Lab Assignment 1 - Introduction to Lidar

Due Date – 12/11/2020 - 100 Points

Overview

The objective of the first lab assignment is simply to familiarize yourself with lidar data and applications that utilize the technology. Specifically, by the end of the lab you will:

- Familiarize yourself with a scientific manuscript on a lidar application of interest
- Learn the basics of using lidar files within ArcGIS

Tasks

Part 1 - Annotated Review - 50 Points

Use a scientific journal search engine of choice (such as Google Scholar) to find a recent (within the last 10 years) journal article that involves an application of lidar data. You are free to select any scientific paper that you like, as long as it involved some aspect of lidar (data collection, data processing, data analysis, etc.). You are encouraged to pick a topic of interest to you.

After you selected an article, read it. It's understandable (and highly likely) that at this point you are new to lidar. Some of the concepts and terms may be unfamiliar to you. Do the best you can to at least understand the overall gist of the application.

Write a review of the article **(~1 page max, single space)**. Include the following in your report:

[1] (5 Points) A citation of the article (authors, year, title, journal, volume, page numbers)

- You are free to select a citation style that you are most familiar with

[2] (20 Points) A couple of paragraphs that summarize the research (Review Component):

- What did the authors do? (e.g. summarize what they did in your own words)
- How did they do it? (e.g. what type of lidar platform did they use?)
- Why did they do it? (e.g. what were they trying to show or measure?)

[3] (20 Points) A couple of paragraphs that summarize your thoughts (Analysis Component):

- Did you like the article? Was it interesting?
- Did the article make sense? Were any parts over your head?
- Do you think the research has value, either to the scientific community or the public?

[4] (5 Points) A copy of the article's abstract

- Include on a separate page after your 1 page review / analysis

Other Information:

- Do not simply restate the article, report the article in your own words.
- You must review a full-length research manuscript (not a web site).

List of Potential Journals:

- Photogrammetric Engineering and Remote Sensing
- Remote Sensing of Environment
- Transactions on Geoscience and Remote Sensing
- International Journal of Remote Sensing
- Transactions of the American Geophysical Union
- Journal of Photogrammetry and Remote Sensing

Part 2 - Exploring Lidar Data in ArcGIS - 25 Points
On your own, browse through some of the ESRI online documentation on lidar data. You can start with the following sites, but feel free to explore others on ESRI's website.

http://desktop.arcgis.com/en/arcmap/latest/manage-data/las-dataset/using-lidar-in-arcgis.htm
http://desktop.arcgis.com/en/arcmap/latest/manage-data/las-dataset/what-is-a-las-dataset-.htm
http://desktop.arcgis.com/en/arcmap/latest/manage-data/las-dataset/lidar-point-classification.htm
http://desktop.arcgis.com/en/arcmap/latest/manage-data/las-dataset/geoprocessing-and-las-datasets.htm
http://desktop.arcgis.com/en/arcmap/latest/manage-data/las-dataset/-as-points-in-arcmap.htm

In particular, focus on the following topics:

- Brief overview of lidar technology
- How to import and view lidar datasets in ArcGIS
- How to edit and access lidar data in ArcGIS

Based on what you learned in the Lecture 1 and on ESRI's website, answer the following questions in your lab assignment submission, following the annotated review:

[5] (5 Points) Assume you have a file with lidar data. Name **three (3) attributes** of the lidar data that could be used to symbolize the data in ArcMap. Assume you are not doing any processing to the lidar data (such as creating surface model) and you are only displaying the raw data points.

[6] (5 Points) List **two (2) tools** that can be used on lidar datasets in ArcMap to convert the data into a raster format and then briefly explain (one sentence) what each does and how they differ.

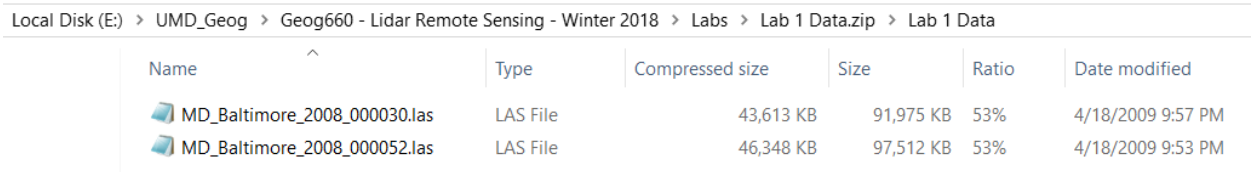
[7] (5 Points) Briefly explain **two (2) methods and/or tools** in ArcMap for changing the classification codes of lidar data. (As in, for example, classifying data points as water or noise.)

[8] (5 Points) What is the **most common file format** for exchanging lidar data and what is the name of the **organization that developed it**? Is this file format **ASCII or binary**?

[9] (5 Points) Name **three (3) types of ESRI datasets** that are compatible with lidar data files.

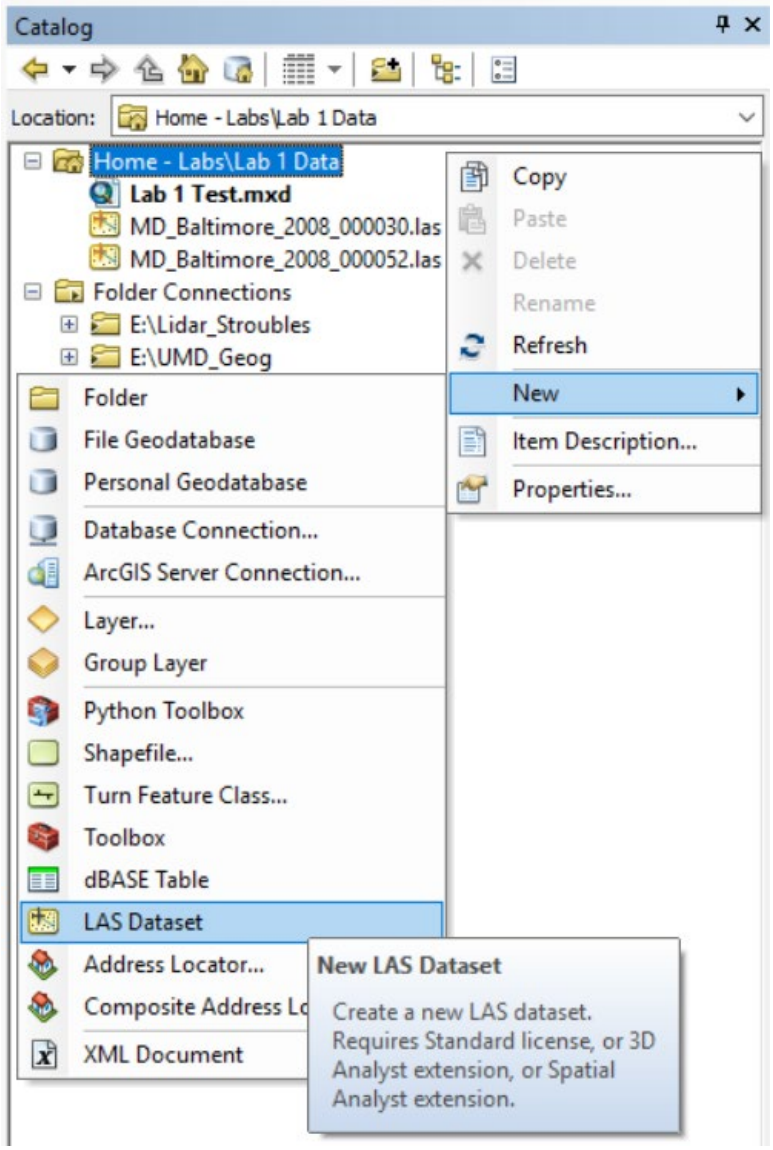
Part 3 - LAS Datasets and the LAS Dataset Toolbar - 25 Points
In the Lab 1 assignment page on ELMS, I have provided two (2) LAS files in a ZIP file. These LAS files contain lidar data for two tiles of a lidar survey performed for Baltimore, MD in 2008.

Download the ZIP file and save it in a working directory for Lab 1. Extract the LAS files.

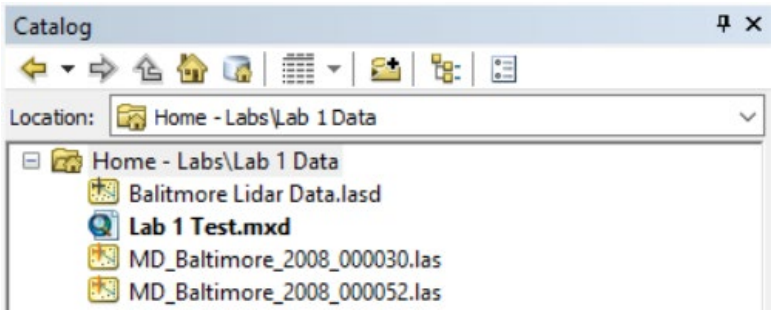


Open ArcMap and create a new Map Document (MXD) and save it in your working directory.

The first step to using lidar data in ArcMap is to create a LAS Dataset file. You can create one using the ArcCatalog. Create a new LAS Dataset in your working directory.

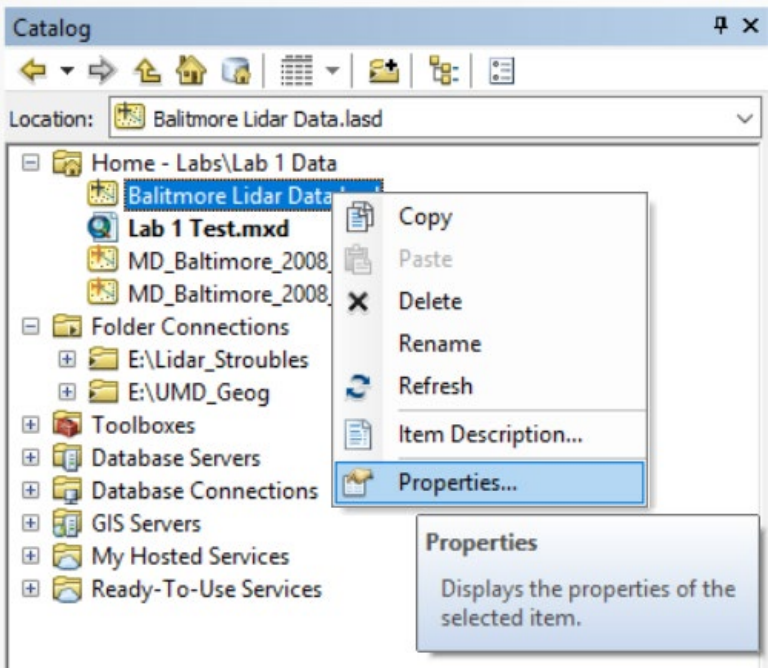


You should now have the following files in your working directory:

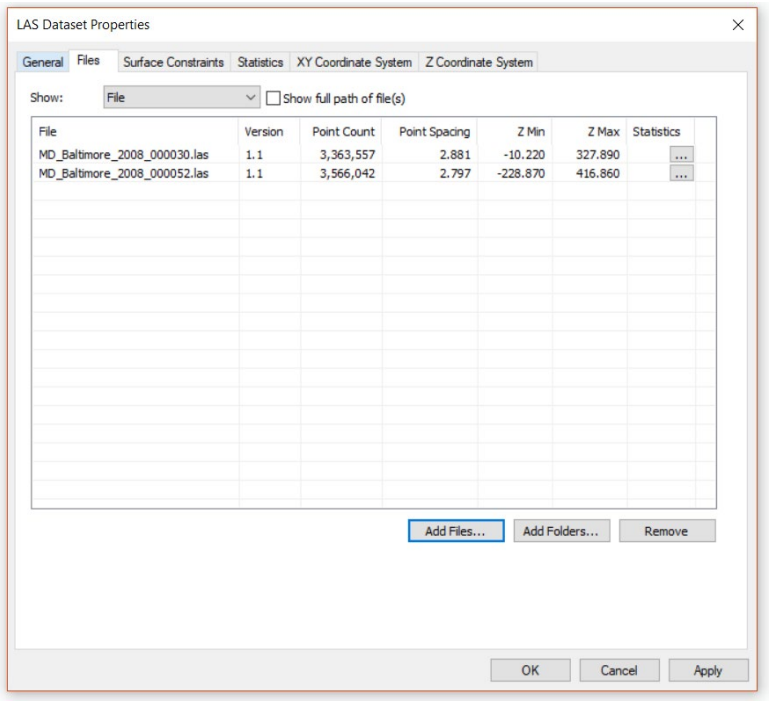


You can think of a LAS Dataset as a container of LAS files. The LAS Dataset file itself does not contain any lidar data points. It simply refers to LAS multiple files that contain lidar data points.

To add LAS files to your LAS Dataset, right-click on the LAS Dataset in the ArcCatalog and go to Properties.

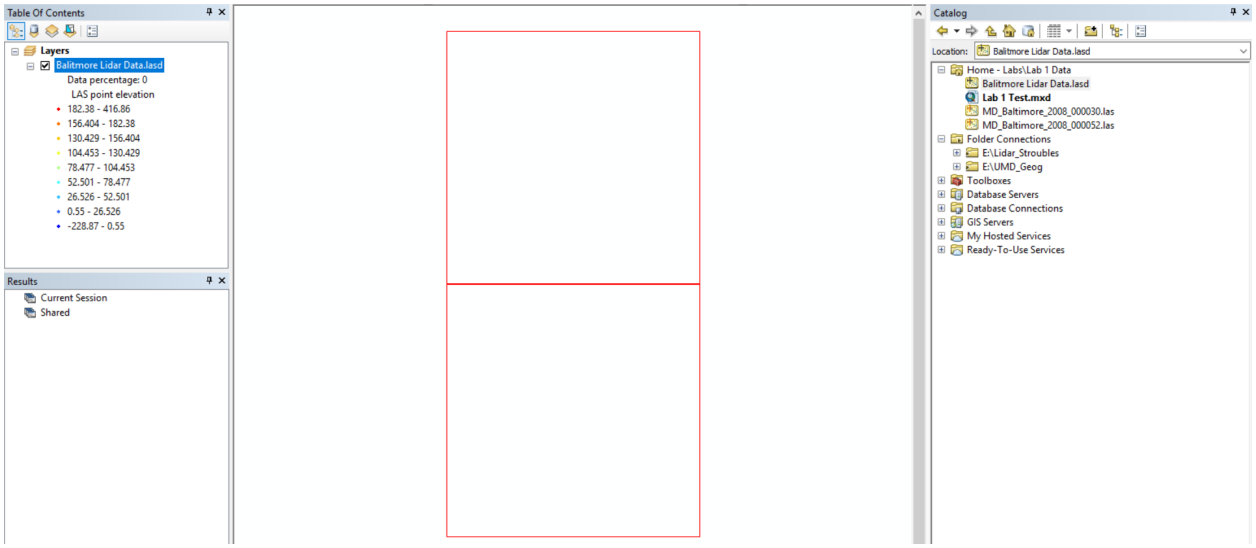


Go to the "Files" tab of the LAS Dataset properties, click "Add Files", add the two LAS files.

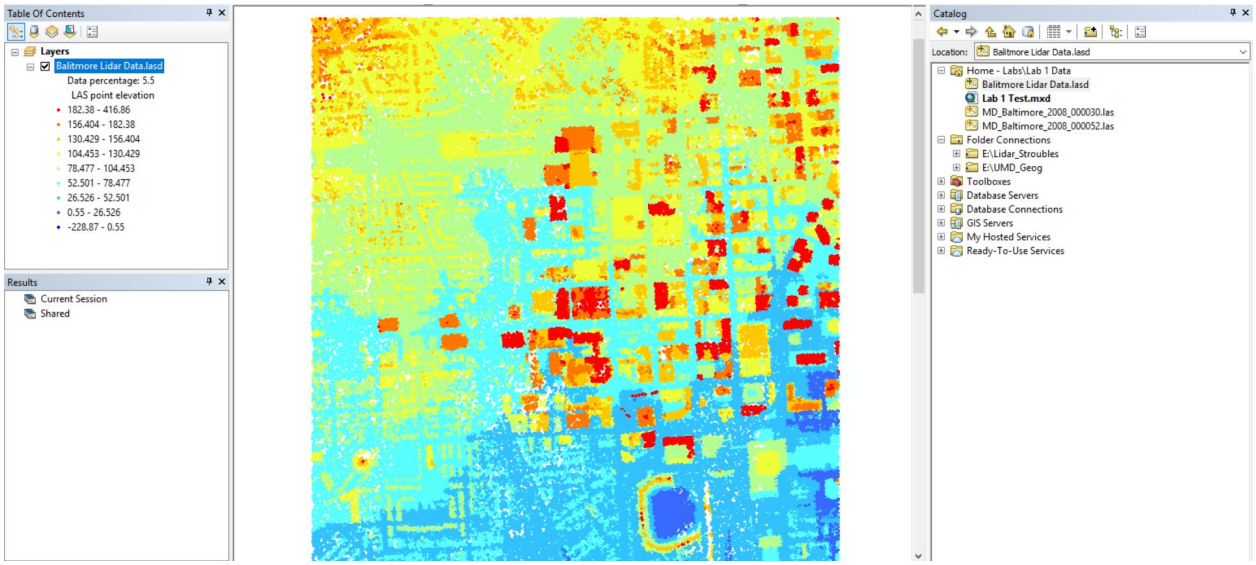


Click "OK" to save the LAS Dataset properties.

Drag-and-drop your LAS Dataset into the Map Document window to add the data to your map.



At this point you should see two red boxes in your map document. Why is that? The current lidar dataset that you are looking at has over 6 million points! When you are zoomed out, ArcMap will not show all of the points. To see the points, select a spot and zoom in a little. The following image is what you should see if you zoom in on the upper LAS tile.



Now that you have your lidar data imported into your map document as a LAS Dataset, you can start to do some very basic data processing and visualization with the lidar data.

First, right-click on the toolbar at the top of ArcMap and add the LAS Dataset toolbar.

Spend some time getting familiar with the basic tools of the LAS Dataset toolbar.

From left to right, the toolbar tools are:

- LAS Dataset Options - Some various LAS Dataset visualization options
- LAS Dataset Dropdown - Shows which LAS Dataset you are currently selecting
- Point Symbology - Visualizes the lidar data as points (elevation, class, return number)
- Surface Symbology - Visualizes the lidar data as a surface (elevation, aspect, slope)
- Filters - Allows you to filter the lidar data by point class (all, ground, non-ground)
- Arrows - Pan the LAS Dataset in different directions
- LAS Dataset Profile View - A 2-D view of a lidar profile manually defined by the user
- LAS Dataset 3-D View - A 3-D view of all lidar points in the current display

Spend some time exploring the LAS Dataset that we have imported into ArcMap by zooming and scrolling around, looking at different features in downtown Baltimore. Play around with some of the tools in the LAS Dataset toolbar.

On your own, select a particular location in the study area (LAS Dataset of Baltimore) that is of interest to you and use the tools in the LAS Dataset toolbar to answer the following. It does not matter what location you select, but try to have your zoom scale around 1:3,000.

[10] (5 Points) Symbolize your scene based on Elevation. View in 3-D. Take a screenshot. What is the range of elevation values in the LAS Dataset? Make sure you include units (meters or feet).

[11] (5 Points) Symbolize your scene based on Classification. View in 3-D. Take a screenshot. Which LAS data classes are visible in your scene?

[12] (5 Points) Symbolize your scene based on Return Number. View in 3-D. Take a screenshot. Is your scene mostly first or second returns? Where do second returns tend to be located?

[13] (5 Points) Symbolize your scene based on Elevation. Use the Profile View tool to manually create a 2-D profile of somewhere in your scene. Take a screenshot.

[14] (5 Points) Filter the lidar data so only ground point are visible. Use the Surface tool to create an Elevation surface model of your scene. View in 3-D. Take a screenshot.