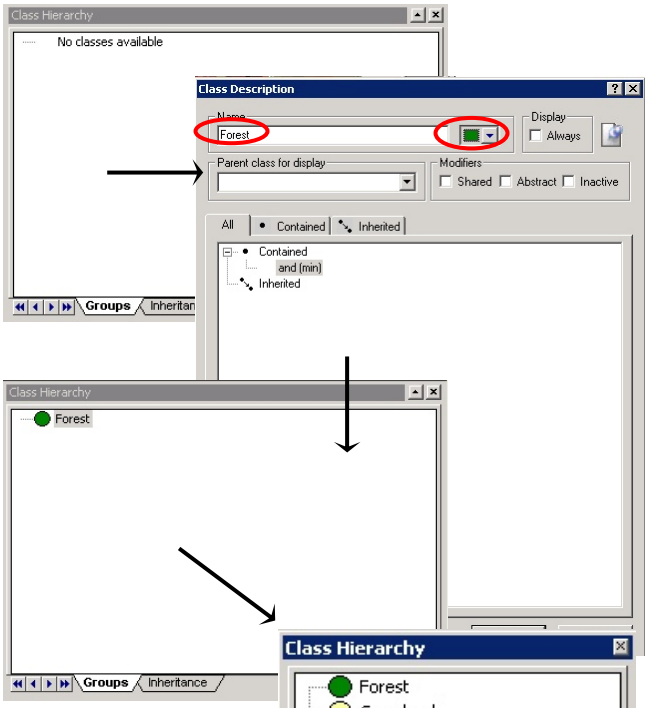
eCognition distinguishes between two types of Nearest Neighbor methods:

- Nearest Neighbor (NN): feature space can be defined independently for each individual class.
- Standard Nearest Neighbor (standard NN): feature space is valid for all classes in the project.

Both NN and standard NN **require samples for each class** as well as a defined feature space, which can be any combination of features except class related features. Starting with a few samples, it produces fast results that can quickly be improved by adding or editing samples.

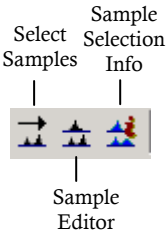
In this lesson, we will examine **Standard Nearest Neighbor (standard NN)**. You will collect samples of four different land cover types and classify the image using the nearest neighbor classifier.

1. Create a Class Hierarchy.
   a. If the **Class Hierarchy** dialog box is not open, go to **Classification > Class Hierarchy** or click on  to begin creating a classification scheme. It might already be open and anchored to the far right; if not, you can place it there if you like.
   b. Right-click in the **Class Hierarchy** dialog box and choose **Insert Class** to begin your classification scheme. A **Class Description** dialog box opens.
   c. Type **Forest** in the name textbox, select an appropriate color, and click **OK** at the bottom of the dialog box. The **Class Description** dialog box closes and the **Forest** class is added to the Class Hierarchy.
   d. Repeat these steps to add the following classes**: Grassland, Road, Trail, Water,** and **Wetland.**



NOTE: If you need to go back to the **Class Description** dialog box after creating a class, click on the class you want to edit and right-click on the class and to go to **Edit Class**.

2. Prepare to create samples for each class.
   a. Look for the Samples toolbar (depicted below). If you do not see the toolbar, go to **View menu > Toolbars > Sample**.
   b. In the Samples toolbar, click all three buttons depicted below: Select Samples, Sample Editor, and Sample Selection Information.



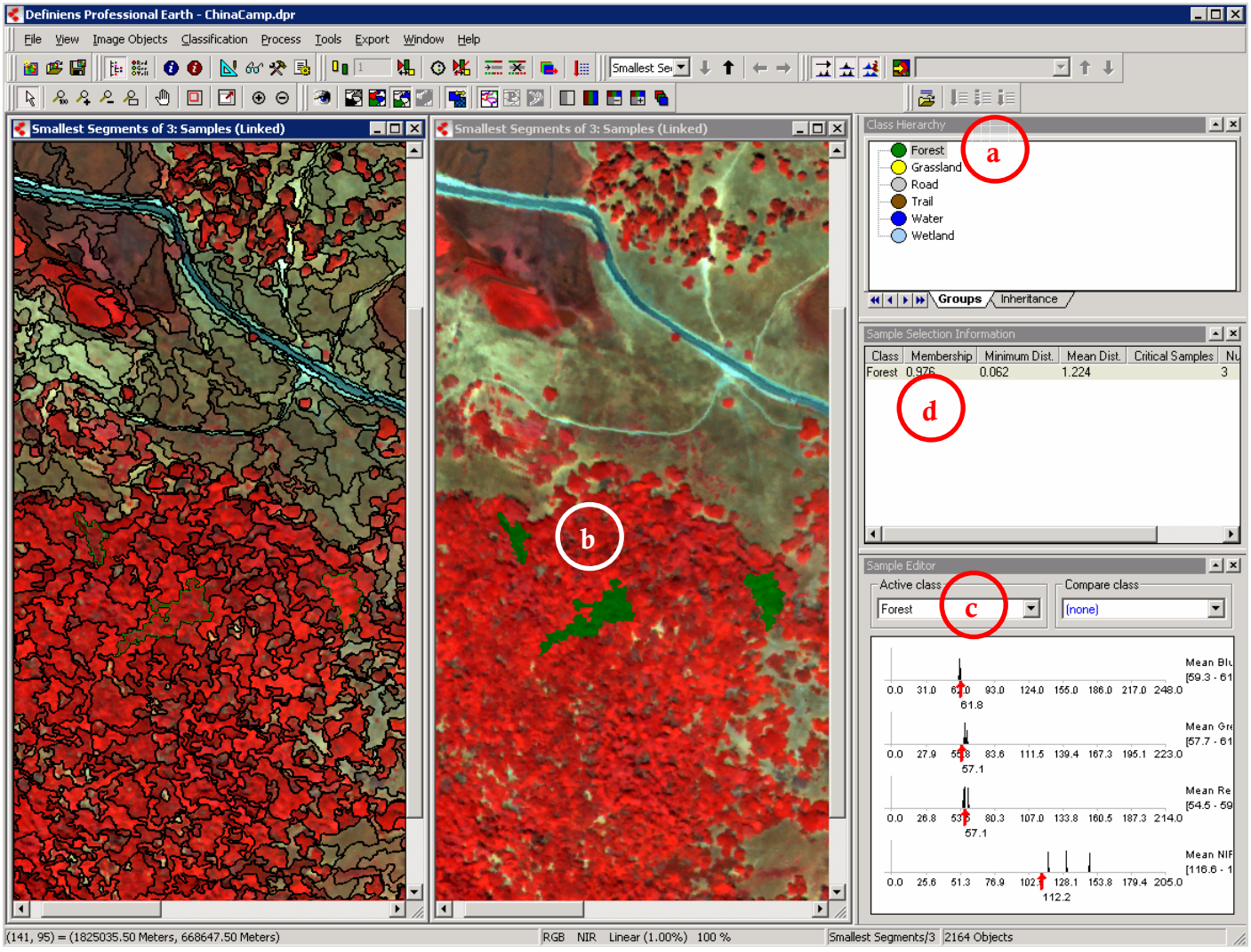
- Select Samples: enables Select Sample Mode, allowing you to select samples for each class.
- Sample Editor: allows you view the histogram of each samples, compare them with other samples within and across classes, to help you choose the most representative samples.
- Sample Selection Info: displays the membership, minimum distance, and mean distance of samples, to help you choose the most representative samples.
  - Membership: shows the potential degree of membership according to the adjusted function slope of the NN classifier.
  - Minimum distance: shows the distance in features space to the closest sample of the respective class.
  - Mean distance: shows the mean distance to all samples of the respective class.

3. Create samples for each class.
   a. With the Forest class selected (in both the Class Hierarchy and the Sample Editor), double-click on an object to designate it as Forest as forest sample.

b. Make 2-3 more samples. You will see them show up in the color for that class. To make it easier to view samples and objects at the same time, use two linked windows.

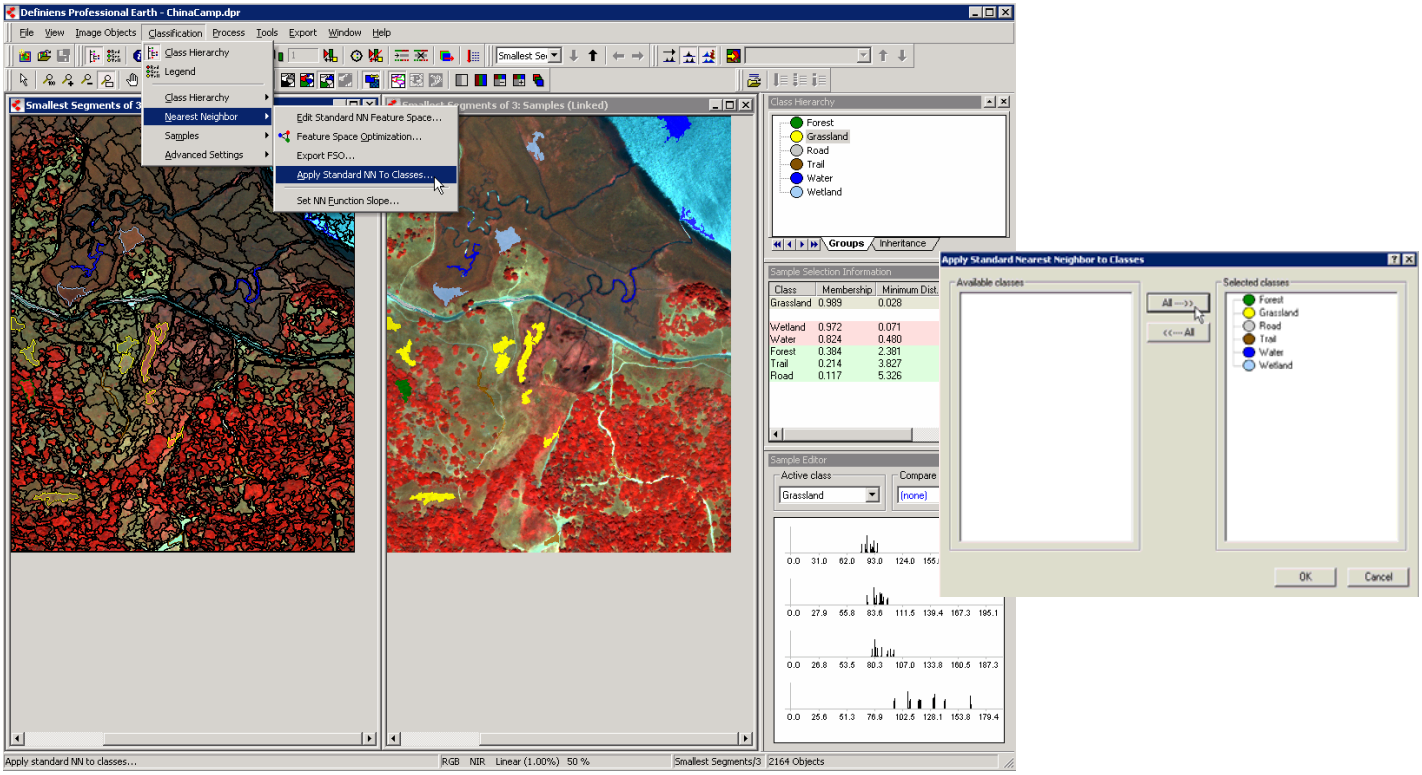
c. Notice how there are little black peaks now on the histogram. Each of these peaks represent a "signature" or the where the sample object's pixels fall in the histogram. When you click once on an object, a red arrow appears showing you were that object's pixels fall in relation to the other existing signatures.
   - Use the black signatures and red arrows to find the best samples. Do this by gauging whether a certain object is *too far* from existing signatures (in which case you don't use it), or somewhat far *but necessary* to include so that it is part of the class (in which case you use it).

d. Use the Select Sample Information window to see the membership (out of 1.00) of that object to the class you are selecting samples for. Again, if the object is *too far* from existing signatures (low membership), you may choose not to include it as a sample. However, even if it is somewhat far, you might find that it is *necessary* to include so that it is part of the class.



4. Add samples for all classes. When you are finished making your samples, go to **Classification > Nearest Neighbor > Apply Standard NN To Classes…**, choose to apply standard NN to **All** classes, and click **OK**.

Basically, what this does is generate a feature space of the **Means** of each band (in this exercise, it's NIR, R, G, and B). The layer means are the *default feature space* for the **standard NN**.



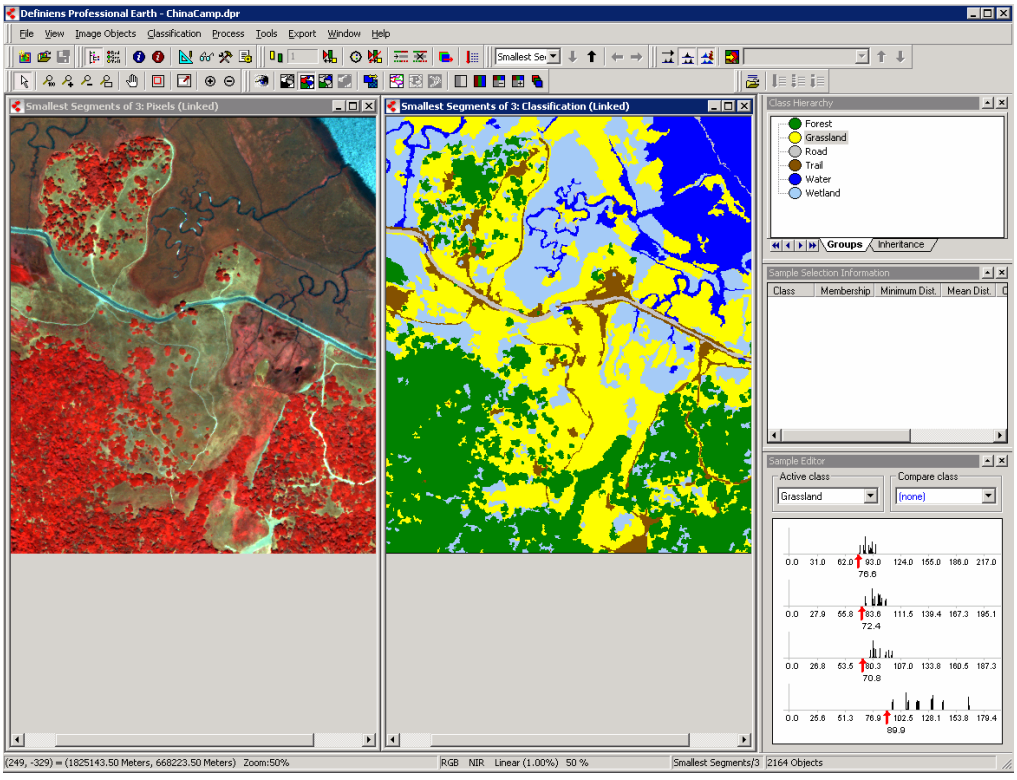
5. Click on the Classify button  and the Classification result comes up.

Examine your classification results. Your classification might look different from the one to the left, but look for unclassified and misclassified objects.

In the classification to the left, it looks like the Water class is **over**classified (where it should be Wetland), and the Grassland is **over**classified (where it should be Wetland).

Therefore, we can conclude that this classification to the left needs more Wetland samples.

Add, remove, and change samples, and click  again, until you get a satisfactory result.



Lesson 5: Classifying Objects Using NEAREST NEIGHBOR CLASSIFIER

Let's say, for example, that you were not happy with the results from the standard NN in the last lesson. For whatever reason, the Layer Means didn't give enough separation between classes, and you decide that you need different feature spaces for the different classes. The next step is to try NN Classifier.

In this lesson, we will examine **Nearest Neighbor (NN) Classifier**, where feature space can be defined independently for each individual class (unlike standard NN where feature space is valid for all classes in the project). Both NN and standard NN **require samples for each class** as well as a defined feature space, which can be any combination of features except class related features. Starting with a few samples, it produces fast results that can quickly be improved by adding or editing samples. The Nearest Neighbor classifier is Definiens' solution for a quick and simple classification of image objects based on given sample image objects within a defined feature space. After a representative set of sample objects has been declared for each class, each image object is assigned to the class of the nearest sample object in the feature space.

1. Delete previous classification by going to **Classification menu > Class Hierarchy > Delete Classification**.

You will now begin a new classification using **NEAREST NEIGHBOR CLASSIFIER**.

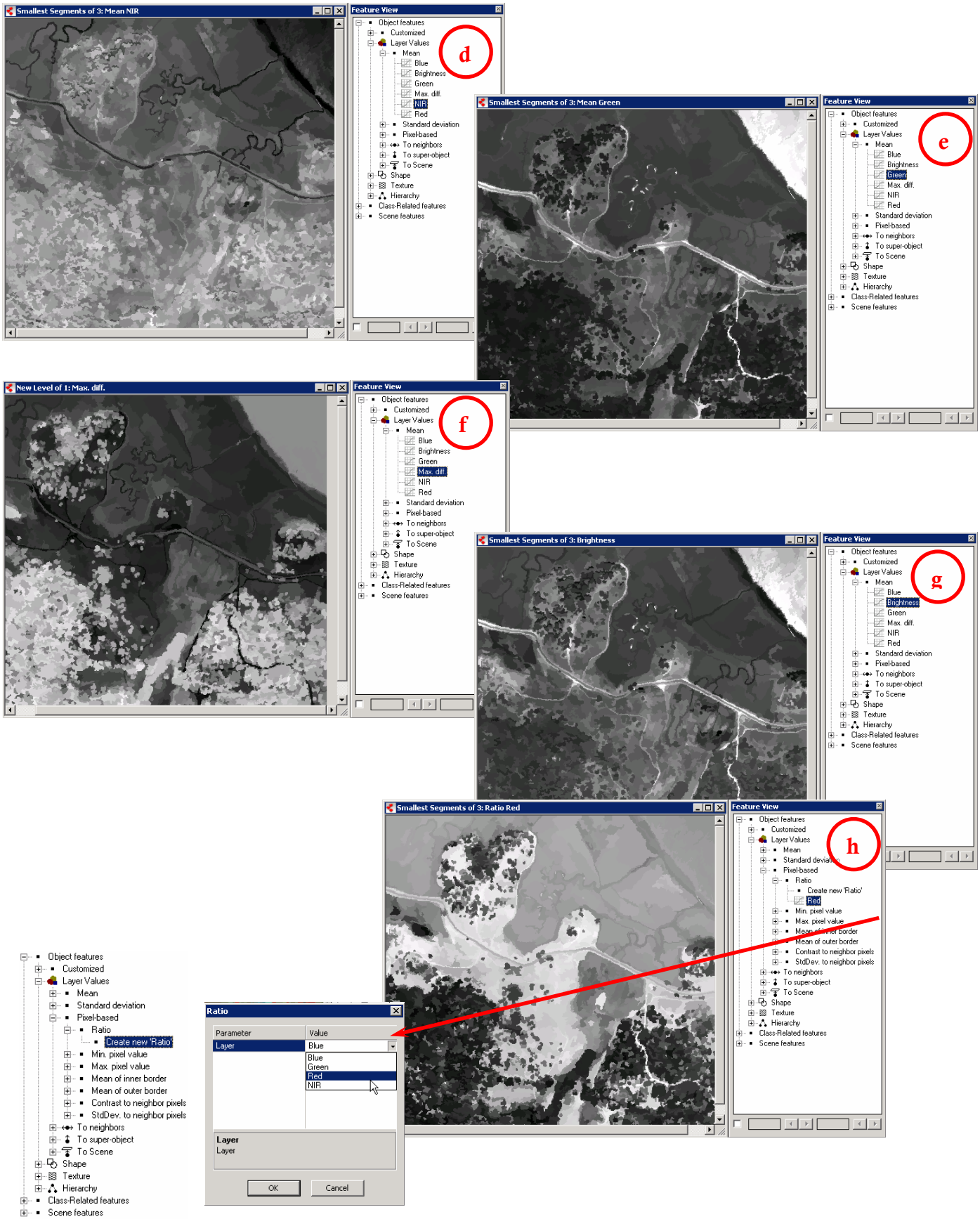
2. Explore the NN Feature Space.
You have already added your classes to your class hierarchy (from the last lesson). Now you need to define the Feature Space individually for each individual class. The Feature Space is an ***n***-dimensional combination of features used for calculating membership values (***n*** depends on how many features *you* choose!). To define the feature space, you will use the **Feature View** tool to visualize which features distinguish between classes best.

a. If **Feature View** dialog box is not open, go to **Tools > Feature View** or click on  button in the toolbar. You might need to anchor it to the far right side.
b. Expand the list of **Object Features**.
c. Expand the list of **Layer Values**.
d. Expand the list of **Mean** features, and double-click **NIR**. You are now viewing the mean NIR value for each object, ranging from ***White*** being the highest value to ***Black*** being the lowest value. Notice how the **Water** stands out.

   - Notice how the view mode is now in Feature View: 
   - In the Feature View, each object is displayed in a gray value according to its value in the feature that is selected for visualization. Objects displayed in red have not been defined for the evaluation of the chosen feature. The feature view is a powerful tool to find features separating different classes of image objects.
   - Double-click various features to determine which ones provide information to distinguish different classes in the image. Your goal is to look for objects that are identifiable. For instance, streams are distinctive in the mean NIR objects. To keep this exercise simple only look through **Layer Values** features and take note of a few that help to pull out certain classes.

e. In the expanded list of **Mean** features, and double-click **Green**. You are now viewing the mean Green value for each object, ranging from ***White*** being the highest value to ***Black*** being the lowest value. Notice how the **Grassland** differs from the **Wetland**.
f. In the expanded list of **Mean** features, and double-click **Max. diff.** You are now viewing the maximum difference of pixels within each object, ranging from ***White*** being the highest value to ***Black*** being the lowest value. Notice how the **Grassland** differs from the **Wetland**.
g. In the expanded list of **Mean** features, and double-click **Brightness**. You are now viewing the mean Brightness value for each object, ranging from ***White*** being the highest value to ***Black*** being the lowest value. Notice how the **Trails** stand out.
h. Expand the list of **Pixel-based** features, and double-click **Create new ratio**. Choose **Red** in the drop-down menu, and click OK. Under **Ratio,** double-click on **red.** You are now viewing the mean ratio-red value for each object, ranging from ***White*** being the highest value to ***Black*** being the lowest value. Notice how the **Forest** stands out.

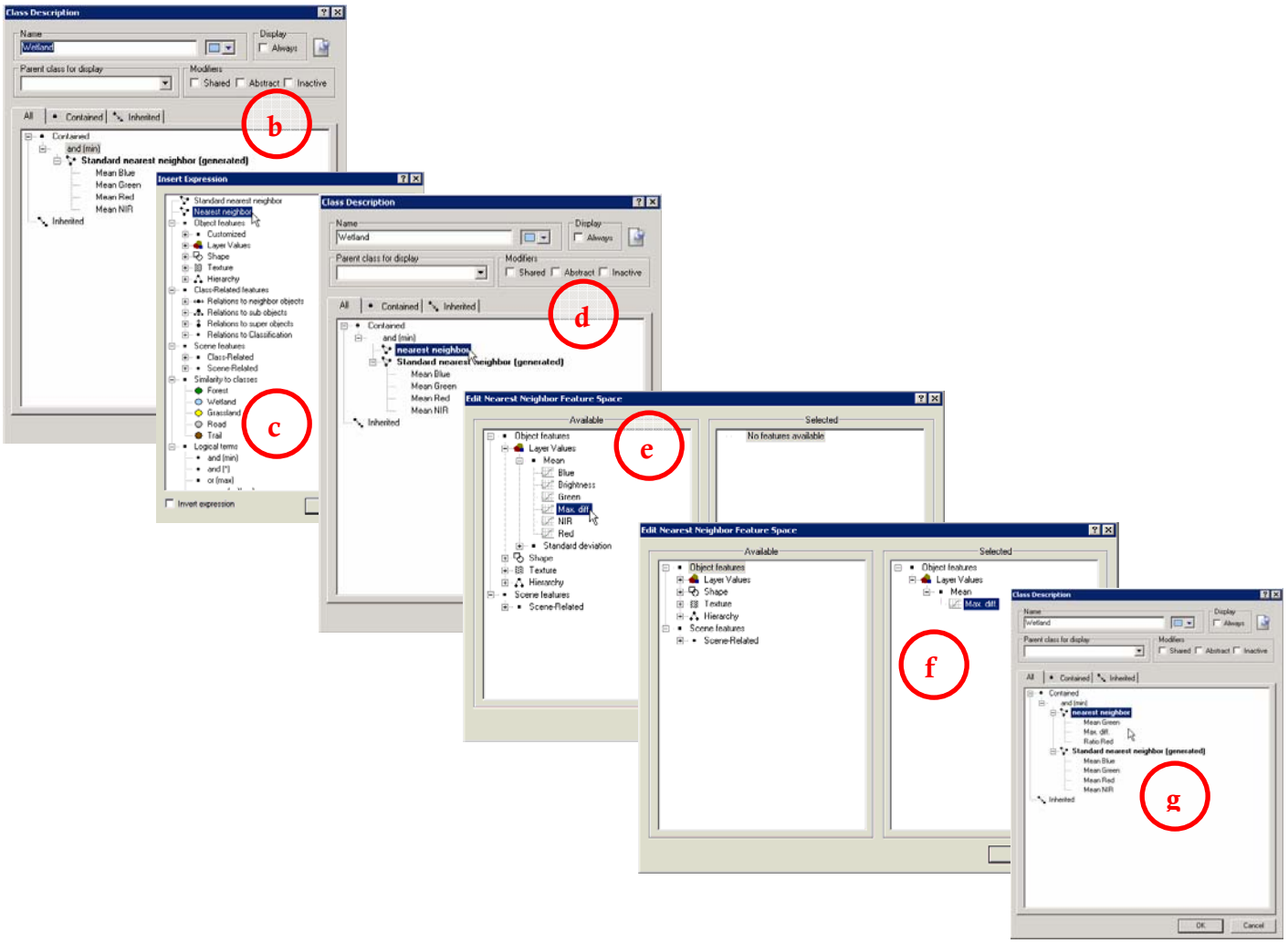
Snapshots of each of these feature space explorations are on the next page to guide you. You can also view the value by hovering over an object or by using the **Image Object Information** dialog box by clicking  .



Now that you know *which* features are good for distinguishing *which* classes, we'll define the NN Feature Space.

3. Define NN Feature Space for specific classes. We know we're having trouble differentiating **Wetland** from **Grassland**, so let's use **Mean of Max. diff.** and **ratio of Red** to help tell them apart.

a. In the Class Hierarchy, double-click on **Wetland** class.
b. The Class Description appears. In it, double-click on **and (min)**. This is how you add features to classes.
c. The Insert Expression dialogue appears. In it, click on **Nearest neighbor**, click **Insert**, then **Close**.
d. **Nearest neighbor** Feature Space now appears in your Class Description for Wetland, but you still have to tell it to look at the **Max. diff. Mean**.
e. In the Class Description, double-click on **nearest neighbor** to add a feature.
f. The **Edit the Nearest Neighbor Feature Space** dialogue opens. In it, on the left-hand side under the *Available* features, go to Object Features > Layer Values > Mean > Max. diff., and double-click on Max. diff. It is added to the right-hand side under *Selected* features. Also add ratio of Red. Then click OK.
g. You should now see the features under the **nearest neighbor** in the Class Description for Wetland.



h. Now do the same thing for the **Grassland** class.
i. Finally, if you have time, look for features that tell the **Trails** class apart from **Roads**, and add that to the NN classifier for the **Trails** class.

Keep the **Standard NN** Feature Space the same as the last lesson (all 4 layer means), and click the Classify button: 

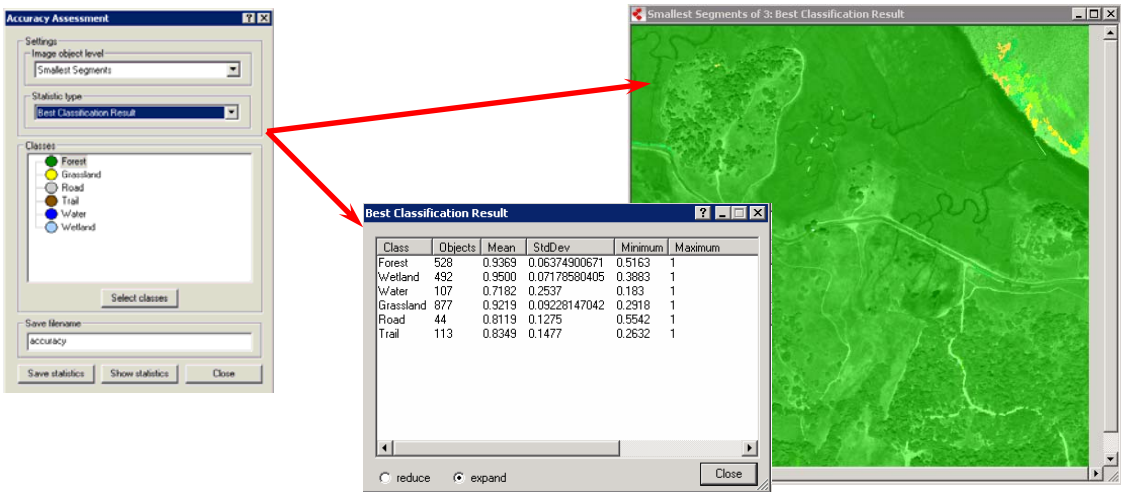
The new classification comes up. Compare this to what you remember from the last classification, which only took into account standard nearest neighbor (in other words, all classes had the same feature space). This classification uses different feature spaces for individual classes, and *should* therefore by a better result.

Lesson 6: Assessing Classification Accuracy

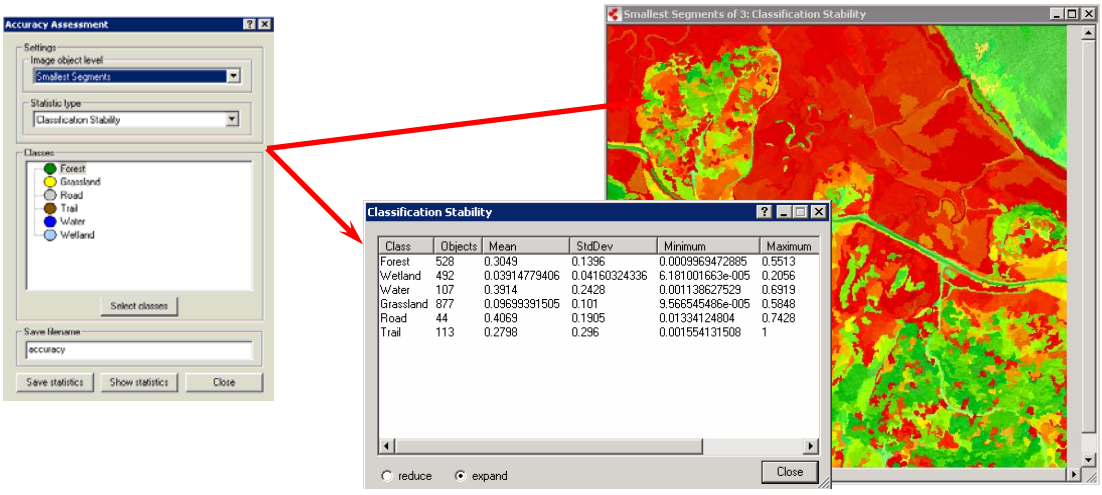
Definiens Professional offers two accuracy assessment tools: Classification Stability, Best Classification Result. In the *Classification Stability* mode, the objects are colored according to the difference in membership values of the best and second best class. In the *Best Classification Result* mode, the objects are colored according to their membership value.

Classification To view the membership values of the final classification

1. Go to **Tools > Accuracy Assessment…,** in the dialog box, click on **"Best Classification Result"** in the Statistic type drop-down menu, click on **Show statistics**. A dialog box appears to view accuracy assessment results (showing each class with the number of objects in each class, the mean, SD, min and max of membership) and the image changes to visually see the assessment (with the **dark green** areas being best classification results, the **yellow** and **orange** being less than good, and the **red** being poor).

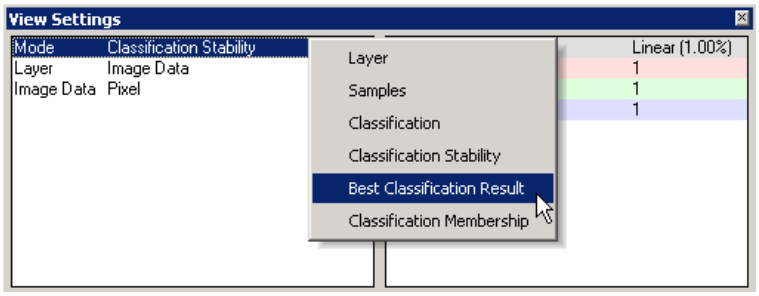


2. Close the statistics window, and choose **Classification Stability**. Click **Show statistics** to view statistics. A dialog box appears to view accuracy assessment results and the image changes to visually see the assessment. The classification stability indicates much of the class **Forest** is stable, thus distinctive from the other classes. In contrast, the wetland area in the upper left area of the image is not distinctive and is in fact areas are misclassified into the **Grassland** class.



3. Close the statistic dialog box, close the accuracy assessment dialog box and you will see that the classification result visual will also close.

4. Go to **View > View Settings** or click on  button in the toolbar. Click on **Mode** and from the drop-down menu, select **Best Classification Result.** Move the mouse over image objects and the membership value will display. This allows for more interaction with the accuracy assessments and the individual objects.

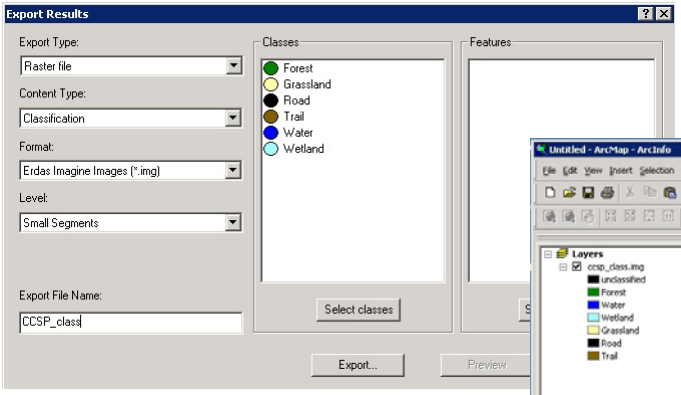


The view setting also allows the user to change the view from pixels to object mean by clicking on Image Data. When the Image data is set to pixels and Mode is one of the classification images, a semi transparent view appears. In contrast, a thematic map is displayed when object mean is displayed.

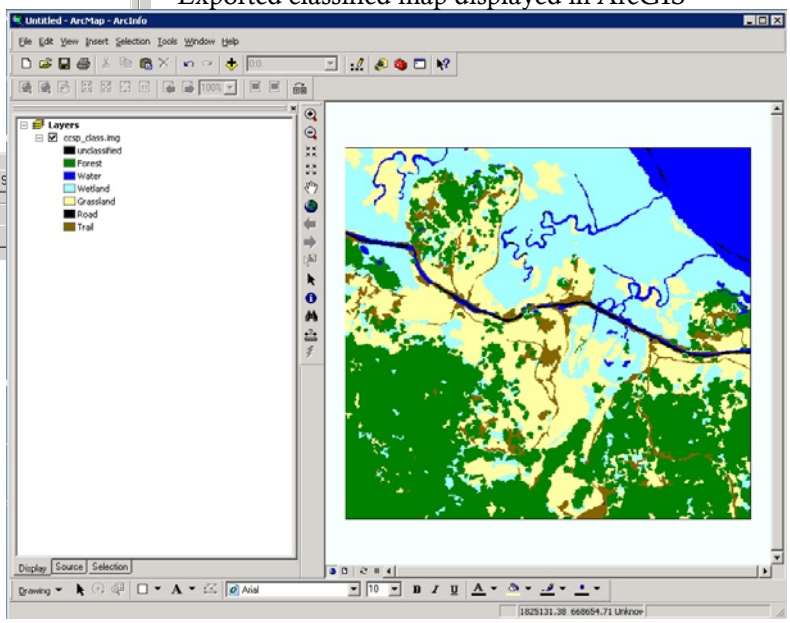
Lesson 7: Exporting Your Results

Classification results can be exported as vector or raster data. Additionally, statistical information and object attributes can be created and exported with the data.

1. Go to **Export > Export Results…**, select **Raster file** in the *Export Type* drop-down menu.
2. Select **Classification** in the *Content Type* drop-down menu, select **Erdas Imagine Images (*.img)** in the *Format* drop-down menu.
3. Name the file CCSP_class.img in the *Export File Name* text box.
4. Click on **Select classes** and **All** when the dialog box appears, click **OK**.
5. Click **Export** and select the **data** folder to save the new file.
6. Open in **Erdas Imagine** or **ESRI ArcGIS** and view your new data file.



Exported classified map displayed in ArcGIS



Supplemental Lessons

These supplemental exercises are designed to allow you to experiment with the segmentation and classification of several different datasets, including

- Color-infrared photography: 0.2-m CIR (NIR,R,G) aerial photography; downloaded from the Integrated Regional Wetland Monitoring Project (www.irwm.org), and clipped using Erdas Imagine.
- NAIP imagery: 1-m true-color (R,G,B) aerial photography; downloaded from State of California website (http://new.casil.ucdavis.edu/casil/remote_sensing/naip_2005/), and clipped using Erdas Imagine.
- LiDAR: 1-m; segment downloaded free from NCALM website (http://calm.geo.berkeley.edu/ncalm/index.html)
- Quickbird 2.4-m in multispectral (NIR,R,G,B)/0.6-m in panchromatic; borrowed from Definiens Professional training data
- IKONOS: 4-m in multispectral (NIR,R,G,B)/1-m in panchromatic; borrowed from Definiens Professional training data
- Landsat imagery: 30-m multispectral (NIR,R,G,B); downloaded from State of California website (http://gis.ca.gov/data.epl)

1. Open the /CIR/CIRphoto_20cm.img and segment using following parameters to start:

- Scale parameter 100
- Color/Shape: 0.9/0.1
- Smoothness/Compactness: 0.5/0.5

Then try building an object hierarchy: Segment one level lower (to aim for any heterogeneity within focal objects), and one level higher (to aim for general objects).


Original image


Objects at focal level (imagery with object outlines)

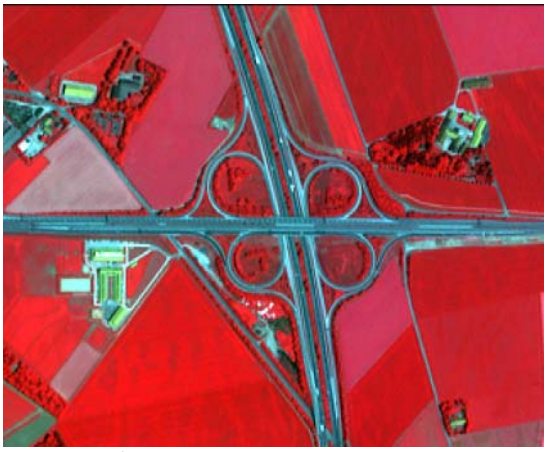

Objects at focal level (object display)

2. Practice segment with datasets from multiple sources. Open a new project and add the NAIP and LiDAR .img files.

a. Display in true color with the addition of LiDAR elevation to represent elevation in combination with RGB.
b. Experiment with different weights during the segmentation project, making LiDAR weighted 1 while the NAIP layers are weighted 0.5, and vice versa.
c. Practice classifying vegetation without the valuable NIR band! Use band ratios, i.e. G to R to try and capture the different between green reflectance and red absorption.

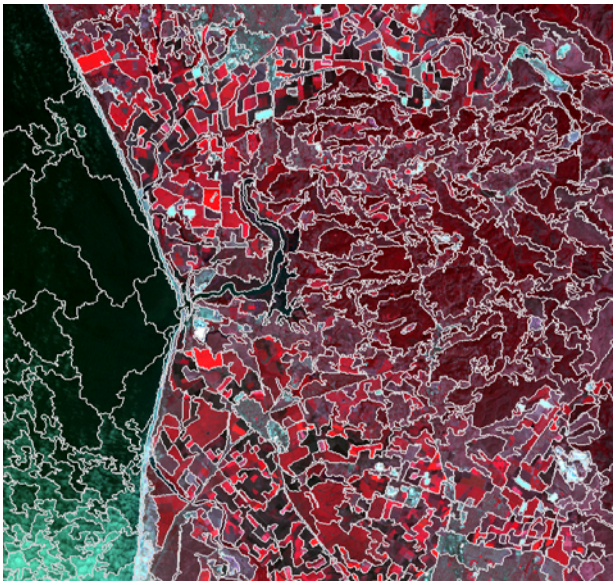
3. Using the IKONOS data OR the Quickbird data, experiment with data of different spatial resolutions. Both these have 4-m multispectral bands (NIR, R, G, and B), and 1-m panchromatic band.

If you weight the panchromatic band a lot more than the multispectral bands, you can get fine-scale segments at the smaller resolution.


IKONOS image


Quickbird image

4. If you are interested in how eCognition works with coarser imagery, experiment with the Landsat image of the Bay Area.
a. Be sure to use the **Subset** when you first add the imagery. Otherwise, the segmentation will take too long.


Landsat 7 image, zoomed into Elkhorn Slough area in Monterey County.

