Creating Digital Height Model (DHM) with Drone and Point Cloud Data

1. Start a blank project, name it something descriptive (e.g. DHM_Analysis), and save it in a safe location.
2. Click New Map to start a new map.
3. Go to the Map tab, and add the PointCloud.las file created from the processing of our drone data into your map.
4. We will create a LAS Dataset based on data from our drone. This will allow us to create our Digital Surface Model (DSM).

Click on the Analysis tab, select Tools, and search for Create LAS Dataset. Within the Create LAS Dataset tool, enter the following:
-Input Files: PointCloud.las
-Output LAS Dataset: PalomarLASDataset (be sure to save this output in a safe location)
-Hit Run

5. We will run a report to get some critical information (e.g. point count, ground points) about the LAS dataset that as created in the previous step.

Click on the Analysis tab, select Tools, and search for LAS Dataset Statistics. Within the LAS Dataset Statistics tool, enter the following:
-Input LAS Dataset: PalomarLASDataset
-(Calculate Statistics for All LAS Files is checked)
-Output Statistics Report Text File: PalomarLASDatasetStat.txt (be sure to include the .txt extension in your file name and save this output in a safe location)
-Hit Run

Open the PalomarLASDatasetStat table in ArcGIS Pro, and answer the following questions:

What is the point count? (13394441; see pt_cnt for All Returns)

What percentage of the points were never classified/unclassified? (100)

What percentage of the points were classified as ground? (0)

6. Repeat step 4 with the CA_San_Diego_2014_000388.las file, call the output LAS Dataset USGSLASDataset (be sure to save this output in a safe location).
7. Repeat step 5 with the USGSLASDataset, call the output Statistics Report Text File USGSLASDatasetStat.txt (be sure to include the .txt extension in your file name and save this output in a safe location).

Open the USGSLASDatasetStat table in ArcGIS Pro, and answer the following questions:

What is the point count? (9516517; see pt_cnt for All Returns)

What percentage of the points were never classified/unclassified? (22.22)

What percentage of the points were classified as ground? (37.89)

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8. Open the layer properties for the USGSLASDataset layer, go to LAS Filter, under Classification Codes, select only Ground. These are our ground returns only, and we will be using these selected point to create our digital terrain model (DTM).

9. We will create our DSM and DTM raster layers from the output from step 4 (i.e. PalomarLASDataset) and step 8 (i.e. USGSLASDataset), respectively.

To create the DSM raster from the PalomarLASDataset, click on the Analysis tab, select Tools, and search for LAS Dataset To Raster. Within the LAS Dataset To Raster tool, enter the following:
-Input LAS Dataset: PalomarLASDataset
-Output Raster: DSMRaster (be sure to save this output in a safe location)
-Value Field: Elevation
-Interpolation Type: Binning, Cell Assignment: Average, Void Fill Method: Natural Neighbor
-Output Data Type: Floating Point
-Sampling Type: Observations
-Sampling Value: 10000 (We need to limit this number to limit processing time)
-Z Factor: 3.28 (this is the conversion factor that we will apply to the PalomarLASDataset's elevation values in order to convert them from meter to feet)
-Click Run. (*This may take a few minutes*)

To create the DTM raster from the USGSLASDataset, click on the Analysis tab, select Tools, and search for LAS Dataset To Raster. Within the LAS Dataset To Raster tool, enter the following:
-Input LAS Dataset: USGSLASDataset (Make sure to select this from the dropdown and not browse to it on your computer, because only the one currently in the map has the ground return points filtered out [we did this in step 8])
-Output Raster: DTMRaster (be sure to save this output in a safe location)
-Value Field: Elevation
-Interpolation Type: Binning, Cell Assignment: Average, Void Fill Method: Natural Neighbor
-Output Data Type: Floating Point
-Sampling Type: Observations
-Sampling Value: 10000 (We need to limit this number to limit processing time)
-Z Factor: 1 (we don't need to apply a conversion factor to the to the USGSLASDataset's elevation values because the layer's elevation values are already in feet)
-Click Run. (*This may take a few minutes*)

10. Given that the DTM raster represents the ground and the DSM raster represents building surfaces, the difference between the DSM and the DTM is the digital height model (DHM), which is an approximation of the various building heights.

To create the DHM raster, click on the Analysis tab, select Tools, and search for Raster Calculator (Spatial Analyst Tool). Within the big white box, enter the following equation (see graphic below) by clicking on the appropriate raster names and operator. Name the output DHMRaster. Hit Run.

"DSMRaster" - "DTMRaster"

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11. Go to the Map tab, and add in the PalomarBldg shapefile. This layer was extracted from OpenStreetMap basemap, and shows the outline for several Palomar College buildings.

12. We will run the Zonal Statistics tool to approximate the average building heights from the DHM for each of the buildings in the PalomarBldg layer.

Click on the Analysis tab, select Tools, and search for Zonal Statistics (Spatial Analyst Tool). Within the Zonal Statistics tool, enter the following:
-Input raster or feature zone data: PalomarBldg
-Zone field: FeatName
-Input value raster: DHMRaster
-Output raster: Zonal
-Statistics type: Mean
Click Run.

13. Overlay the PalomarBldg layer on top of the Zonal raster, and answer the following questions:

What is the mean building height (i.e. Pixel Value) for the SU building? Approximately 22.95 feet

What is the mean building height (i.e. Pixel Value) for the PL building? Approximately 33.02 feet

What is the mean building height (i.e. Pixel Value) for the LL building? Approximately 32.84 feet

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