GST 103: Data Acquisition & Management Lab Series

Lab 6: Raster Data Structure

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Organization: Del Mar College
Author: Richard Smith

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Introduction

This lab is part of a series of lab exercises designed through a grant initiative by the National Information, Security & Geospatial Technologies Consortium (NISGTC), funded by the United States Department of Labor in partnership with the Department of Education under the Trade Adjustment Assistance Community College and Career Training Grant Program (TAACCCT).

Your instructor may require that you provide screen captures, exported files and database designs (as directed in the lab). Please check with your instructor for the requirements specific to your class.

Raster data is a data model used in GIS, represented in a grid. Each grid cell can contain a value representing an attribute or the level of some attribute. For example, a satellite image of an area where each cell's value represents the temperature of the location. Accuracy is measured with the resolution of the smallest measureable object on the image itself. We use raster data as backdrops or functional layers when digitizing and performing analysis.

This lab includes the following task: Working with Statistics, Pyramids, and Attributes of Raster Data.

Objective: Explore Raster Data Structure

In this lab, we will examine some of the attributes of a raster data image, such as the resolution and the compression. We will also discuss collection of statistics and building pyramids for imagery.

Lab Settings

Required Virtual Machines and Applications

Windows Machine User Account	Train
Windows Machine User Password	Train1ng$

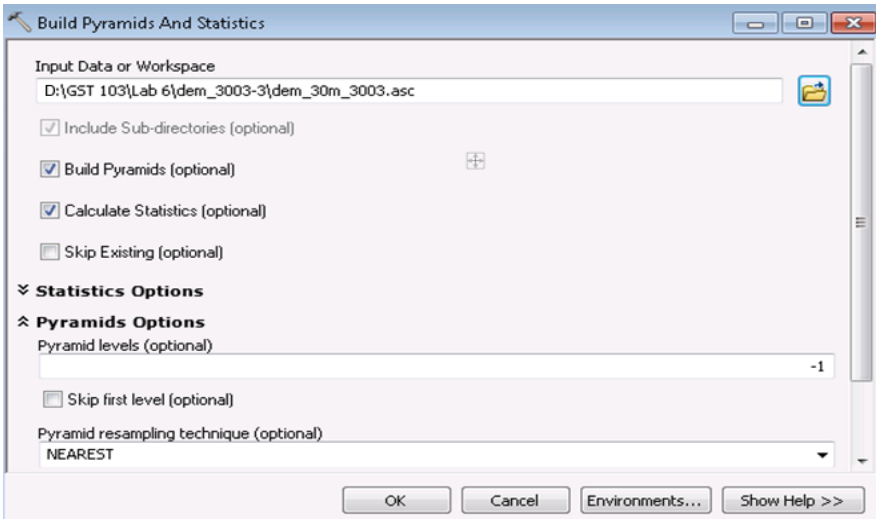
1 Statistics, Pyramids, and Attributes of Raster Data

Understanding raster data is important; as it is becoming more and more available we need to ensure we know how to work with it effectively. We will be looking at a few attributes of raster data. We need to look at the attributes of the image such as the resolution and the compression. These all factor into how the image may be used. We must remember that rasters are not only images. We may also have a surface model, which is in a raster format, where similar concepts apply.

1. Log into the computer, using the information provided in the Lab Settings section.
2. Click **Start->all Programs->ArcGIS->ArcMap 10.1** to a blank map.
3. Connect to the *Lab 6* folder.
4. Add the dem_30m_3003.asc image file from the Lab 6\dem_3003-3 folder to the map display

Before we use imagery such as satellite imagery or aerial imagery, we should always collect the statistics and build pyramids for the imagery. The statistics give us an idea of the colors and the distribution of the data. Pyramids are a way of compressing the data and speeding up the display time of an image.

5. Open the **Search** tab. Type `Build Pyramids and Statistics.` The tool is located in the **Data Management** toolbox (**ArcToolbox->Data Management Tools->Raster->Raster Properties->Build Pyramids and Statistics**). Open the tool.
6. For the Input Data, browse to the dem_30m_3003.asc image and select it.
7. We will be building the pyramids and calculating the statistics for the image so leave those boxes checked. Uncheck **Skip Existing** as we want to recalculate all the values (see the screenshot below).
8. Leave all the Statistics Options and the Pyramids Options as their defaults for the first run. Click **OK**. It may take some time to finish, as it is a complex process that is run on the imagery.



9. Once the calculation is complete, you will notice that the image renders faster when zoomed in or out. This is due to the pyramids that were constructed. If you right-click on the image in the Table of Contents and go to **Properties** and to the **Source** tab we can see the statistics have been calculated.
10. You can also see that the pyramids have been built using the Nearest Neighbor resampling method. There are 3 methods we can use to resample: Nearest Neighbor (uses the value of the nearest cell to determine the value of the cell in question), Bilinear (interpolate a value from a weighted distance average of the four nearest cell centers), and Cubic (determines the value of the cell by fitting it to a smooth curve over the 16 nearest cell centers). We will now rebuild the pyramids using the other methods and you will look at the differences.
11. Zoom into the image close enough that you can see the individual pixels. When you build your pyramids using the other resampling methods, you may want to focus in on a small group of pixels to see how they change. It will be very subtle.
12. Open the **Build Pyramids and Statistics** tool again. Uncheck **Skip Existing**. Go to the **Pyramids Options** dropdown section, change the **Pyramid Resampling Technique**, from **NEAREST** to **BILINEAR**, and click **OK**.
13. Repeat Step 12, replacing **BILINEAR** with **CUBIC**.
14. Right-click on the dem_30m_3003.asc image and go to the Source tab to view the Statistics.

The resolution is determined by the cell size. The number of bands in an image determines what kind of image it is and in what instances it can be used. Format refers to the file extension. The pixel type is the format the pixel values are in, such as float or integer. Pixel depth is the spectral resolution, which means the value that is captured in each cell can only, be between 0 and 255 values if the pixel depth is 8bit. Compression describes the way the image has been made smaller.

15. Examine the image properties and complete the table below:

Resolution	
Pyramids	
Compression	
Pixel Depth	
Number of Bands	
Format	

Conclusion

In this lab, we focused on looking at raster images and their attributes such as resolution and pixel depth. Each image will have different characteristics and it is important to note that various raster datasets have various uses. Not all raster datasets are images.

Discussion Questions

1. What is a raster dataset?

2. Compare raster and vector by discussing their various uses. Explain how one type of dataset would be preferable over another and the pros and cons of each.

3. Why do we use raster data?