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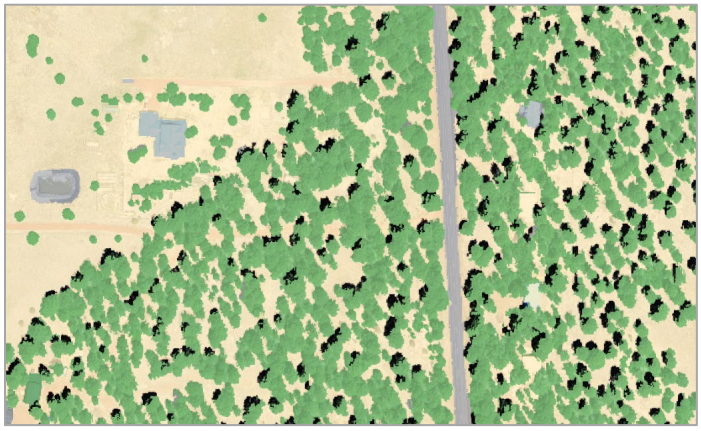
EXERCISE 2
Object-Based Image Classification



Introduction

Object-based image classification offers advantages to pixel-based classification. Pixel-based classification only uses spectral information, but object-based classification, much like human visual recognition, can use shape and spatial relationships to classify objects. In this exercise you will learn how to select training samples and run an object-based supervised classification in ArcGIS Pro.

Objectives

- Learn how to conduct an object-based image classification in ArcGIS Pro
- Learn how to select training samples

Required Data

- **NAIP.tif**- NAIP imagery for reference
- **Composite.tif** - composite multiband raster from exercise 1
- **tree_segment.tif** – segmented output from exercise 1
- **Kaibab_class.ecs** – classification schema

Prerequisites

- **Esri ArcGIS Pro installed on computer and a basic understanding of how to use GIS.**
- **Complete Exercise 1**

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Part 1: Set up ArcGIS Pro Project

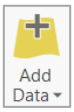
For this exercise we will work off the Segmentation_Classification project from exercise 1. If you already have the project open and data loaded skip to Part 2.

A. Open Project

1. Launch ArcGIS Pro from the start menu by clicking **Start, Programs, ArcGIS, ArcGIS Pro**.
2. Navigate to your Exercise 1 file location.
3. Open the **Segmentation_Classification** project.

B. Load the Project Data

1. In the Map tab click **Add data.**



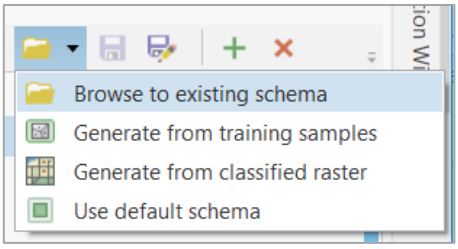
2. Navigate to your outputs from Exercise 1.
3. Select **Composite.tif** and **tree_segment.tif**
4. Click **Ok** to add to map.
5. Click **Add Data.** Navigate to the course downloads folder. Select **NAIP.tif**
6. Click **Ok** to add to map.

Part 2: Select Training Samples

The Training Sample Manager can be used to easily collect and evaluate pixels or object samples. We will use the Training Sample Manager to select training objects. The classifier will use object attributes, such as shape and compactness when executing the classification.

A. Open the Training Sample Manager and load schema

1. In the table of contents select **tree_segment.tif**
2. Open the **Imagery** Tab.
3. In the **Classification Tools** drop down menu open the **Training Sample Manager**. The default NLCD schema will load.
4. In **Training Sample Manager** Click the drop down menu next to the yellow folder. Click **Browse to existing schema.**

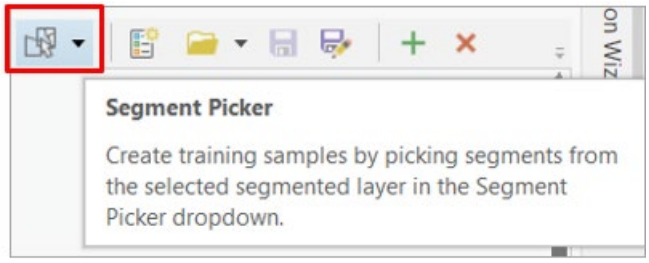


5. Navigate to your course downloads folder. Select the **Kaibab_class.ecs**.

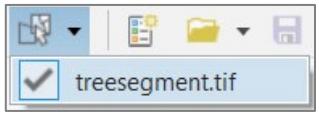
Note: The default classification schema in ArcGIS Pro is National Land Cover Dataset (NLCD) 2011. If you are working with your own data, you can start with the default schema and add or remove categories as necessary using the plus and minus buttons.

B. Select Training Samples

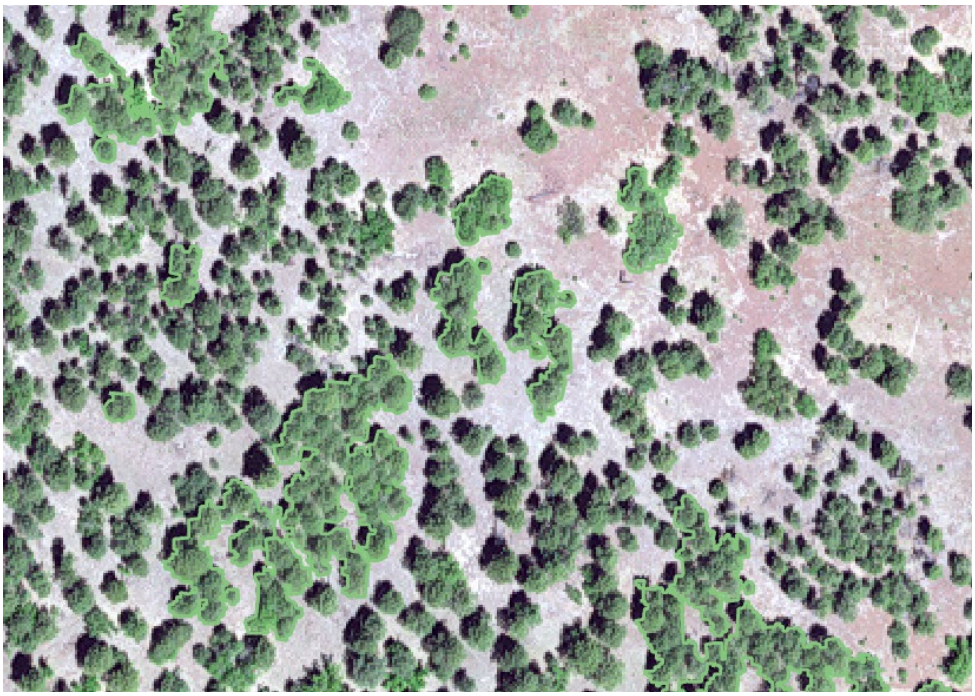
1. In the Table of Contents turn off the segmented image to view the NAIP imagery.
2. Click the Select **Segment Picker** Tool.



3. Click the dropdown menu next to the segment picker tool and make sure **tree_segment.tif** is selected.



4. Click the **forest** class in the classification schema.
5. In the map pane, **double click** on a tree to select it as a sample. The segment outline will turn green when it is selected (see below).



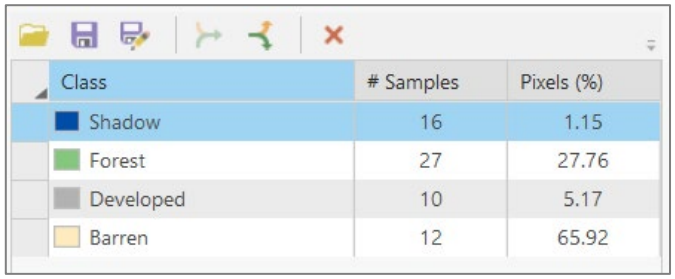
6. **Pan** and **zoom** around the image to select segments. Collect samples across the entire image to account for variations in the imagery. Collect samples that capture all types of tree

segments (large and small, bright and dark, individual trees and clusters). A strong set of training data covers all the unique segments in your image. You can turn on and off tree_segment.tif to help identify objects for samples.

7. If you want to remove a sample, select that sample in the training sample manager and click the red x to delete it.

8. Select about **25 samples** for the forest class.

Note: The Training Samples Manager tells you the number of samples and percent pixels in each class. You can merge samples of the same class to summarize these values. When you use the segment picker, # Samples tells you the number of segments you have selected. If you draw polygons to select pixels # Samples will tell you the number of pixels you have selected. The number and percent pixels are important when using classifiers that assume a normalized distribution such as Maximum Likelihood but is less important for this exercise.



9. Next, move on to the shadow class. Click on the **shadow** class to select it in the classification schema.
10. Using the same process from steps 3-7, pan and zoom around the image to select about 15 shadow segments.
11. Repeat steps 3-6 for the remaining classes. Select about 15 samples for the developed and barren classes.
12. When you are satisfied with your training data click the **Save As** button. Name the samples and save to your desired location.

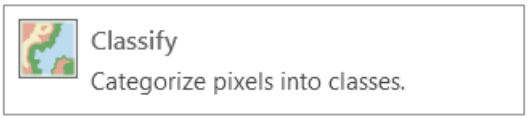
***Note**: Remember that photo interpretation takes practice and familiarity with an area. Choosing samples is often an iterative process where you select an initial set of samples, run a classification, and evaluate the classification, then go back to the Training Sample Manager and add or remove samples based on misclassifications.*

Part 3: Classify Segments

In this step we will use the Classify tool to classify segments from exercise 1. First, we will train the classifier with the samples and then classify the remaining features.

A. Classify Segments

1. In the Table of Contents, **select Compsite.tif**
2. Click on the **Imagery** Tab, **Classification** Tools, then **Classify** to open the Image Classification tool.



3. For Classifier select **Support Vector Machine (SVM)** from the drop down. SVM is a robust classifier that performs well classifying datasets with many attributes and a limited number of samples. Compared to other common classifiers, SVM is not as susceptible to noise or unbalanced training samples.
4. Set **Maximum Number of Samples per Class** to **0**. This will use all training samples to train the classifier.
5. Select **tree_segment.tif** from the **Segmented Image** dropdown menu.
6. For **Segment Attributes** select **Active chromaticity color, Mean digital number, Count of pixels** and **Standard deviation**.

Note: There are several other object attributes that can be used in classification, but it is not necessarily better to use all the attributes, only choose attributes that represent objects. Mean and standard deviation are only available when you specify an additional raster for classification.

7. Name the output classified data set **classified_tree**
8. Name the Output Classifier Definition file **svm_tree.edc**
9. **Click** Run.

B. Evaluate the Classification

1. Since we are primarily interested in tree cover, we will change the symbology to evaluate the forested class. Select the **classified_tree** in the table of contents. In the Raster Layer tab click Symbology to open the symbology pane.

2. Right click on the color box for **Shadow**.
3. Click **Format Symbol**.
4. Change to **No Color**.
5. Repeat steps 2-4 for Bare and Developed.
6. In the **Appearance** tab set the **transparency** to **30%** so you see the forest class over imagery (see below).

7. Pan around the image to evaluate your results. Do you see any areas classified incorrectly? Are there consistent misclassifications such as trees classified as shadows? If so, do you have training samples of these areas? Segmentation and classification rarely produce desired results on the first try. Refining a classification may involve altering the classification schema, segmentation parameters, samples or classification methods.

Congratulations! You have successfully completed this exercise. You now know the basics of object-based image classification and how to classify objects in ArcGIS Pro. You now know how to complete these steps to conduct your own object- based image classification.